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Author Topic: DIY Metcal 13.56 MHz RF Supply (Read 238182 times)

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mamalala
Supporter

Posts: 777
Country:

DIY Metcal 13.56 MHz RF Supply
« **on:** December 08, 2012, 10:17:45 pm »

Say Thanks Reply Quote

Note: There have been quite some updates, new PCB layouts, firmware, etc. So please read the whole thread (or start from the last post if you only want to grab the latest files). Thanks!

Hello everyone,

i'm in the process of designing a DIY RF-Supply for use with the Metcal handpieces/cartridges. So far i have an initial prototype schematic and layout done. The supply consists of two boards, each 90 x 90 mm in size. One is the main power supply/controller, the other is the RF output stage.

Finished soldering the prototype yesterday, and did some tests today. Unfortunately i did not yet have a 13.56 MHz oscillator (it's on the way to me, however), so i ran the tests with a 11.0something MHz osc instead. So far, everything works as expected.

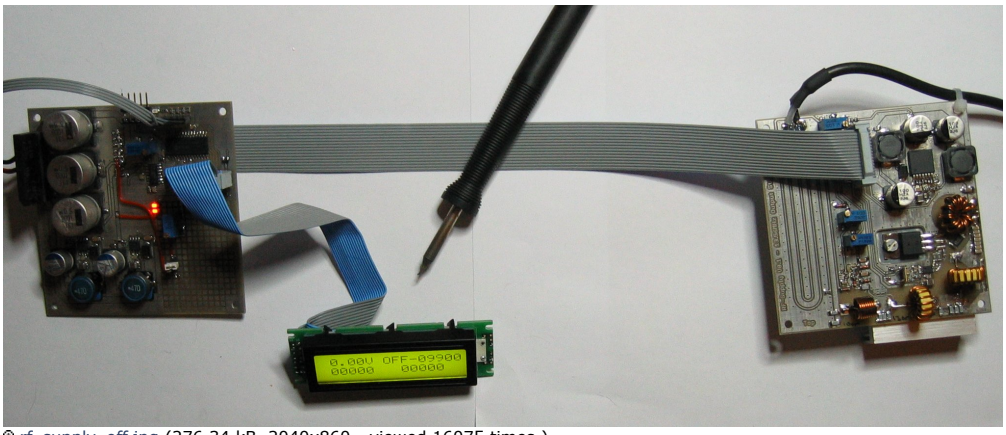
Attached are some images of the test-setup of the prototype. One is when the RG gen is turned off, the next is the heatup phase, the last is when it reached temperature. However, these are just very preliminary tests to check if the overall concept/circuit works. The circuit still has a lot of unnecessary trimpots that i used only to evaluate some parameters and values. On the controller-board there is a small aread just with solder pads, on which i soldered another trimpot. That was used during the very first testing to "simulate" the feedback from the RF gen and check if the DC/DC converter there can be adjusted by that as intended. For the real test run that was disconnected, using the real control signal instead.

No schematics/layout for the public yet, since this all is just the first step. As soon as i could check with the 13.56 MHz osc, decided on some final part values and types, and finally wrote some usable firmware for it, i will upload the stuff here, in the hope that it will be useful for some folks

The LCD shows the actual output voltage of the RF stage's DC/DC converter in the upper left, the VSWR in the upper right (divide by 10 to get a real VSWR, i.e. 242 means a VSWR of 2.42). The bottom left shows the raw readout of the forward power meassured at the SWR bridge, the bottom right is the reflected power.

Greetings,

Chris



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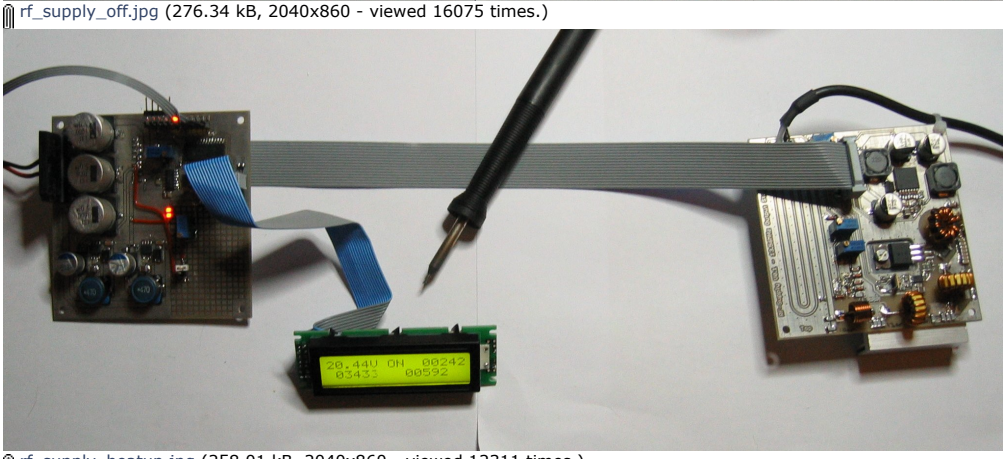
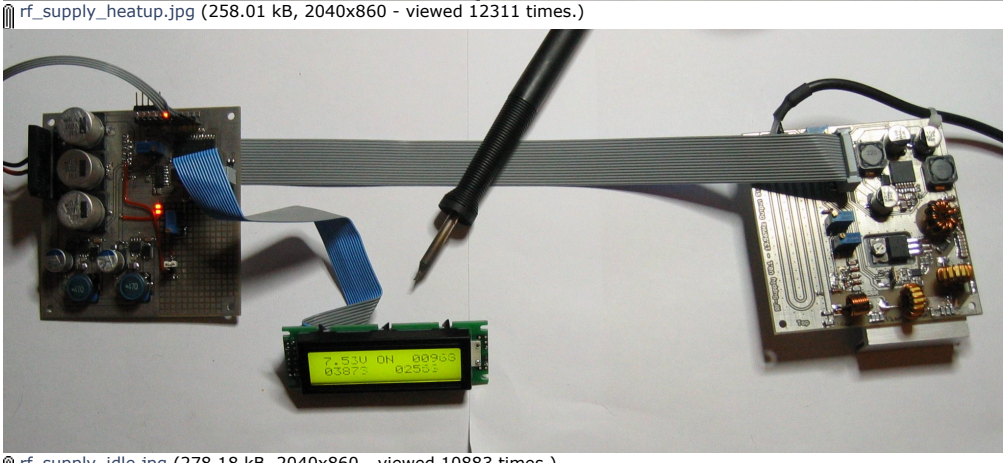


rf_supply_heatup.jpg (258.01 kB, 2040x860 - viewed 12311 times.)



rf_supply_idle.jpg (278.18 kB, 2040x860 - viewed 10883 times.)

« Last Edit: May 28, 2013, 11:54:02 am by mamalala »

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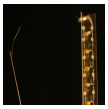
The following users thanked this post: Mephitus, MRBadGuy, Free_WiFi

mikeselectricstuff
Super Contributor

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #1 on:** December 08, 2012, 11:46:13 pm »

Say Thanks Reply Quote

Cool! I've always wanted a small lightweight Metcal supply for on-site use - SMPSU for light weight and fan cooled to minimise heatsink. Maybe even a battery option...
Do you really need the MCU?



Posts: 11971
Country:

Report to moderator Logged

Youtube channel:Taking wierd stuff apart. Very apart.
Mike's Electric Stuff: High voltage, vintage electronics etc.
Day Job: Mostly LEDs

mamalala
Supporter

Posts: 777
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #2 on:** December 09, 2012, 12:16:14 am »

Say Thanks Reply Quote

Quote from: mikeselectricstuff on December 08, 2012, 11:46:13 pm

> Cool! I've always wanted a small lightweight Metcal supply for on-site use - SMPSU for light weight and fan cooled to minimise heatsink. Maybe even a battery option...
> Do you really need the MCU?

Well, even the original Metcal RF supplies have a SMPS, at least for the RF part, as well as linear regulators for the remaining stuff. But then, they also have much more circuitry in general. I attempt to go a bit more minimalistic, if possible. Right now i have three buck converters, one for 5V (OpAmp, µC, oscillator and LCD), one for 12V (for the ISL55110 FET driver) and one variable for the RF generator itself.

Instead of the "discrete" oscillator circuit plus driver i go for a small SMD oscillator plus the ISL as driver. Output FET is a IRF510. The power supplies are a bit oversized right now, all are fed from the same input. I could do that a bit better, input to the 12V buck, from there to the 5V buck.

The µC is not really needed, the feedback-loop works on it's own. However, the µC is used to give a fancy display, as well as powering up/down the RF stage. I always hated it to switch of the Metcal supply to change tips....

What is missing is the detection whether a tip is inserted into the handpiece or not using some analogue circuitry. Right now the µC is supposed to detect a fault condition and shut down the RF stage then. Maybe i'll add some analogue fanciness, so that one can chose to leave out the µC completely but still have the RF final somewhat protected.

Not sure if a fan is needed. Right now i have a small heatsink (60 mm x 40 mm, 20 mm height). As you can see in the pictures it's even under the board, so no real convection takes place. While it does get hot, it's still acceptable. I have seen audio amps run hotter... The ISL chip might need some small heatsink glued on top of it, it gets hot as well. But so far no failures. For some reason Intersil decided to not put a thermal pad there... Only the QFN variant seems to have one, but i would prefer to avoid using QFN's.

My idea was to use a standard 100 mm x 100 mm heatsink as a base. The output stage board would then mounted directly onto that without any spacers. The whole bottom side of that one is a solid groundplane, no signals there. The controller board would then sit right on top of that, connection is made through a simple male/female header combination. The flat-ribbon cable in the image is just for testing, to keep the boards apart so that i can access all the signals for measurement purposes. So the whole thing would probably become something like a 10 x 10 x 10 cm block.

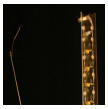
But then, this all are just the first steps and thoughts. Any input is welcome, of course. I hope to have some initial schema and layout ready to upload here in one or two weeks. Right now thermal recovery is not as good as the original. But i mostly blame that on the 11 MHz instead of the 13.56. After all, that's about 20% off the target frequency. Plus, the feedback loop needs a bit more tweaking, as you can see the supply voltage for the RF stage goes way too low. But that's mainly a matter of finding some proper resistor values. Which i will do once i get the 13.56 MHz oscillators.

Greetings,

Chris

Report to moderator Logged

mikeselectricstuff
Super Contributor



Posts: 11971
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #3 on:** December 09, 2012, 12:40:54 am »

Say Thanks Reply Quote

Quote

> Well, even the original Metcal RF supplies have a SMPS, at least for the RF part, as well as linear regulators for the remaining stuff.

The STSS and MX500 use a huge, heavy mains transformer - only the MX5000 uses a switchmode mains supply, but it's still in a heavy cast case.

Quote

> The µC is not really needed, the feedback-loop works on it's own. However, the µC is used to give a fancy display, as well as powering up/down the RF stage. I always hated it to switch of the Metcal supply to change tips....

The display on the MX5000 is nice, but in practice could be reduced to a LED that shows when power is below a certain threshold (i.e. heated up). Maybe a bicolour that did a gradual change of coluur over the power range.

Auto-reset on error is certainly useful.

Quote

> What is missing is the detection whether a tip is inserted into the handpiece or not using some analogue circuitry. Right now the µC is supposed to detect a fault condition and shut down the RF stage then. Maybe i'll add some analogue fanciness, so that one can chose to leave out the µC completely but still have the RF final somewhat protected.

The Metcals put some DC through the heater and use this to detect open-circuits, but an RF fault detection cct could probably do this as well as protection against shorts etc.

Quote

> But then, this all are just the first steps and thoughts. Any input is welcome, of course. I hope to have some initial schema and layout ready to upload here in one or two weeks. Right now thermal recovery is not as good as the original. But i mostly blame that on the 11 MHz instead of the 13.56. After all, that's about 20% off the target frequency.

I don't think the frequency is that critical as far as the heater is concerned- AIUI the choice of 13.56 is just to keep it in the ISM band.

As regards using a fan, this was purely to minimise size & weight, for cooling both the PSU and RF stage.

I had another thought for a more 'extreme' approach to a lightweight solution : generate the 13.56MHz direct from a rectified, unsmoothed mains supply, and use an RF transformer to do the mains isolation.

Report to moderator Logged

Youtube channel:Taking wierd stuff apart. Very apart.
Mike's Electric Stuff: High voltage, vintage electronics etc.
Day Job: Mostly LEDs

mamalala
Supporter

Posts: 777
Country:

Re: DIY Metcal 13.56 MHz RF Supply

« **Reply #4 on:** December 09, 2012, 01:12:54 am »

Say Thanks Reply Quote

Quote from: mikeselectricstuff on December 09, 2012, 12:40:54 am

> The STSS and MX500 use a huge, heavy mains transformer - only the MX5000 uses a switchmode mains supply, but it's still in a heavy cast case.

Ah, sorry, my bad. I was talking about the stuff in the circuitry itself to generate local supplies and the supply for the RF stage. My design is open to whatever one wants to use. While i have a rectifier and caps on the controller board, so that it can accept AC voltage, one could directly feed a DC in there instead. But since i have a bunch of 24V/2A transformers here from old, broken soldering stations, i also placed the rectifier and stuff there.

In any case, no need for a dual-output transformer like in the STSS for example. Always wondered why the schema on the net shows a 2x19V transformer, when the converter output for the RF stage goes to only 21V max. anyways....

Quote

> The display on the MX5000 is nice, but in practice could be reduced to a LED that shows when power is below a certain threshold (i.e. heated up). Maybe a bicolour that did a gradual change of coluur over the power range.
>
> Auto-reset on error is certainly useful.

Agreed, generally it's pretty useless. but i like that bling-factor somewhat. Plus it helps me a great deal with the developing stage. After all, this is the very first circuit and layout i did on this project.

However, i'm pretty sure that for now i keep at least the µC. Makes a lot of things much easier for me. Instead of putting a lot of analogue circuitry on the board, i can do all that with the µC instead.

Quote

> The Metcals put some DC through the heater and use this to detect open-circuits, but an RF fault detection cct could probably do this as well as protection against shorts etc.

Yea, i have seen that in the schematic that floats around on the net. Some transistor to generate the bias, plus some comparator circuitry to process that. As written above, for now i prefer to get the detection done with the µC.

In the end, there is no real need to have extra circuitry for that, i think, since the µC should be able to handle all that. As far as the RF final is concerned, all that matters is to protect it against too much reflected power due to mismatch, and against too high a supply voltage from the feedback loop. The former detected by the µC, the latter simply a matter of having a low enough input voltage to begin with. My idea was to use 24DC or thereabouts for supply. That way the output of the buck converter for the RF can't get too high at all.

From the FET the RF is AC coupled into the filters. So any random short on the output would just mean a mismatch. No "real" short is happening there, as far as the RF stages supply is concerned.

Quote

> I don't think the frequency is that critical as far as the heater is concerned- AIUI the choice of 13.56 is just to keep it in the ISM band.

Yes and no. True, it could be done with basically any frequency. However, the filters of the RF stage, plus the inductance and capacitance of the tip/handpiece are somewhat tuned. After all, the tip _is_ like an antenna to the RF output. It just happens that due to the Curie effect it will go into a mismatch once the temp. is reached. But then, i will see how it behaves once i use the right frequency.

Quote

> As regards using a fan, this was purely to minimise size & weight, for cooling both the PSU and RF stage.

True. but since i plan to make all the stuff available, everyone can modify it to whatever he/she wants

Quote

> I had another thought for a more 'extreme' approach to a lightweight solution : generate the 13.56MHz direct from a rectified, unsmoothed mains supply, and use an RF transformer to do the mains isolation.

Uh, not sure that this would be a good idea. For one, generating such high frequencies directly at these voltage levels is no simple feat. At least not if it is supposed to be efficient. The next problem is regulation. Once the tip reaches temperature, you will have a mismatch. That means that a most of the RF is reflected back into the supply. The purpose of the buck converter on that supply is to reduce the voltage the more power gets reflected. Otherwise you end up with several hundreds of volts reflected back.

Greetings,

Chris

Report to moderator Logged

mikeselectricstuff
Super Contributor

Posts: 11971
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #5 on:** December 09, 2012, 10:49:38 am »

Say Thanks Reply Quote

Quote

> My idea was to use 24DC or thereabouts for supply. That way the output of the buck converter for the RF can't get too high at all.

Looking at the MX500 schematic and description, although it feeds about 50V into the buck converter, the description indicates that the output voltage only goes to about 21V - I wonder why they used such a high input voltage, unless maybe they were initially unsureabout how much power they'd need and just didn't bother changing the design.

Quote

> I don't think the frequency is that critical as far as the heater is concerned- AIUI the choice of 13.56 is just to keep it in the ISM band.
>
> Yes and no. True, it could be done with basically any frequency. However, the filters of the RF stage, plus the inductance and capacitance of the tip/handpiece are somewhat tuned. After all, the tip _is_ like an antenna to the RF output. It just happens that due to the Curie effect it will go into a mismatch once the temp. is reached. But then, i will see how it behaves once i use the right frequency.

If the element is absorbing a lot of power I'd expect the Q is going to be pretty low, so it shouldn't be too sharply resonant.

Quote

Quote

I had another thought for a more 'extreme' approach to a lightweight solution : generate the 13.56MHz direct from a rectified, unsmoothed mains supply, and use an RF transformer to do the mains isolation.

Uh, not sure that this would be a good idea. For one, generating such high frequencies directly at these voltage levels is no simple feat. At least not if it is supposed to be efficient. The next problem is regulation. Once the tip reaches temperature, you will have a mismatch. That means that a most of the RF is reflected back into the supply. The purpose of the buck converter on that supply is to reduce the voltage the more power gets reflected. Otherwise you end up with several hundreds of volts reflected back.

Yeah I doubt it's very practical... it was just a crazy idea!
Having said that, the fact that you don't need DC for heating applications, and the AC reservoir cap is one of the biggest parts of a SMPS means there might be some scope to do something interesting, even if it's just a non-isolated, buck converter followed by RF isolation, or an unsmoothed DC supply
Or even just phase-angle control to use just the leading and trailing parts of the mains waveform.
I don't know enough about RF power stuff to know how practical an RF transformer at this power level with mains isolation would be.

Another approach might be to use a SMPS that has a wide voltage adjustment range, and use that to do the control, although that only saves the second buck reg which isn't a big deal in size/weight terms.

Would a fixed RF output and PWM control be another option? Could get a bit noisy I suspect!

Report to moderator Logged

Youtube channel:Taking wierd stuff apart. Very apart.
Mike's Electric Stuff: High voltage, vintage electronics etc.
Day Job: Mostly LEDs

mamalala
Supporter

Posts: 777
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #6 on:** December 09, 2012, 11:17:47 am »

Say Thanks Reply Quote

Quote from: mikeselectricstuff on December 09, 2012, 10:49:38 am

If the element is absorbing a lot of power I'd expect the Q is going to be pretty low, so it shouldn't be too sharply resonant.

Well, i'm no RF expert either (or even analogue stuff in general, my main focus is digital electronics). Simulating the RF stage in LT-Spice, however, shows that the power level at the output varies depending on the inductance of the load at a fixed frequency, or depending on the frequency and a fixed load inductance. So at least there it seems to have some effect. But as said, i will find out soon enough.

Quote

Yeah I doubt it's very practical... it was just a crazy idea!
Having said that, the fact that you don't need DC for heating applications, and the AC reservoir cap is one of the biggest parts of a SMPS means there might be some scope to do something interesting, even if it's just a non-isolated, buck converter followed by RF isolation, or an unsmoothed DC supply Or even just phase-angle control to use just the leading and trailing parts of the mains waveform.
I don't know enough about RF power stuff to know how practical an RF transformer at this power level with mains isolation would be.

Putting the issue of regulation and isolation aside, the biggest problem is with unwanted RF emission. To use RF as a general means for heating, even on regular irons, you would have to modify the whole thing. Shielded coax cable, and grounding the metal sleeve. Otherwise you make a lot of HAM folks unhappy

Quote

Another approach might be to use a SMPS that has a wide voltage adjustment range, and use that to do the control, although that only saves the second buck reg which isn't a big deal in size/weight terms.

Would a fixed RF output and PWM control be another option? Could get a bit noisy I suspect!

Here the problem is indeed with RF noise. Due to the non-sine waveform you will produce a massive amount of harmonics that get radiated as well. It will result in a rather nice spread-spectrum RF noise

emitter

Greetings,

Chris

Report to moderator Logged

mamalala
Supporter

Posts: 777
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #7 on:** December 09, 2012, 05:45:29 pm » Say Thanks Reply Quote

Just some updates.

The frequency is indeed important. I did some more measurements today (well, at least as far as my half-broken HP54201D got me). The signal for the feedback is picked up before the last series coil in the RF path (400nH). After that it goes through the stripline-style SWR bridge to the output.

If i connect a purely resistive 50 ohms dummy load there, i get roundabout the same peak readings on both ends of that coil. If i plug in the handpiece, the peak voltage drops by over half _after_ the coil, while still at full level before it. Then i used a 10 MHz osc, even lower in frequency, and the voltage after the coil dropped even more. Using a 12.8 MHz resulted in a much higher voltage there.

So i'm pretty confident now that things will look much better once i got the 13.56 MHz oscillators.

Then i did some more adjustments/part-value changes. The RF stage buck converter now idles at roundabout 16-17 volts and peaks at around 22-23 volts during heatup. So that got much better now as well.

Also changed a cap at the RF detector section. Had a 10nF there, which resulted in a rather slow response (after all, it got charged through a 160 resistor....). Now placed a 56pF there, and the response is really fast.

Alright, that's it for now, now i'm waiting for those stupid oscillators

Greetings,

Chris

Report to moderator Logged

mamalala
Supporter

Posts: 777
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #8 on:** December 11, 2012, 05:38:15 pm » Say Thanks Reply Quote

Small update....

I have reworked the layout of the RF stage board. Now the OpAmp used in the feedback loop is on that boards as well (was on the controller-board before). Also designed some simple circuitry for tip/cartridge detection. Build that detection on a perfboard, and it works just fine.

The new layout means that the RF stage PCB can basically be used on it's own now. All it requires are the supply voltages and enable signals for the osc and buck converter. The output of the tip detection circuit is open-drain through a small N-FET (2N7002). This means that it would be sufficient to pull-up the enable signals through 1k to the +5V rail, and also connect them to the tip detection signal. That way it will automatically shut of the buck converter and oscillator when a tip is removed, and switches it back on once a tip is re-inserted.

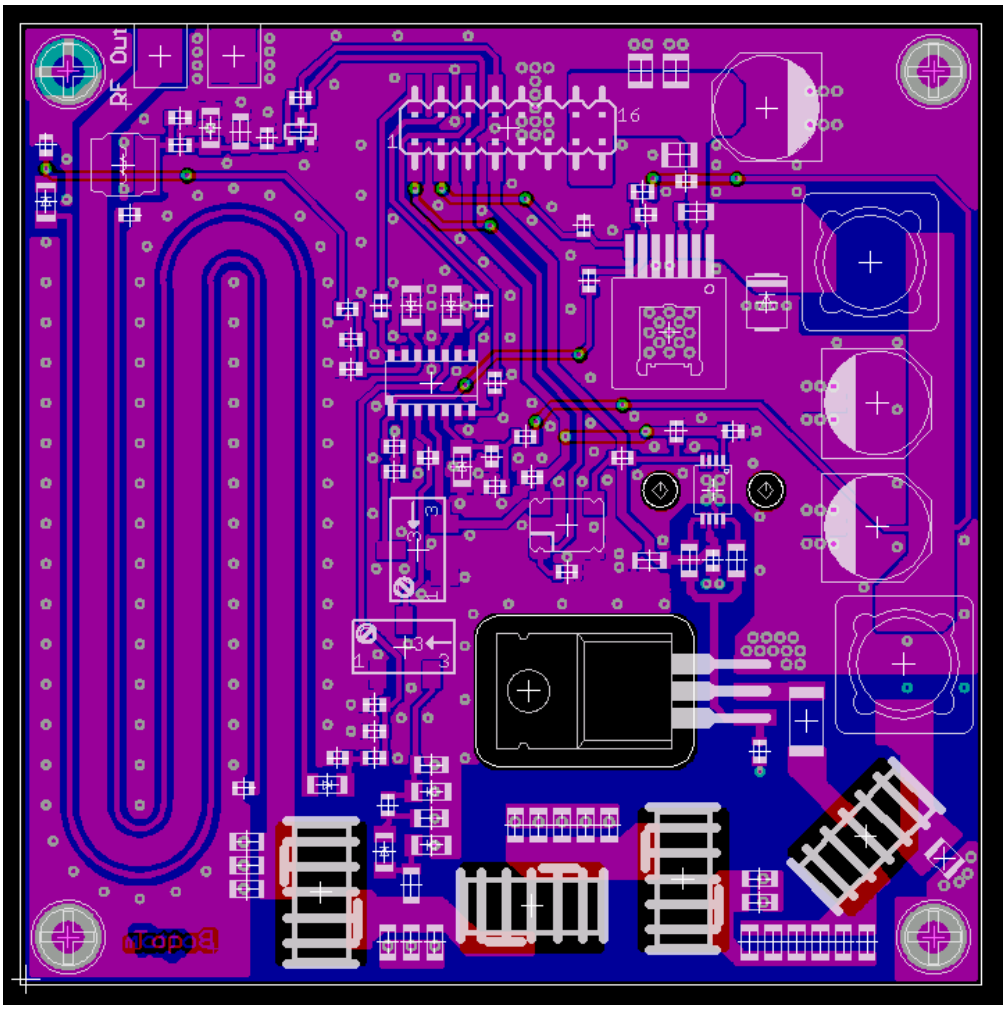
Also added two 3.2mm holes next to the FET driver chip. This is to install a small heatsink onto it.

Will do a new circuitry/layout for the controller board as well. The one i'm doing will be using a PIC microcontroller, LCD, rotary encoder, etc. It also contains the buck regulators to generate the +12V and +5V. The bridge rectifier is now optional, the board can be fed either AC (with bridge rectifier installed) or DC, through separate pads. It will be fairly easy to have different controller-boards there. Minimum requirement is basically just the main supply, +12V and +5V supplies. Everything else is completely optional.

Attached is a screenshot of the current layout of the RF stage board.

Greetings,

Chris



rf-stage.png (40.68 kB, 720x720 - viewed 11370 times.)

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mamalala
Supporter

Posts: 777
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #9 on:** December 13, 2012, 02:51:47 am »

Say Thanks Reply Quote

After some testing it turns out that the RF transformer toroid seems to be way too small. It gets rather hot, meaning a lot of core losses. So i will change that part once i got a fresh set of toroids. Same applies for the first 1µ filter coild after the xformer, albeit not hat badly.

Wondering what material they used in the original circuit. I mean, even there the toroids do have a small diameter, and i used the same.

It's not that it would prevent proper functionality, just that it means a lot of losses that can be avoided. Thinking of battery operation here ....

Greetings,

Chris

Report to moderator Logged

cwalex
Frequent Contributor

Posts: 302
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #10 on:** December 13, 2012, 10:37:19 am »

Say Thanks Reply Quote

Awesome project! I'll be watching this closely

Report to moderator Logged

poorchava
Super Contributor

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #11 on:** December 13, 2012, 10:54:04 am »

Say Thanks Reply Quote

Posts: 1539
Country:

Troll Cave Electronics!

Could you please share the schematic of power stage? RF has always been a total voo-doo for me.

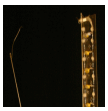
I always assumed that RF-guys (plus EMC engineers) can do their work only after they sacrifice a goat/virgin/infant/whatever during full moon Probably some illegal substance use is also involved [no offense, rly, I'm impressed with your design]

Report to moderator Logged

I love the smell of FR4 in the morning!

mikeselectricstuff

Super Contributor



Posts: 11971
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #12 on:** December 13, 2012, 11:27:51 am »

Say Thanks Reply Quote

Quote from: poorchava on December 13, 2012, 10:54:04 am

> Could you please share the schematic of power stage? RF has always been a total voo-doo for me.
>
> I always assumed that RF-guys (plus EMC engineers) can do their work only after they sacrifice a goat/virgin/infant/whatever during full moon Probably some illegal substance use is also involved [no offense, rly, I'm impressed with your design]

Here's the schematic of Metcal's MX500 (pdf)
And a description (rtf)

Report to moderator Logged

Youtube channel:Taking wierd stuff apart. Very apart.
Mike's Electric Stuff: High voltage, vintage electronics etc.
Day Job: Mostly LEDs

amyk

Super Contributor

Posts: 6414

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #13 on:** December 13, 2012, 12:23:49 pm »

Say Thanks Reply Quote

Quote from: mamalala on December 13, 2012, 02:51:47 am

> Wondering what material they used in the original circuit. I mean, even there the toroids do have a small diameter, and i used the same.

What colour are they?

http://www.micrometals.com/materialchart.html

Report to moderator Logged

mamalala

Supporter

Posts: 777
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #14 on:** December 13, 2012, 06:57:09 pm »

Say Thanks Reply Quote

Quote from: amyk on December 13, 2012, 12:23:49 pm

> **Quote from: mamalala on December 13, 2012, 02:51:47 am**
>
> > Wondering what material they used in the original circuit. I mean, even there the toroids do have a small diameter, and i used the same.
>
> What colour are they?
>
> http://www.micrometals.com/materialchart.html

Yellow, depending on the light with a greenish tint. Roundabout 0.5" outer diameter. No matter where i look, i can't find any toroids with which i can arrive at the 9µH per winding ~~(about 11 turns)~~ (Scratch that, the ones in my unit have 7.5 turns). And all the ones i can find have slightly less height as well.

In any case, pumping 30+ watts of HF energy through such a little core is silly, i think. Maybe someone can check on a real Metcal if the xformer there gets hot as well. It's not that it interferes with functionality. It works well, that's not the issue. I just would prefer to avoid such losses there.

Greetings,

Chris

« *Last Edit: December 13, 2012, 06:59:13 pm by mamalala* »

Report to moderator Logged

mamalala

Supporter

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #15 on:** December 13, 2012, 07:11:00 pm »

Say Thanks Reply Quote

Posts: 777
Country:

> **Quote from: poorchava on December 13, 2012, 10:54:04 am**
>
> Could you please share the schematic of power stage? RF has always been a total voo-doo for me.
>
> I always assumed that RF-guys (plus EMC engineers) can do their work only after they sacrifice a goat/virgin/infant/whatever during full moon Probably some illegal substance use is also involved [no offense, rly, I'm impressed with your design]

Sure, attached is the current schematic as zipped PDF file. Keep in mind that this is preliminary, once i got all the kinks sorted out i will release the Eagle files for the whole project.

Yeah, RF is a bit tricky sometimes. What looks like a short for DC can be perfectly fine for RF

Greetings,

Chris

rf_stage.zip (739.94 kB - downloaded 2268 times.)

Report to moderator Logged

KD0CAC John
Frequent Contributor

Posts: 608
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #16 on:** December 13, 2012, 10:30:28 pm » Say Thanks Reply Quote

Couple of things , I have a SST unit and have not found any schematics or manual , I did check on Metcals site , but nothing as old as my unit .
On the torrides , sounds like you may not know the mix ?
I am a ham radio operator and have come across a lot of discussion of torrides , and the mix is related to frequency .
a couple of my bookmarks ,
http://www.kitsandparts.com/faq.php

https://www.amidoncorp.com/

http://www.cwsbytemark.com/

http://www.cliftonlaboratories.com/estimating_q_of_ferrite_cores.htm

Report to moderator Logged

mamalala
Supporter

Posts: 777
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #17 on:** December 14, 2012, 12:20:31 am » Say Thanks Reply Quote

> **Quote from: KD0CAC John on December 13, 2012, 10:30:28 pm**
>
> Couple of things , I have a SST unit and have not found any schematics or manual , I did check on Metcals site , but nothing as old as my unit .
> On the torrides , sounds like you may not know the mix ?
> I am a ham radio operator and have come across a lot of discussion of torrides , and the mix is related to frequency .
> a couple of my bookmarks ,
> http://www.kitsandparts.com/faq.php
>
> https://www.amidoncorp.com/
>
> http://www.cwsbytemark.com/
>
> http://www.cliftonlaboratories.com/estimating_q_of_ferrite_cores.htm

Thanks for the links. Yes, i have a STSS unit as well. The circuit is basically the same as the one in the MX500 circuit diagram. A very few things are different, for example the MX500 has an output section to hook up a power output meter, which the STSS does not have. Also, there is no auto-sleep thingy in the STSS. But the main RF circuit and stuff is identical.

About the toroids, yes, i know that the material is important and that not every random core can be used for every frequency. But short of desoldering the actual xformer and coils from a real unit and measuring them, there is little i can do. Plus, even if i would unsolder them i simply lack the proper tools to analyze these parts.

The two toroids for the filter are yellow core with a green side. It's 12.7mm o.d., 6.8mm i.d. and 5.7mm height, 16.5 turns of 0.65mm magnet wire. The toroids for the transformers (for driver and final) are yellow-green in color, 13mm o.d., 7.5mm i.d. and 6.5mm height, 7.5 turns each winding.

But in any case, a 0.5" diameter toroid sounds awfully small compared to the power it has to handle. Also, i can only get Amidon iron powder cores here in Germany, as well as ferrite cores from Amidon

and a few other manufacturers. I have to live with that and simply go through trial & error to see what works best here. I use the -2 and -6 materials for the Amidon iron powder cores, which also suit the frequency we have here. As for ferrite, on the xformer the one which seemingly runs a little less hot is the -61, also from Amidon.

Already ordered iron poweder cores in larger sizes, should arrive here on Monday.

Greetings,

Chris

Report to moderator Logged

mamalala
Supporter

Posts: 777
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #18 on:** December 14, 2012, 12:59:38 am » Say Thanks Reply Quote

Just checked in a toroid calculator. No matter what, using a T50 sized core is too small to handle that amount of power at that frequency. The -6 is for 2-50 MHz, and the -2 for 1-30 MHz. The flux density is just too big at the resulting voltage that i get at the RF transformer, resulting in quite a temperature rise of the core. Changing the size to T80 already brings it down into the acceptable range. Well, at least as far as the calculations go...

Also just calculated the output power, it nicely dumps over 30 watts into a 50 ohms dummy (i have around 115 volts Vpp at the dummy), so that part is OK.

Greetings,

Chris

Report to moderator Logged

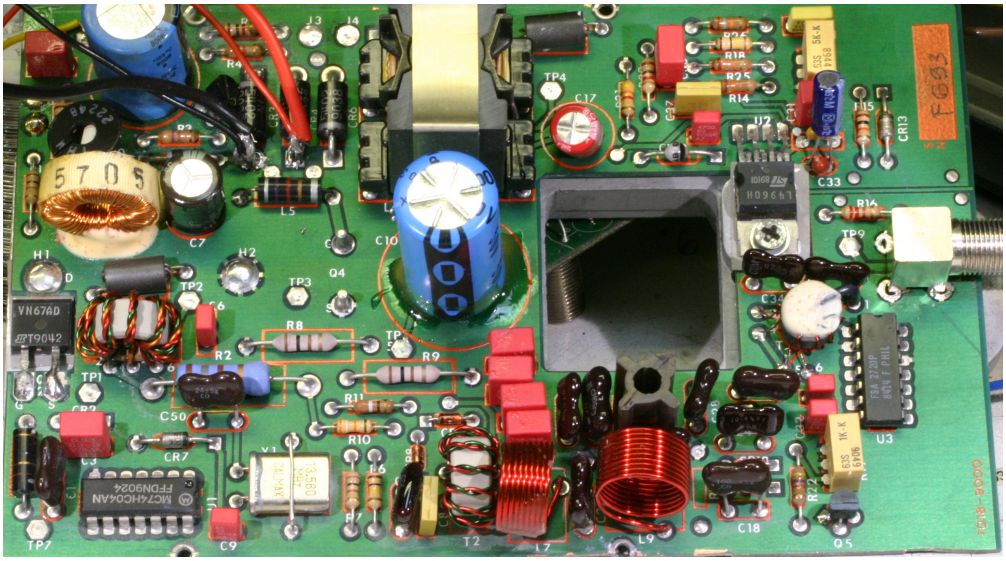
mikeselectricstuff
Super Contributor

Posts: 11971
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #19 on:** December 15, 2012, 01:09:07 pm » Say Thanks Reply Quote

I've uploaded some hi-res PCB pics of the MX5000 here
This has higher output power, although ISTR the spec mentions a temperature alongside the power so maybe it scales back if it gets too hot.
I can't easily power it open to measure inductor temps.
BTW PIC is unprotected if anyone feels like a hack.
I have no idea what they were thinking putting an RTC in this.. ridiculous!

Here's a pic of an old (slightly hacked) US STSS-002. If you want to borrow the inductors to test/compare you're welcome - not sure if I have suitable kit to measure here.
Main output device is a TO-3 IRF130 on the back.
Also a thermal image running - the hottest coil is only hitting about 35 deg.C



Img_5259.jpg (1147.14 kB, 2925x1614 - viewed 6467 times.)

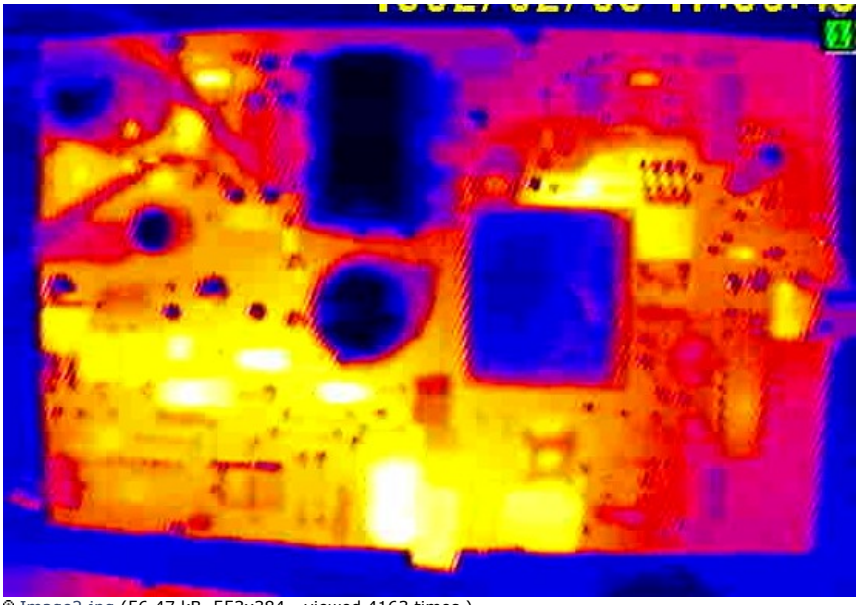


Image2.jpg (56.47 kB, 553x384 - viewed 4163 times.)

Report to moderator Logged

Youtube channel:Taking wierd stuff apart. Very apart.
Mike's Electric Stuff: High voltage, vintage electronics etc.
Day Job: Mostly LEDs

nukie
Frequent Contributor
Posts: 770
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #20 on:** December 15, 2012, 02:05:05 pm »
Say Thanks Reply Quote

Nice parts there look at those expensive silver micas, they are very stable, military like them very much. Love it!

Report to moderator Logged

grenert
Frequent Contributor
Posts: 446

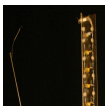
Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #21 on:** December 15, 2012, 03:33:38 pm »
Say Thanks Reply Quote

> **Quote from: mikeselectricstuff on December 15, 2012, 01:09:07 pm**
> Here's a pic of an old (slightly hacked) US STSS-002.

What did you do to the older STSS-002? Think it is possible to boost the power to MX-5000 levels?

Report to moderator Logged

mikeselectricstuff
Super Contributor



Posts: 11971
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #22 on:** December 15, 2012, 03:35:52 pm »
Say Thanks Reply Quote

> **Quote from: grenert on December 15, 2012, 03:33:38 pm**
> > **Quote from: mikeselectricstuff on December 15, 2012, 01:09:07 pm**
> > Here's a pic of an old (slightly hacked) US STSS-002.
>
> What did you do to the older STSS-002? Think it is possible to boost the power to MX-5000 levels?

I was looking at repackaging it with a SMPS to make a smaller PSU thin enough to fit a laptop bag. I had problems with the RF upsetting the SMPSU and never got round to finishing it.
Doubt it's practical to increase power much. increased power on 5000 doesn't make a huge difference except maybe on big tips like long blades

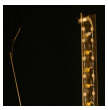
Report to moderator Logged

Youtube channel:Taking wierd stuff apart. Very apart.
Mike's Electric Stuff: High voltage, vintage electronics etc.
Day Job: Mostly LEDs

mikeselectricstuff

Re: DIY Metcal 13.56 MHz RF Supply

Super Contributor



Posts: 11971
Country:

« **Reply #23 on:** December 15, 2012, 03:39:14 pm » Say Thanks Reply Quote

> **Quote**
>
> Also just calculated the output power, it nicely dumps over 30 watts into a 50 ohms dummy (i have around 115 volts Vpp at the dummy), so that part is OK.

Might be interesting to try measuring the actual impedance of a Metcal tip to optimise matching & make an accurate dummy load for testing.

Report to moderator Logged

Youtube channel:Taking wierd stuff apart. Very apart.
Mike's Electric Stuff: High voltage, vintage electronics etc.
Day Job: Mostly LEDs

KD0CAC John

Frequent Contributor

Posts: 608
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #24 on:** December 15, 2012, 04:03:32 pm » Say Thanks Reply Quote

I have an antenna analyzer , but would have to make up an adapter to the meter .
But again , I would assume [we know what that spells] that Metcal would make the system resonant on the one frequency it uses ?

Report to moderator Logged

mamalala

Supporter

Posts: 777
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #25 on:** December 15, 2012, 04:06:34 pm » Say Thanks Reply Quote

> **Quote from: mikeselectricstuff on December 15, 2012, 01:09:07 pm**
>
> Here's a pic of an old (slightly hacked) US STSS-002. If you want to borrow the inductors to test/compare you're welcome - not sure if I have suitable kit to measure here.
> Main output device is a TO-3 IRF130 on the back.
> Also a thermal image running - the hottest coil is only hitting about 35 deg.C

That's interresting. I have a STSS-PS2V-02 here, and it has a quite different PCB layout, see attached image (it's quickly stitched together from three separate pics, so ignore the distortion and seams...).

The toroids have a different color. Seems that Metcal was also trying to figure out which ones work best.

The output stage in my circuit is slightly different, since i don't use a pre-driver circuit here but a cheap FET driver chip instead. Saves a bunch of parts and another inductor. Plus, the IRF510 that i use works just well so far. Also, i'm wondering, looking at the datasheet. The IRF130 has much longer turn on/off and rise/fall times than the IRF510.

Anyways, FT82-61 for the xformer works well, T80-2 or -6 for the first filter coil, and T50-2 or -6 for the remaining filter coils. They don't get hot anymore, only a bit warmer. Thing is i have to work with the parts that i can get here. Makes no sense for me to design using some exotic parts that are hard to get. Amidon cores are widely available. It's already bad enough that a 13.56 MHz is so uncommon. Which is quite a surprise, given the fact that this is a common frequency (RFID uses that, for example).

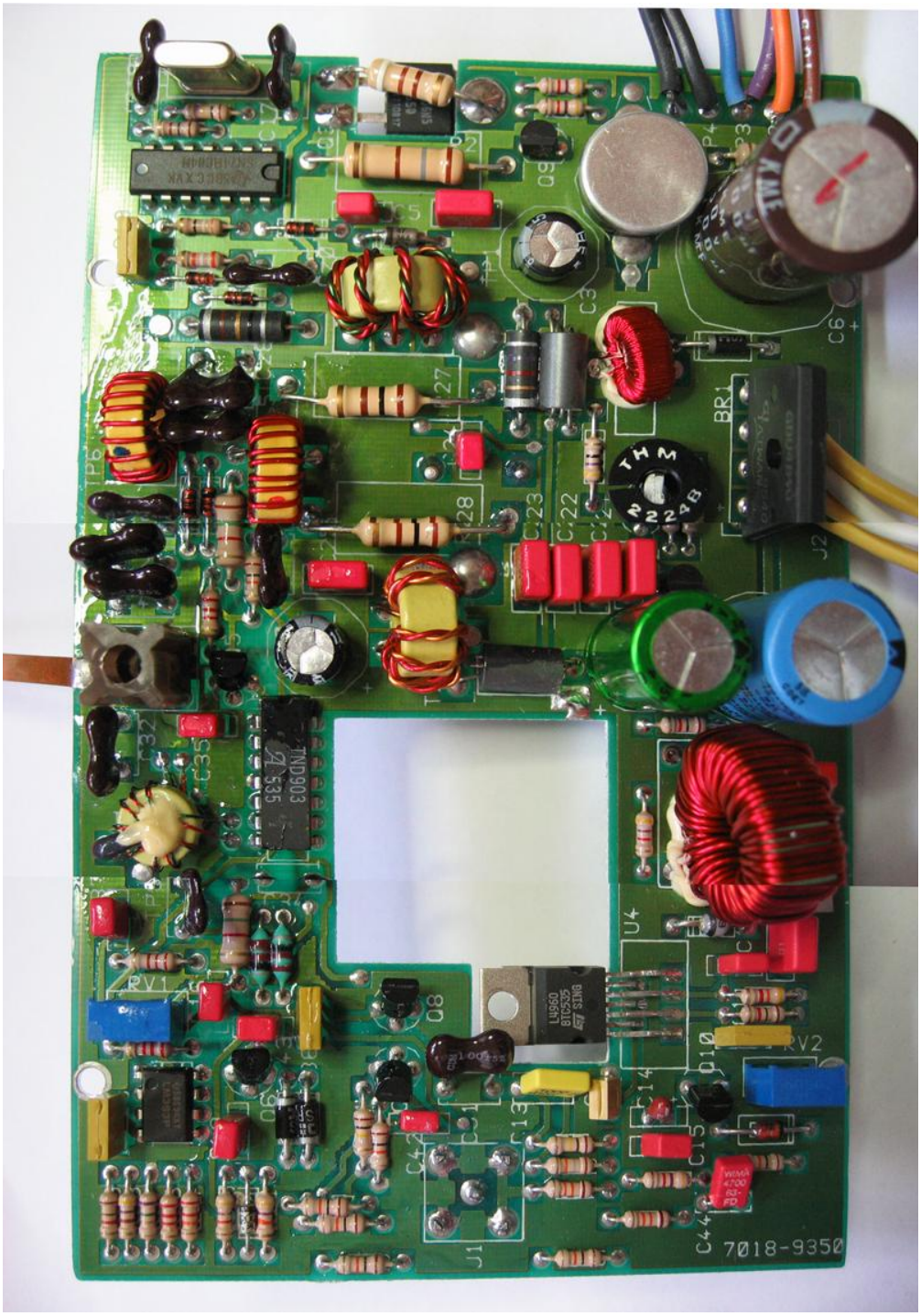
Fun fact: I use the AVX - K50-HC1CSE13.5600MR. Go to Farnell Belgium. There it costs 4,28 Euro. On Farnell in Germany it costs 9,57 Euro. On Newark (basically the US Farnell) it is 3,17 US$.

That's craziness...

Have you taken the thermal images after an hour or so of the station idling? Because it takes some time for the inductors to "warm up".

Greetings,

Chris



Top_STSS-PS2V-02.jpg (178.19 kB, 800x1145 - viewed 2880 times.)

Report to moderator Logged

mamalala
Supporter

Posts: 777
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #26 on:** December 15, 2012, 04:13:37 pm »

Say Thanks Reply Quote

Quote from: mikeselectricstuff on December 15, 2012, 03:39:14 pm

Quote

Also just calculated the output power, it nicely dumps over 30 watts into a 50 ohms dummy (i have around 115 volts Vpp at the dummy), so that part is OK.

Might be interesting to try measuring the actual impedance of a Metcal tip to optimise matching & make an accurate dummy load for testing.

Well, given what little info can be found on the net, it seems that during heat-up there is also about

100odd volts at the output. Heatup isn't that much of a concern for me right now anyways. It's takes the same time as with the original. The interesting part starts when it reached temperature. I still only have the 11.0something MHz osc in the circuit. So after heat-up the voltage drops considerably at the RF output. This is where i am pretty sure that the inductance of the coil in the tip itself plays an important role. After all, that is what keeps it warm then, it's not that it completely "switches off" power consumption. One i reached temp it behaves _almost_ the same as the original when soldering on a massive groundplane, it's just _slightly_ worse with thermal recovery. Using the proper frequency should remedy that little difference then, i think.

Dumping more power into the tip is not a big problem for the circuitry. The question is just how the tip cartridges will handle that in the long term. And then, i see no real need to do that anyways. I can live with 6 seconds heat-up time. Bringing it down to 5 or 4 serves no real useful purpose, IMHO. What is a real gain is the fact that you can now change the tips without having to power-cycle the supply. Just pull the old one out and insert the new one, that's it.

Greetings,

Chris

Greetings,

Chris

Report to moderator Logged

mamalala
Supporter

Posts: 777
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #27 on:** December 15, 2012, 04:14:20 pm »

Say Thanks Reply Quote

> **Quote from: KD0CAC John on December 15, 2012, 04:03:32 pm**
>
> I have an antenna analyzer , but would have to make up an adapter to the meter .
> But again , I would assume [we know what that spells] that Metcal would make the system resonant on the one frequency it uses ?

Hehe, should have checked the new posts. My previous one basically goes into the same direction.

Greetings,

Chris

Report to moderator Logged

mamalala
Supporter

Posts: 777
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #28 on:** December 15, 2012, 04:25:27 pm »

Say Thanks Reply Quote

Oh, and another thing. Obviously i am trying to come up with a circuit of my own. Not trying to copy the original circuit here, where would be the fun in that... So it's only natural that a few things are different, which is just another reason why knowing the exact specs of the original toroids is not really that important. In the end it's just a simple step-up transformer followed by a low-pass filter.

My focus is mainly on making the whole thing a bit simpler, so that others can build one as DIY project. If in the end it is 90% as good as the original, i'm already happy. I'm hoping that then others will follow up and do the final tweaks to get it to 100% or even better

Greetings,

Chris

Report to moderator Logged

mamalala
Supporter

Posts: 777
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #29 on:** December 15, 2012, 05:13:18 pm »

Say Thanks Reply Quote

> **Quote from: mikeselectricstuff on December 15, 2012, 01:09:07 pm**
>
> I've uploaded some hi-res PCB pics of the MX5000 here

Now _that_ is very interresting. It seems that in this unit they also used T80-6 toroids. Yellow, with gray side, and the size seems to be that of the T80 (0.8"). Also an IRF510, but not as the final i think, but as a driver. More SMD capacitors instead of all-THT-mica.

Greetings,

Chris

Report to moderator Logged

mamalala
Supporter

Posts: 777
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #30 on:** December 15, 2012, 05:36:36 pm »

Say Thanks Reply Quote

Quote from: mikeselectricstuff on December 15, 2012, 01:09:07 pm

> Here's a pic of an old (slightly hacked) US STSS-002. If you want to borrow the inductors to test/compare you're welcome - not sure if I have suitable kit to measure here.

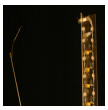
Forgot to mention: If you could post a scope trace from the waveform at the drain of the final (IRF130) that would be very helpful. That way i can check if mine matches somewhat.

Greetings,

Chris

Report to moderator Logged

mikeselectricstuff
Super Contributor



Posts: 11971
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #31 on:** December 15, 2012, 05:36:59 pm »

Say Thanks Reply Quote

Quote

> It's already bad enough that a 13.56 MHz is so uncommon. Which is quite a surprise, given the fact that this is a common frequency (RFID uses that, for example).

13.56MHz crystals are much more readily available and cheaper than oscillator modules (eg. 14 vs. 1 at farnell,cost below GBP0.50) -using an xtal with an HC04 or whatever inverter will be much cheaper and not take much space.

Quote

> Have you taken the thermal images after an hour or so of the station idling? Because it takes some time for the inductors to "warm up".

No - was in a hurry so only a few mins. May try again later

Quote

> Now _that_ is very interresting. It seems that in this unit they also used T80-6 toroids. Yellow, with gray side, and the size seems to be that of the T80 (0.8"). Also an IRF510, but not as the final i think, but as a driver. More SMD capacitors instead of all-THT-mica.

Looks like that http://uk.farnell.com/jsp/displayProduct.jsp?sku=1347752&action=view&CMP=GRHB-FINDCHIPS1-1007025]ixys 1xfh12N50F[/url] part is the main output - Ixys parts are popular for solid-state tesla coils.
Interesting to note The SMD caps are white instead of the usual brown - oddball dielectric perhaps? Also interesting that they are using quite a few different values in parallel - I wonder if maybe this is to reduce self-resonant effects.

Quote

> The question is just how the tip cartridges will handle that in the long term. And then, i see no real need to do that anyways. I can live with 6 seconds heat-up time. Bringing it down to 5 or 4 serves no real useful purpose, IMHO. What is a real gain is the fact that you can now change the tips without having to power-cycle the supply. Just pull the old one out and insert the new one, that's it.

Reducing peak draw from cold may also be useful for SMPSU sizing and possible battery operation. I also wonder if teher is scope for fairly slow PWM control instead of analogue to simplify control. I'd think something like 50-100Hz wouldn't produce much in the way of sidebands etc, while still retaining fast response.

Although the 5000 auto-resets I still tend to turn off out of habit. They could have added auto-reset quite easily to the older units.

It would be interesting to see the insides of a Thermaltronics PSU - the Metcal ones don't seem to have changed much over the years.

Report to moderator Logged

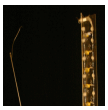
Youtube channel:Taking wierd stuff apart. Very apart.
Mike's Electric Stuff: High voltage, vintage electronics etc.
Day Job: Mostly LEDs

mikeselectricstuff

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #32 on:** December 15, 2012, 05:41:11 pm »

Say Thanks Reply Quote

Super Contributor



Posts: 11971
Country:

> **Quote**
>
> The toroids have a different color. Seems that Metcal was also trying to figure out which ones work best.

Or maybe just a different supplier

Report to moderator Logged

Youtube channel:Taking wierd stuff apart. Very apart.
Mike's Electric Stuff: High voltage, vintage electronics etc.
Day Job: Mostly LEDs

mamalala

Supporter

Posts: 777
Country:

Re: DIY Metcal 13.56 MHz RF Supply

« **Reply #33 on:** December 15, 2012, 05:47:05 pm »

Say Thanks Reply Quote

> **Quote from: mikeselectricstuff on December 15, 2012, 05:36:59 pm**
>
> 13.56MHz crystals are much more readily available and cheaper than oscillator modules (eg. 14 vs. 1 at farnell,cost below GBP0.50) -using an xtal with an HC04 or whatever inverter will be much cheaper and not take much space.

True. Maybe i go for that, if board space allows. Right now it's rather crammed, but i should be able to make some space for that.

> **Quote**
>
> Interesting to note The SMD caps are white instead of the usual brown - oddball dielectric perhaps? Also interesting that they are using quite a few different values in parallel - I wonder if maybe this is to reduce self-resonant effects.

Well, either that or to get the proper value out of a combination, and also for current handling capacity i think.

The white/gray dielectric is usually NP0, which is preferred to be used in such places anyways due to low dielectric losses and low drift.

> **Quote**
>
> Reducing peak draw from cold may also be useful for SMPSU sizing and possible battery operation. I also wonder if teher is scope for fairly slow PWM control instead of analogue to simplify control. I'd think something like 50-100Hz wouldn't produce much in the way of sidebands etc, while still retaining fast response.

Right now it draws up to 2.3 amperes during heat up for a few seconds, at 26 volts supply voltage. It drops to about 700something mA once the tip reached it's temperature.

You can't really PWM regulate that thing, i think. What it does is to pick up the peak voltage right before the last output filter coil. It then tries to keep the voltage at that point constant, by feeding that back into the buck regulators feedback pin. The principle here is that if the load matches (i.e. cold tip), the voltage before and after that coil are roundabout the same. The hotter the tip gets, the more of the RF power is reflected back. That means that after that coil the voltage drops, while before it will rise. But since that is in the feedback loop, the buck will lower the output voltage, and thus reduces power fed into the cartridge. And, of course, it keeps the final from going up in smoke: that reflected power would cause a voltage increase there as well, effectively destroying it if there was to be no regulation.

Greetings,

Chris

Report to moderator Logged

SeanB

Super Contributor

Posts: 15069
Country:

Re: DIY Metcal 13.56 MHz RF Supply

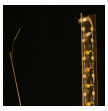
« **Reply #34 on:** December 15, 2012, 06:01:35 pm »

Say Thanks Reply Quote

Probably a low loss ceramic material, possibly pure aluminia, as they do have a very high RF current in them The parallel units will also help to increase the cooling as the current gets spread over a larger area of capacitor

Report to moderator Logged

mikeselectricstuff
Super Contributor



Posts: 11971
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #35 on:** December 15, 2012, 06:05:25 pm »

Say Thanks Reply Quote

> **Quote from: mamalala on December 15, 2012, 05:47:05 pm**
>
> > **Quote from: mikeselectricstuff on December 15, 2012, 05:36:59 pm**
> >
> > 13.56MHz crystals are much more readily available and cheaper than oscillator modules (eg. 14 vs. 1 at farnell,cost below GBP0.50) -using an xtal with an HC04 or whatever inverter will be much cheaper and not take much space.
>
> True. Maybe i go for that, if board space allows. Right now it's rather crammed, but i should be able to make some space for that.

or use the osc on a PIC12 or ATTiny - smaller than a HC04, and you get some simple control functions for free (auto-reset, powerdown timeout, startup current limit.)

> **Quote**
>
> > **Quote**
> >
> > Interesting to note The SMD caps are white instead of the usual brown - oddball dielectric perhaps? Also interesting that they are using quite a few different values in parallel - I wonder if maybe this is to reduce self-resonant effects.
>
> Well, either that or to get the proper value out of a combination, and also for current handling capacity i think.

The number will be to get current handling - don't have it in front of me but I think there were 3 or 4 different values. Could be to balance qties used in the BOM but considering other cost-inefficiencies (e.g.RTC and use of TH where SMD could have been used) it seems unlikely

> **Quote**
>
> > **Quote**
> >
> > Reducing peak draw from cold may also be useful for SMPSU sizing and possible battery operation. I also wonder if teher is scope for fairly slow PWM control instead of analogue to simplify control. I'd think something like 50-100Hz wouldn't produce much in the way of sidebands etc, while still retaining fast response.
>
> Right now it draws up to 2.3 amperes during heat up for a few seconds, at 26 volts supply voltage. It drops to about 700something mA once the tip reached it's temperature.

I suppose worst-case when you hit a heavy tip to a groundplane is the most significant limit - if this is a lot lower than cold then it may be worth looking at some sort of startup current limit.

> **Quote**
>
> You can't really PWM regulate that thing, i think. What it does is to pick up the peak voltage right before the last output filter coil. It then tries to keep the voltage at that point constant, by feeding that back into the buck regulators feedback pin. The principle here is that if the load matches (i.e. cold tip), the voltage before and after that coil are roundabout the same. The hotter the tip gets, the more of the RF power is reflected back. That means that after that coil the voltage drops, while before it will rise. But since that is in the feedback loop, the buck will lower the output voltage, and thus reduces power fed into the cartridge. And, of course, it keeps the final from going up in smoke: that reflected power would cause a voltage increase there as well, effectively destroying it if there was to be no regulation.

I didn't appreciate the voltage issue though - was thinking in terms of heat only.
It might be viable if you took more control of the loop - would maybe need to take the buck reg into a microcontroller. I supppose you could integrate some current limiting into the buck.

Report to moderator Logged

Youtube channel:Taking wierd stuff apart. Very apart.
Mike's Electric Stuff: High voltage, vintage electronics etc.
Day Job: Mostly LEDs

mamalala
Supporter

Posts: 777
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #36 on:** December 15, 2012, 06:23:06 pm »

Say Thanks Reply Quote

> **Quote from: mikeselectricstuff on December 15, 2012, 06:05:25 pm**
>
> or use the osc on a PIC12 or ATTiny - smaller than a HC04, and you get some simple control functions for free (auto-reset, powerdown timeout, startup current limit.)

Well, i would prefer to have the main RF board working without any µC. It should be purely optional to have µC in there.

However, the SN74LVC1GX04 looks like exactly the right part for this. Now i have to check where to get it. I only have an account at RS, and they don't have it. Digikey is too expensive wrt. shipping costs for just a few parts. Farnell has it, but i don't have an account there.

> **Quote**
>
> I didn't appreciate the voltage issue though - was thinking in terms of heat only.
> It might be viable if you took more control of the loop - would maybe need to take the buck reg into a microcontroller. I supppose you could integrate some current limiting into the buck.

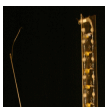
Well, it's pretty easy. The max. current draw is a function of the voltage supplied by the buck converter. Reducing that will reduce the max. current it draws. It would be easy to inject some voltage at the feedback input during startup, through a diode, to limit that. A simple R/C network plus a small FET will do the trick. Of course that also means it will take a lot longer for the tip to reach it's temp. I can route the feedback input of the buck to a pin on the header as well, also placing a 1N4148 in series there.

Greetings,

Chris

Report to moderator Logged

mikeselectricstuff
Super Contributor



Posts: 11971
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #37 on:** December 15, 2012, 09:06:30 pm »
Say Thanks Reply Quote

This is the drain waveform on that old STSS unit starting from cold. Interesting how it slowly climbs for a few secs before peaking.

Regulator output goes 20V up to 24V then down to 18.5V at idle. Current draw at 30Vin goes 2.0 to 2.8 to 0.9A

Ignore 'incident' at end due to stuff shorting out on bench.... it survived!
http://youtu.be/Qslmsz4THvA

Report to moderator Logged

Youtube channel:Taking wierd stuff apart. Very apart.
Mike's Electric Stuff: High voltage, vintage electronics etc.
Day Job: Mostly LEDs

mikeselectricstuff
Super Contributor

Posts: 11971
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #38 on:** December 15, 2012, 09:47:57 pm »
Say Thanks Reply Quote

Here are the MX5000 waveforms :
Yellow - IXFH12N50F drain, 50V/div Green = IRF510 drain, 10V/div Blue=regulator out 5V/div

BTW the parallel caps on the 5000, they use following combinations :
150p,33p,82p / 6x150p, 33p,39p / 150px2, 33px2 39p

Report to moderator Logged

Youtube channel:Taking wierd stuff apart. Very apart.
Mike's Electric Stuff: High voltage, vintage electronics etc.
Day Job: Mostly LEDs

mamalala
Supporter

Posts: 777
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #39 on:** December 15, 2012, 10:24:50 pm »

Say Thanks Reply Quote

Wonderful, thank you very much, this was indeed really helpful. Turns out that i'm not that far away Attached is a photo of the waveform i have at the drain of the IRF510 in my circuit. The "ringing" at the bottom can be reduced or increased by adding/removing turns from the transformer. Plus, i have a really lousy probe as well, that just shows crap at the 10:1 setting, so the voltages there are not correct at all. Anyways, finetuning of the xformer/filters makes sense only once i get the 13.56 MHz source.

The changing waveform on the STSS is correct, i have the very same effect in my circuit. It seems that a cold cartridge reflects more RF than when it has a little temperature. Then it reflects less, until to start reflect much more once it reached its temperature.

Again, thanks a lot for the help. That just confirmed that i'm pretty much on track with what i am doing here.

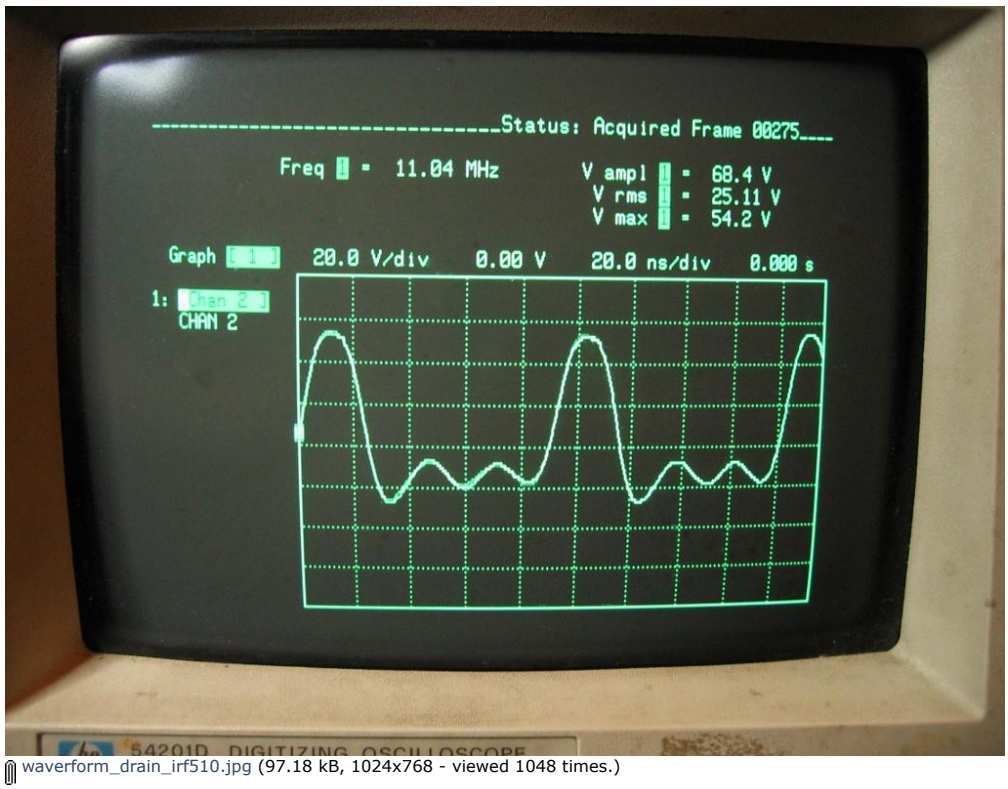
Oh, that the MX-5000 is a bit different there is because it seems not to have the xformer circuitry that the STSS/RFG/MX500 units have. Instead it seems that it just generates a high voltage "square" wave which is then simply filtered to a sine-like shape. Because the older units drive the center tap of an auto-transformer, you naturally get more ringing and stuff there.

BTW, i changed the circuit and layout here already to use bigger toroids for the xformer and the first filter coil, replaced the osc with the SN74.. and crystal, and also added the diode thingy to allow external limiting of the buck's voltage.

I will look and think about the current layout a bit during the next week, then i'll get a batch of boards produced in China. I guess you are interested in some boards as well?

Greetings,

Chris



waveform_drain_irf510.jpg (97.18 kB, 1024x768 - viewed 1048 times.)

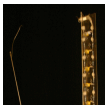
Report to moderator Logged

mikeselectricstuff
Super Contributor

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #40 on:** December 15, 2012, 11:26:41 pm »

Say Thanks Reply Quote

Do you have an enclosure in mind? It's always easier to make a PCB fit an enclosure than find an enclosure to fit an arbitarily designed PCB.
As people may want to do different things with PSUs etc, maybe a good approach would be to find a



Posts: 11971
Country:

small off-the-shelf well-shielded metal box, which forms a module that can then be put into whatever less shielding-critical case along with PSU.
This would have the RF connector (these are usually long enough to go through multiple panel walls), and maybe some RF feedthroughs for DC-in and feedback/control.
Seems it would be simple to keep the noisy RF stuff contained in a small module rather than try to stop it coming out of a large box.

e.g. this sort of thing :
http://www.perancea.com/prod-fr.htm
or maybe a small diecast box.

Or at least include holes to allow for an off-the-shelf can to go over the PCB (might you need to add clearance to avoid eddy-current losses?)
e.g. http://www.perancea.com/prod-fr.htm

Getting good heatsink coupling with good shielding may make this slightly tricky.

Another option may be to make a set of shielding panels out of PCB that can be slotted together and seam-soldered.

Report to moderator Logged

Youtube channel:Taking wierd stuff apart. Very apart.
Mike's Electric Stuff: High voltage, vintage electronics etc.
Day Job: Mostly LEDs

mamalala
Supporter

Posts: 777
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #41 on:** December 15, 2012, 11:54:52 pm »

Say Thanks Reply Quote

Quote from: mikeselectricstuff on December 15, 2012, 11:26:41 pm

> Do you have an enclosure in mind? It's always easier to make a PCB fit an enclosure than find an enclosure to fit an arbitarily designed PCB.

Ahh, well, the dreaded issue of enclosures. In the past decades i found that it is close to useless to design DIY stuff for some specific enclosure. The markets are way too different to even come close to a common denominator here. For example, in the US market you see Hammond very often. In Europe they are more of a curiosity, however. In Germany you see things like Bopla or OKW very often (BTW, check out OKW. They make _really_ nice enclosures!), but overseas they are basically unheard of.

The current PCB is exactly 91mm x 91mm. It has four mounting holes in the corners. The FET final sits in a cut-out inside the PCB. The reasons for that are various. For one, there are 100mm x 100mm heatsinks available. Or any other heatsink in a plain square format with roundabout the same dimensions. So the PCB would be mounted directly onto that heatsink, allowing the FET to be mounted on there as well. Since the heatsink is massive aluminium, it acts as a shield as well in that direction.

Then, all the connections are done as solder pads, and the header is also placed on the board in a way that does not require any "sideways" stuff. So the controlling/supply PCB can be stacked directly onto it. Using hex standoffs, they can act as the screws to mount the RF PCB on the heatsink, while allowing the control/supply PCB screwed on top of that. Like a sandwich.

What goes around is completely up to the folks building that thing. I would go for sheet aluminium and 90° aluminium profiles, all stuff that is readily available. A heatsink usually has a thick enough base to allow tapping in of threads on the sides.

Or the whole thing can be screwed into some die-cast metal box. There are many options, actually. In any case, i'm definitely not going to plan the PCB for a specific enclosure. Too much trouble down that route....

Oh, since 100x1600mm for example is a standard format, at least here in Europe, for PCB's (heck, that format is even called "Euro-Format"), there are plenty of enclosures available where it will fit into. For example that stuff that is basically extruded aluminium profiles with sheet aluminium as the front/rear panels (and sometimes top/bottom). So, with the PCB size i have chosen there should be little problems to find a suitable enclosure.

Greetings,

Chris

Report to moderator Logged

mamalala
Supporter

Posts: 777
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #42 on:** December 16, 2012, 12:03:47 am »
Say Thanks Reply Quote

Speaking of heatsink, this is the one i had in mind:

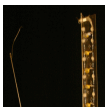
http://uk.farnell.com/fischer-elektronik/sk-508-100-sa/led-heatsink-standard-extruded/dp/1850032

Greetings,

Chris

Report to moderator Logged

mikeselectricstuff
Super Contributor



Posts: 11971
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #43 on:** December 16, 2012, 12:36:16 am »
Say Thanks Reply Quote

> **Quote**
>
> Ahh, well, the dreaded issue of enclosures.

tell me about it - I've spend way too many hours of my life finding just the right one...

> **Quote**
>
> In the past decades i found that it is close to useless to design DIY stuff for some specific enclosure. The markets are way too different to even come close to a common denominator here. For example, in the US market you see Hammond very often. In Europe they are more of a curiosity, however. In Germany you see things like Bopla or OKW very often (BTW, check out OKW. They make _really_ nice enclosures!), but overseas they are basically unheard of.

Nonsense - There are no significant national borders these days for that sort of stuff. All of the above are widely available pretty much anywhere. I think they all have UK offices, but as most are stocked by Farnell/E14, Digikey etc. they're no problem (at least no more than any other component) to get pretty much anywhere.
OKW and Bopla are nice but often rather expensive. Hammond are usually very good value and well made - usually my first choice when looking for plastic enclosures.

Incidentally have you done any measurements on the actual dissipated power/heatsink requirement?

Report to moderator Logged

Youtube channel:Taking wierd stuff apart. Very apart.
Mike's Electric Stuff: High voltage, vintage electronics etc.
Day Job: Mostly LEDs

mamalala
Supporter

Posts: 777
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #44 on:** December 16, 2012, 01:03:08 am »
Say Thanks Reply Quote

> **Quote from: mikeselectricstuff on December 16, 2012, 12:36:16 am**
>
> Nonsense - There are no significant national borders these days for that sort of stuff. All of the above are widely available pretty much anywhere. I think they all have UK offices, but as most are stocked by Farnell/E14, Digikey etc. they're no problem (at least no more than any other component) to get pretty much anywhere.

Well, yes and no. True, it is nonsense in so far that many distributors offer them. But then, in the EU they have the habit of not wanting private people as customers but only want to sell to businesses. And the shops that sell to everyone usually have a very limited range.

Sure, it's somewhat of a moot point anyways, since this circuit already uses parts that are not available in many hobbyist shops anyways. but then, it's kind of a habit of mine to ignore the issue of specific enclosures. It's too much of a waste of time for some generic DIY project that is intended to be modified or have different "extras". It's not like i'm doing this for some customer, where i can decide what has to be used and what not.

Talking about DigiKey. I find their shipping costs absurd, at least last time i checked. Oh, and have you ever ordered samples from Texas Instruments? Compare the paperwork with that of a DK shipping

> **Quote**
>
> Incidentally have you done any measurements on the actual dissipated power/heatsink requirement?

Not yet, no. I use a pretty inefficient heatsinking right now, since i'm still in development of that thing. This is what i have for testing:

http://www.pollin.de/shop/dt/MzI5OTY1OTk-/Bauelemente_Bauteile/Mechanische_Bauelemente/Kuehlkoer

As you can see in the first images i posted, it actually is _under_ the PCB, fins down. Plus, it is really small. All i can say is that after 1 hour, my dummy load that uses 2 of these heatsinks gets hotter than the one on the FET.

Greetings,

Chris

Report to moderator Logged

mikeselectricstuff
Super Contributor

Posts: 11971
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #45 on:** December 16, 2012, 01:07:58 am »
Say Thanks Reply Quote

> **Quote**
>
> Talking about DigiKey. I find their shipping costs absurd, at least last time i checked.

They ship free to UK for orders >GBP50 - I think it's similar in EU

> **Quote**
>
> Oh, and have you ever ordered samples from Texas Instruments?

Yes, but not recently - usually very quick & efficient - only issue I've had is once needing more then their max qty, so got someone else to get some as well. This was for parts that weren't in stock anywhere.

Report to moderator Logged

Youtube channel:Taking wierd stuff apart. Very apart.
Mike's Electric Stuff: High voltage, vintage electronics etc.
Day Job: Mostly LEDs

mamalala
Supporter

Posts: 777
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #46 on:** December 17, 2012, 03:59:02 pm »
Say Thanks Reply Quote

Alright, just placed the order for a bunch of PCB's, 10pcs. of the RF stage PCB and 10 pcs. of the Controller/Supply PCB. Should arrive between mid and end of next week. Hope i didn't introduce some nasty mistakes, but after rechecking several times i found nothing suspicious.

Once they arrive i will assemble a unit to determine the final values of a few parts, and then release the design files plus some docu on how to assemble it, winding the toroids, how to adjust, etc.

Greetings,

Chris

Report to moderator Logged

mamalala
Supporter

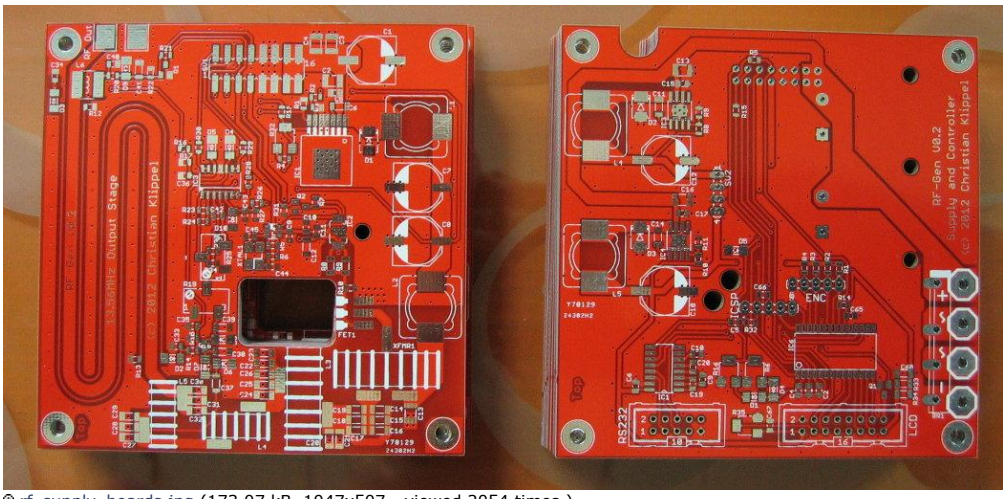
Posts: 777
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #47 on:** December 28, 2012, 11:19:26 am »
Say Thanks Reply Quote

Small update: The PCB's arrived today, after the delivery guy messed it up yesterday. First he claimed my name was nowhere to be found. Then wrote a notice for the delivery attempt using a different name (from a neighbour) and put it in her mailbox. Also claimed my name was nowhere on any of the mailboxes here. DHL Express, my ass ;(

Greetings,

Chris



rf_supply_boards.jpg (173.07 kB, 1047x507 - viewed 2054 times.)

Report to moderator Logged

SeanB
Super Contributor

Posts: 15069
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #48 on:** December 28, 2012, 02:55:57 pm »
Say Thanks Reply Quote

What do you expect from the lowest paid worker? Here I have difficulty getting the post on a postbox, often the wrong box bgets my mail and vice versa. I often lean in through the box and put it in the next box where it should have been.

Report to moderator Logged

mamalala
Supporter

Posts: 777
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #49 on:** December 28, 2012, 03:35:44 pm »
Say Thanks Reply Quote

> **Quote from: SeanB on December 28, 2012, 02:55:57 pm**
>
> What do you expect from the lowest paid worker? Here I have difficulty getting the post on a postbox, often the wrong box bgets my mail and vice versa. I often lean in through the box and put it in the next box where it should have been.

Well, i expect from them to be able to read what is written on the mailbox and the doorbell-knob. The latter being a really big one. I expect that especially from some alleged premium service. And i don't like to be lied to in my face. Because that guy today claimed that my name was not on any doorbell at the front, nor on any mailbox in the house. Which is just wrong. Not only is it there, for years, it is printed out in big letters. Funny enough, i usually get everything without any problems. It's only around holiday seasons that things go south, when they get a bunch of reserve people because the regular ones are in holidays.

I understand that they get little pay and have a heavy workload. But that still isn't a reason to be that sloppy, let alone to lie straight into my face.

Greetings,

Chris

Report to moderator Logged

SeanB
Super Contributor

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #50 on:** December 28, 2012, 03:55:33 pm »
Say Thanks Reply Quote

Here a part of the application process is a reading test, because you find many with a school certificate who cannot do more than read and write their own name..... And this after 12 years of school.

Report to moderator Logged

Posts: 15069
Country:

mamalala
Supporter

Posts: 777
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #51 on:** December 28, 2012, 04:06:42 pm »
Say Thanks Reply Quote

Quote from: SeanB on December 28, 2012, 03:55:33 pm

> Here a part of the application process is a reading test, because you find many with a school certificate who cannot do more than read and write their own name..... And this after 12 years of school.

Well, he surely can read and write. After all, he was able to read my neighbors name from their mailbox, and write it onto the notification. He just didn't give a damn about his job in general, it seems. He could have said he was in a hurry and didn't check all the mailboxes. Or that he thought the recipient name on the parcel was wrong (my neighbors name and mine share a few letters). But instead he chose to flat out lie into my face, which is just stupid. My name is on the houses front door in big, printed letters. On my mailbox, again in big, printed letters. And on my entry door, dare i say it: in big printed letters.

Ahh, whatever. He surely got his share of abuse from me today. Now back to soldering a pair of these boards, to get things rolling here Already prepared some graphics for the documentation of this thing, now need to figure out a few final part values.

Greetings,

Chris

Report to moderator Logged

cwalex
Frequent Contributor

Posts: 302
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #52 on:** December 29, 2012, 09:26:26 am »
Say Thanks Reply Quote

Quote from: mamalala on December 28, 2012, 11:19:26 am

> Small update: The PCB's arrived today, after the delivery guy messed it up yesterday. First he claimed my name was nowhere to be found. Then wrote a notice for the delivery attempt using a different name (from a neighbour) and put it in her mailbox. Also claimed my name was nowhere on any of the mailboxes here. DHL Express, my ass ;(
>
> Greetings,
>
> Chris

Nice looking boards Are you going to sell some?

Report to moderator Logged

mamalala
Supporter

Posts: 777
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #53 on:** December 29, 2012, 10:33:36 am »
Say Thanks Reply Quote

Quote from: cwalex on December 29, 2012, 09:26:26 am

> Nice looking boards Are you going to sell some?

Thanks!

Sure, once i checked that they work as expected i can hand out the excess boards, no problem. The ten sets came out at around 100 Euros when i got them. This included shipping and taxes. So a single set would be 10 Euros plus shipping.

So far i have the supply/controller board assembled and it works OK, and so does the dc/dc converter part of the generator board. Today i'm assembling the remainder of the generator board, step-by-step, and check it. After that i plan to write up some docu for it, and work on the firmware for the controller board. Then, finally, updating the Eagle files, and packaging it all up to upload it here.

Greetings,

Chris

Report to moderator Logged

mamalala
Supporter

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #54 on:** December 29, 2012, 09:07:38 pm »
Say Thanks Reply Quote

Posts: 777
Country:

Hi all,

that thing works

Today i assembled a complete unit, step by step, testing functionality after each step. Attached are some pictures of the unit, without enclosure.

After i was finished it did not output enough power. I was searching, comparing to the old prototype, etc. After about an hour and a half it dawned me: heck, i now use the 13.56 MHz instead of the 11 of the old unit. Of course! The toroids didn't fit anymore. So i had to sit down and wind a collection of toroids with decreasing numbers of turns, until i found a combination that pretty much matched the old one in terms of output power. Sure, it's probably not perfect yet, but so far it's OK.

In the pictures you can see the main RF generator board mounted flat on a heatsink. The one i used is pretty thick, 40mm. In the end, a 25mm heatsink will do fine. That big thing just gets hand-warm after over an hour...

On top of the generator board is the supply/controller board. This one just generates the +5V and +12V rails, and has a µC for all the bells and whistles. However, it is pretty much optional. Any other design will do as well. The bare minimum is to provide the two voltages and connecting the tip-detection output via a 1k pull-up to the enable line of the generator.

From that it follows that on the main generator board the parts for the SWR bridge can be omitted as well, if that feature is not wanted.

The unit _can_ run from 24 volts supply just fine, however, a bit more is recommended if one wants a really fast heat-up time after power-up. Something around 26 to 28 volts should be OK.

On the current controller/supply boards the buck regulators for the 5/12 volt rails are heavily oversized. That's simply because i used what i had at hand. I have not checked the actual current requirements for these rails, but i think something in the region of a few hundred mA each should do fine. Maybe a bit more for the 12V rail, peak current to drive the FET final is around 1A, but only for a short spike, so some hundred mA plus the buffer cap on the RF board should do just fine.

So, what can it do? Well, of course it happily drives Metcal handpieces/cartridges for the 13.56 MHz system. Oh, and the Thermaltronics stuff for the same frequency as well, of course. The tip-detection works without shutting and locking the whole unit down, like the original Metcal stuff, and thus does not require a power-cycle. Simple pull out the tip and put a new one in, done.

Then i implemented the idea from mikeselectricstuff to allow some form of current limiting. This is done by providing a connection (through a series resistor) to the RF generators buck regulator. Feeding in a positive voltage will decrease the maximum output voltage of that buck, how much depends on the voltage fed into it. Accordingly, feeding a voltage that is lower than what is "normal" will result in boosting the output. The µC can control that with a tri-state pin: pin as input = normal operation, pin as output high = limiting, pin as output low = boosting. I provided two trimpots on the controller board to set both of these option separately.

This is quite a useful option. For example, the limiting option can be used in cases were the power supply/transformer can not supply enough amperes to satisfy the maximum demand during power-up/after tip change. Once the tip reached a certain temp (well, in reality if the SWR reached a certain value) it can switch to normal mode, to still get a good thermal recovery.

But then it can be used to implement some smart standby function. After a while of idling, detected through the lack of bigger SWR changes, the unit can limit the power to send it into standby. This means that the tip does not cool down completely. Once a big downward change in SWR is detected it means that the tip is used. Then it can go into boost mode for a really quick heat-up, and once it reached a certain SWR fall back into normal mode. it then will stay in normal mode until some user-definable timespan has elapsed, after which the whole thing starts over...

Alright, that's it for now. Tomorrow i will work on the documentation, so that i can finally upload the first part (that is, the RF generator board) here. After that follows some doc about my current supply/controller board (plus schema/layout of course). Once i'm done with those two things i will work on a first usable version of the firmware.

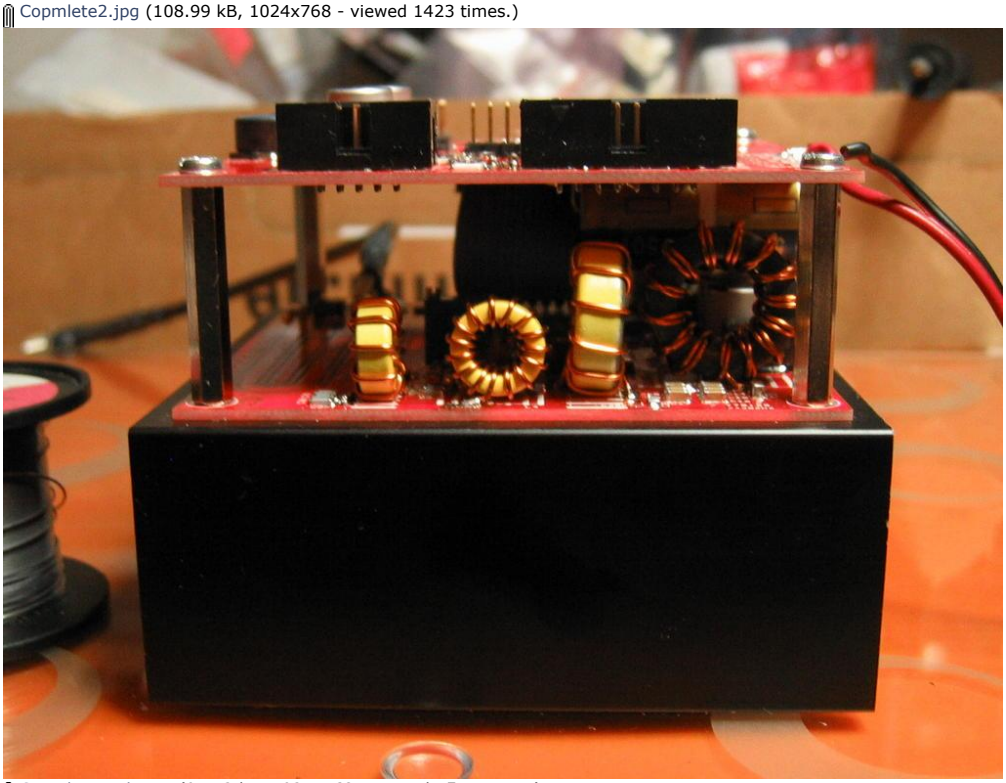
Greetings,

Chris

RF-Gen_Heatsink.jpg (115.27 kB, 1024x768 - viewed 1768 times.)

Copmlete1.jpg (105.44 kB, 1024x768 - viewed 1449 times.)

Copmlete2.jpg (108.99 kB, 1024x768 - viewed 1423 times.)



Copmlete_side.jpg (94.12 kB, 1024x768 - viewed 1571 times.)

Report to moderator Logged

mamalala

Supporter

Posts: 777

Country:

Re: DIY Metcal 13.56 MHz RF Supply

« **Reply #55 on:** December 29, 2012, 10:07:13 pm »

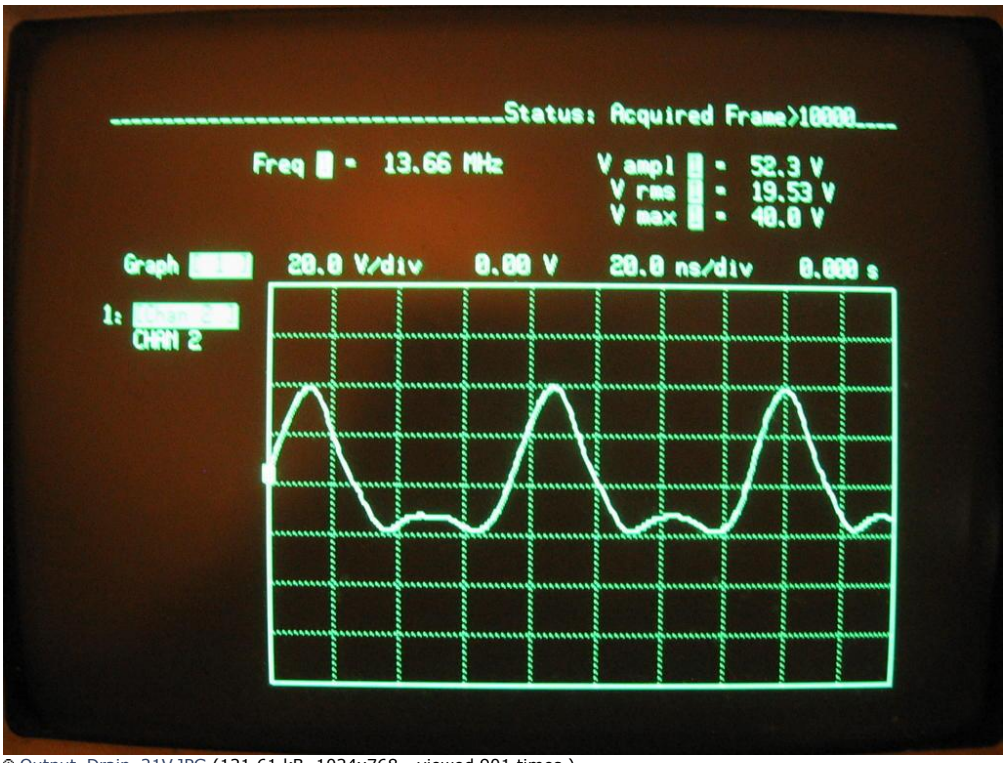
Say Thanks Reply Quote

And here are some scope images of the waveforms with a 50 ohms dummy load connected to the output. One is the output at the IRF510 drain, the next is the output of the RF transformer and the last is the output at the dummy load itself. Output voltage of the buck converter on the generator board is about 21 volts.

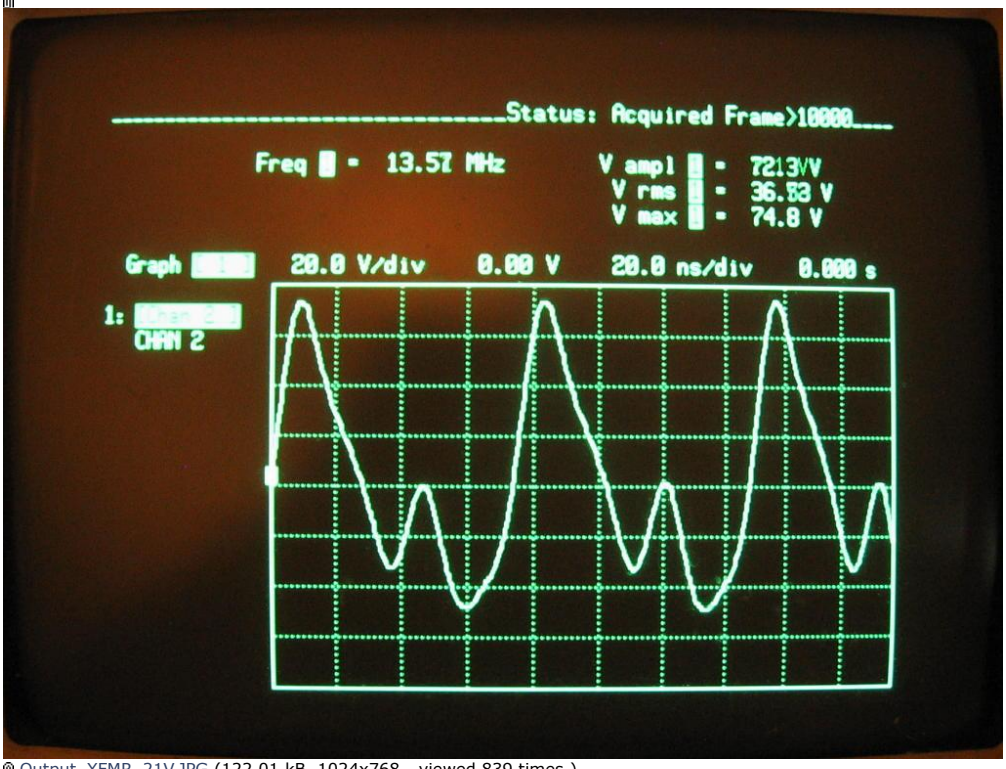
Greetings,

Chris

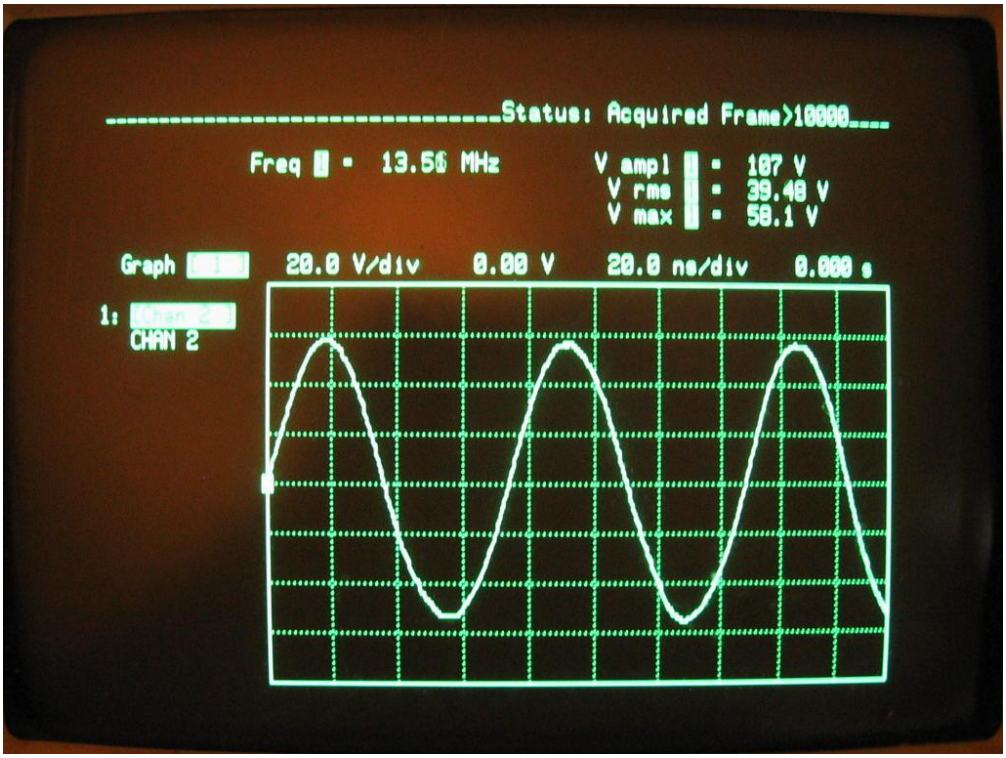
Edit: Keep in mind that i have a really shitty probe, one of these 10 Euro crappy things. Plus, my scope is half-broken (that is, channel 1 is dead, so i don't really know how good channel 2 (which i use) still is....)



Output_Drain_21V.JPG (121.61 kB, 1024x768 - viewed 901 times.)



Output_XFMR_21V.JPG (122.01 kB, 1024x768 - viewed 839 times.)



Output_50-ohm_21V.JPG (122.88 kB, 1024x768 - viewed 873 times.)

« *Last Edit: December 29, 2012, 10:09:01 pm by mamalala* »

Report to moderator Logged

Fsck
Super Contributor

Posts: 1157
Country:
sleep deprived

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #56 on:** December 30, 2012, 12:45:19 am »

Say Thanks Reply Quote

Awesome project! Always looking forward to the updates and definitely jumping on one of those boards!

Report to moderator Logged

"This is a one line proof...if we start sufficiently far to the left."

peter.mitchell
Super Contributor

Posts: 1568
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #57 on:** December 30, 2012, 04:29:49 am »

Say Thanks Reply Quote

Damn, this is looking good, i'm going to start looking at enclosures Speaking of, can you extend the leads on the main FET so it can be mounted on a heatsink elsewhere? Or will the extra inductance mess with the switching?
Also, you say it ***can*** run from 24v, but you suggest 26-28v, do you have a definitive voltage and current spec or is this coming?

Sorry about all the questions I'll keep an eye out for the documentation

Report to moderator Logged

SeanB
Super Contributor

Posts: 15069
Country:

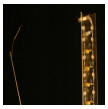
Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #58 on:** December 30, 2012, 09:06:41 am »

Say Thanks Reply Quote

That FET is running at 13MHz, so extending the leads is a no no.

Report to moderator Logged

mikeselectricstuff
Super Contributor



Posts: 11971
Country:

Youtube channel:Taking wierd stuff apart. Very apart.
Mike's Electric Stuff: High voltage, vintage electronics etc.
Day Job: Mostly LEDs

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #59 on:** December 30, 2012, 11:14:07 am »
Say Thanks Reply Quote

Something I was considering is making something for field use to run off a laptop PSU (typically 19V), so you'd only have to take one PSU with you.
This would probably need a buck/boost topology, or a pre-boost stage, complicating things....

Report to moderator Logged

mamalala
Supporter

Posts: 777
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #60 on:** December 30, 2012, 11:52:41 am »
Say Thanks Reply Quote

> **Quote from: Fsck on December 30, 2012, 12:45:19 am**
>
> Awesome project! Always looking forward to the updates and definitely jumping on one of those boards!

Thanks!

> **Quote from: peter.mitchell on December 30, 2012, 04:29:49 am**
>
> Damn, this is looking good, i'm going to start looking at enclosures Speaking of, can you extend the leads on the main FET so it can be mounted on a heatsink elsewhere? Or will the extra inductance mess with the switching?
> Also, you say it ***can*** run from 24v, but you suggest 26-28v, do you have a definitive voltage and current spec or is this coming?
>
> Sorry about all the questions I'll keep an eye out for the documentation

No, placing the FET elsewhere and extending its connections will very likely not work. As SeanB said, this is running at 13.56 MHz. RF is nasty with these things

The 100mm x 100mm x 25mm heatsink is not that expensive and serves as a base to mount all the stuff on.

Regarding the specs for power consumption at different voltages, well, i have to check out those details later. Obviously it will draw a bit more current at 24 volts when idle, since we have buck converters here.

> **Quote from: mikeselectricstuff on December 30, 2012, 11:14:07 am**
>
> Something I was considering is making something for field use to run off a laptop PSU (typically 19V), so you'd only have to take one PSU with you.
> This would probably need a buck/boost topology, or a pre-boost stage, complicating things....

These universal laptop supplies which have a switch to select the voltage can usually go up to 24 volts. And it should be rather easy to hack them to produce 26 volts, if needed, i think.

Greetings,

Chris

Report to moderator Logged

peter.mitchell
Super Contributor

Posts: 1568
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #61 on:** December 30, 2012, 12:10:43 pm »
Say Thanks Reply Quote

> **Quote from: SeanB on December 30, 2012, 09:06:41 am**
>
> That FET is running at 13MHz, so extending the leads is a no no.

Yeah, i doubted it would, but worth asking anyways, the reason I asked was so I could think of enclosures and heat sink designs for minimal space, 10x10x2.5 is pretty large and heavy for a portable device, If I cut the size and weight down with a smaller heat sink and a fan you could easily offset the extra power consumption with more batteries or a tiny bit larger power supply... Hmm... Maybe I could get a notebook heat sink, add a little fan, bend the heatpipe a little... hmmm... i'd be very much interested in buying/building up one of these, anyway, don't take this the wrong way, i'm like a little kid thinking of things he will do with his birthday presents before he gets them, hopefully you understand.

I made up a few LiPo LVCO boards a little while back, i've been using them for a small industrial PC running of RC LiPos, I think they might come in useful for this too.

Report to moderator Logged

SeanB
Super Contributor

Posts: 15069
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #62 on:** December 30, 2012, 12:18:17 pm »
Say Thanks Reply Quote

You could get by with a thinner heatsink, or use a laptop heatpipe and make it thin but longer so the fan is next to the board. The power device is near enough to an end to fit one.

Report to moderator Logged

mamalala
Supporter

Posts: 777
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #63 on:** December 30, 2012, 12:40:48 pm »
Say Thanks Reply Quote

Yea, but note that the PCB itself is already 91mm x 91mm in size. So the only thing that could really minimized is the depth. There are really flat heatsinks available, i think 10mm or so, but dunno how much they cost.

Also, you could probably use the base/wall of whatever metal/alu enclosure you chose and mount the PCB flat on there, and add a fan on the outside. You can also place the FET upright instead, and figure out some other way of attaching a heatsink then.

Another issue to consider is the buck regulator and the FET driver on that board. I placed a bunch of thermal vias underneath each of them. The buck itself already has a thermal pad, which i solder as well. On the bottom side of the board there is no solderstop in that area. So in my setup i put a dab of thermal compound there as well.

No idea how hot the buck would really get, and for the driver it's more of a "better safe than sorry" thing. Maybe its already enough the way it is due to the copper groundplane, or maybe glue some small heatsinks on top of those parts as well. Time will tell...

Greetings,

Chris

Report to moderator Logged

mamalala
Supporter

Posts: 777
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #64 on:** December 30, 2012, 12:42:51 pm »
Say Thanks Reply Quote

> **Quote from: mikeselectricstuff on December 30, 2012, 11:14:07 am**
>
> Something I was considering is making something for field use to run off a laptop PSU (typically 19V), so you'd only have to take one PSU with you.
> This would probably need a buck/boost topology, or a pre-boost stage, complicating things....

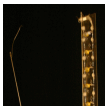
It just occurred to me that maybe it is possible to wind the RF transformer a bit differently. Right now it uses a bifilar winding, that is basically two windings with the same number of turns. Maybe the output winding could get a few more turns to transform it up a bit more, thus making up for a lower supply voltage.

Greetings,

Chris

Report to moderator Logged

mikeselectricstuff
Super Contributor



Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #65 on:** December 30, 2012, 01:12:21 pm »
Say Thanks Reply Quote

> **Quote from: mamalala on December 30, 2012, 12:42:51 pm**
>
> > **Quote from: mikeselectricstuff on December 30, 2012, 11:14:07 am**
> >
> > Something I was considering is making something for field use to run off a laptop PSU (typically 19V), so you'd only have to take one PSU with you.

Posts: 11971
Country:

> This would probably need a buck/boost topology, or a pre-boost stage, complicating things....

It just occurred to me that maybe it is possible to wind the RF transformer a bit differently. Right now it uses a bifilar winding, that is basically two windings with the same number of turns. Maybe the output winding could get a few more turns to transform it up a bit more, thus making up for a lower supply voltage.

Greetings,

Chris

I was wondering that but assumed that higher current in the MOSFET may be a problem.

Quote

> **Quote**
>
> > Something I was considering is making something for field use to run off a laptop PSU (typically 19V), so you'd only have to take one PSU with you.
> > This would probably need a buck/boost topology, or a pre-boost stage, complicating things....
>
> These universal laptop supplies which have a switch to select the voltage can usually go up to 24 volts. And it should be rather easy to hack them to produce 26 volts, if needed, i think.

I was thinking more along the lines of making it work with the laptop PSU that's probably already going to be in my bag, so would need to match that. Running off a laptop or power drill battery would also be a nice option, but that would certainly need some boost.

Report to moderator Logged

Youtube channel:Taking wierd stuff apart. Very apart.
Mike's Electric Stuff: High voltage, vintage electronics etc.
Day Job: Mostly LEDs

SeanB
Super Contributor

Posts: 15069
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #66 on:** December 30, 2012, 02:39:36 pm »
Say Thanks Reply Quote

I would guess there is plenty of current drive spare on the mosfet, or you can just use a higher current one in the same family.

Report to moderator Logged

mamalala
Supporter

Posts: 777
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #67 on:** December 30, 2012, 10:25:17 pm »
Say Thanks Reply Quote

Alright, here is the docu of the main RF board.

Here it is attached as the original Libre-Office .odt file. In the next post i attach it as PDF file.

The .odt is very basic, plus lots of images/graphics. I'm too stupid with that office stuff to add a proper index, etc. If anyone can and wants to help out, this original file should be useful for that purpose.

Greetings,

Chris

RF_Gen_Description.odt (1560.65 kB - downloaded 942 times.)

Report to moderator Logged

mamalala
Supporter

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #68 on:** December 30, 2012, 10:26:34 pm »
Say Thanks Reply Quote

As said, here comes the same but as PDF, for those who don't have Libre-Office installed or otherwise can not read the .odt files properly.

In the next post i attach the Eagle files and a PDF of the current schematic.

Posts: 777
Country:

Greetings,

Chris

RF_Gen_Description.pdf (1724.12 kB - downloaded 4272 times.)

Report to moderator Logged

mamalala
Supporter

Posts: 777
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #69 on:** December 30, 2012, 10:37:15 pm »
Say Thanks Reply Quote

And here are Eagle files in the ZIP archive, as well as a PDF of the schematic. Silly Forum software doesn't allow for .sch and .brd files, so i had to pack them.

Please note that i still use Eagle 4.16. So if you make any changes that you want me to include in this project, make sure that i can read your files. That is, if you edit it with never version i'm out of luck. In that way i would have to manually add the changes to my files...

The (c) of these files and the docu is with me, of course, but you are free to use that stuff as you see fit. The only request i have is that if you base your own design on this and distribute it, that you properly mention that the original design is (c) by me. And of course i can't stop (nor will) stop you from commercializing this thing. However, it would be nice if you would contact me first in that case.

Once the new-years frenzy is over i will do the same for the supply/controller board i made.

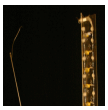
Have fun, and greetings,

Chris

RF-Gen_RF-Stage.zip (55.8 kB - downloaded 841 times.)
RF-Gen_RF-Stage.pdf (722.73 kB - downloaded 1379 times.)

Report to moderator Logged

mikeselectricstuff
Super Contributor



Posts: 11971
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #70 on:** December 30, 2012, 11:23:08 pm »
Say Thanks Reply Quote

Thinking about it, it should be pretty easy to use a boost reg instead of the buck for operation at lower voltages. What's the lowest regulator output voltage when idling?

Also, any chance you could measure the power draw from the 5V and 12V rails?

Is there any need for the fwd/reverse power measurement part other than debugging? What's the reason for it being the length it is?

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Youtube channel:Taking wierd stuff apart. Very apart.
Mike's Electric Stuff: High voltage, vintage electronics etc.
Day Job: Mostly LEDs

mamalala
Supporter

Posts: 777
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #71 on:** December 30, 2012, 11:36:13 pm »
Say Thanks Reply Quote

Just noticed that i forgot to change one part value, and thus have it wrongly in the schematic and description. R23 (around the OpAmp) should be 22k instead of 2k2. Have updated my files here, but won't upload them again just for this small change. Just make some notes about it

Once everything is published and folks have played around with it for a while (and maybe found some other bugs/errors) i can then upload a new set with all the corrections included.

Greetings,

Chris

Report to moderator Logged

mamalala
Supporter

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #72 on:** December 30, 2012, 11:42:18 pm »
Say Thanks Reply Quote

Quote from: mikeselectricstuff on December 30, 2012, 11:23:08 pm

Posts: 777
Country:

> Thinking about it, it should be pretty easy to use a boost reg instead of the buck for operation at lower voltages. What's the lowest regulator output voltage when idling?
>
> Also, any chance you could measure the power draw from the 5V and 12V rails?
>
> Is there any need for the fwd/reverse power measurement part other than debugging? What's the reason for it being the length it is?

Hi Mike,

yes, using a boost regulator should work as well, i think. The lowest output voltage depends on how one wants to fine-tune the thing later on. The values i have given in the docu are just pointers to get something working. My unit here is happy with 18-19 volts idling, going up to over 22 volts during heat-up.

The SWR bridge is purely optional. It's nothing more than a piece of the "bells and whistles" stuff i added. So you can remove it if you want to redesign the board. The length has no special meaning. It just happens that this layout and length is something i used earlier in other circuits and found to work well enough. It can't be too short, otherwise it will produce too little voltages, and the differentiation between forward and reflected isn't that goo either, i think.

So you could use that space to put the 5/12 volt supplies there. As for the 12 volts, it surely is only a few mA since it has only very few components attached to it. For the 12V rail i'm not sure, some hundred mA definitely. I will do some measurements after new-years frenzy. Reminds me that i still have to replace the fuse in my shitty multimeter....

Greetings,

Chris

Edit: Of course the SWR bridge is usefull to detect gross mismatches due to whatever reason. under normal conditions the SWR goes not above 8 or so, depending on the used tip.

« *Last Edit: December 30, 2012, 11:44:41 pm by mamalala* »

Report to moderator Logged

mamalala

Supporter

Posts: 777
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #73 on:** December 30, 2012, 11:50:42 pm »

Say Thanks Reply Quote

Oh, and the idle voltage also depends on the tip. Larger tips will have a higher idle voltage since they loose heat due to radiation and their larger surface area.

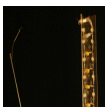
Greetings,

Chris

Report to moderator Logged

mikeselectricstuff

Super Contributor



Posts: 11971
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #74 on:** December 31, 2012, 12:39:46 am »

Say Thanks Reply Quote

Just been looking for some UK sources for magnetics. Turns out Amidon are just distributors for small qtys of cores from Micrometals and Fair-rite

RS stock the FT82-61 , Fair-rite p/no 5961000601 http://uk.rs-online.com/web/p/ferrite-rings/4674267
Farnell also list it, but as US stock: http://uk.farnell.com/fair-rite/5961000601/ferrite-core-toroid-61/dp/1781353?Ntt=5961000601

Pace Magnetics stock the T80-6 and T50-6 (£3.95 UK postage)

RS are also cheaper than Farnel for the ISL55110, but sold in packs of 2

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Youtube channel:Taking wierd stuff apart. Very apart.
Mike's Electric Stuff: High voltage, vintage electronics etc.
Day Job: Mostly LEDs

mamalala

Supporter

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #75 on:** December 31, 2012, 11:15:31 am »

Say Thanks Reply Quote

Posts: 777
Country:

A few notes that i forgot to include in the docs...

First of all, the values i have given in the docu for adjustment are just general pointers to get things to work. Of course they can be tweaked.

For example, the maximum output voltage adjusted by R32. You could set it higher, so that it will dump more energy into the tip when heating up initially. However, i have no idea how much they can handle, so be careful. Of course you could also set it lower, which would increase heatup time a bit, but at the same time reduces stress on the coil in the tip and the output driver. Generally, the higher the voltage there the higher the current consumption, naturally.

The adjustment of the idle voltage using R19 can also be tweaked. Higher idle voltage means higher idle tip temp and faster thermal recovery. Again, lower idle voltage means a bit lower idle temp and a slower thermal recovery.

The OpAmp feedback network R23/R24 defines the gain of that stage. Since this is what is in the feedback loop, tweaking these values can give you a harder/deeper or softer/shallower response for thermal recovery when using the tip.

Greetings,

Chris

Report to moderator Logged

plazma
Frequent Contributor

Posts: 443
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #76 on:** December 31, 2012, 12:43:46 pm »
Say Thanks Reply Quote

Nice
I just got a Metcal handle, tweezer and a pile of unused tips for free.
With this project I can get them into use

Report to moderator Logged

mamalala
Supporter

Posts: 777
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #77 on:** December 31, 2012, 01:01:28 pm »
Say Thanks Reply Quote

If anyone wants a set of PCB's, i still have 6 sets. One set consists of the main RF PCB and the supply/controller PCB. I'm happy to give them away without profit, that is, for the same price that i paid, plus shipping. So it comes down to 10 Euro for a set, plus whatever shipping cost is (depends on where it has to go and by what method).

So, if anyone wants a set, drop me an eMail and we'll figure out how to proceed.

Greetings,

Chris

Report to moderator Logged

mamalala
Supporter

Posts: 777
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #78 on:** December 31, 2012, 01:06:28 pm »
Say Thanks Reply Quote

Quote from: plazma on December 31, 2012, 12:43:46 pm

> Nice
> I just got a Metcal handle, tweezer and a pile of unused tips for free.
> With this project I can get them into use

That's great! Just make sure that the stuff is for the 13.56 MHz system. They also have a 455 kHz system, those things will not work on this supply.

Since i don't have such a system myself, i also can't adapt this circuit for it. My guess is that basically just the oscillator need to be changed and the xformer and filter section adapted to the lower frequency.

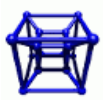
If anyone wants to jump in and work on that it would be great.

Greetings,

Chris

Report to moderator Logged

plazma
Frequent Contributor



Posts: 443
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #79 on:** December 31, 2012, 01:16:39 pm »
Say Thanks Reply Quote

Quote from: mamalala on December 31, 2012, 01:06:28 pm

Quote from: plazma on December 31, 2012, 12:43:46 pm

Nice
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That's great! Just make sure that the stuff is for the 13.56 MHz system. They also have a 455 kHz system, those things will not work on this supply.

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If anyone wants to jump in and work on that it would be great.

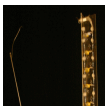
Greetings,

Chris

They are for MX-500 so should work.
Is the connector some standard model or Metcal proprietary?

Report to moderator Logged

mikeselectricstuff
Super Contributor



Posts: 11971
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #80 on:** December 31, 2012, 01:43:19 pm »
Say Thanks Reply Quote

Quote from: plazma on December 31, 2012, 01:16:39 pm

Quote from: mamalala on December 31, 2012, 01:06:28 pm

Quote from: plazma on December 31, 2012, 12:43:46 pm

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That's great! Just make sure that the stuff is for the 13.56 MHz system. They also have a 455 kHz system, those things will not work on this supply.

Since i don't have such a system myself, i also can't adapt this circuit for it. My guess is that basically just the oscillator need to be changed and the xformer and filter section adapted to the lower frequency.

If anyone wants to jump in and work on that it would be great.

Greetings,

Chris

They are for MX-500 so should work.
Is the connector some standard model or Metcal proprietary?

I's a standard F type, as used on cable/sat Tv so easily obtainable.

Report to moderator Logged

Youtube channel:Taking wierd stuff apart. Very apart.
Mike's Electric Stuff: High voltage, vintage electronics etc.
Day Job: Mostly LEDs

mikeselectricstuff
Super Contributor

Posts: 11971

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #81 on:** January 02, 2013, 12:48:22 pm »
Say Thanks Reply Quote

A few typos in instructions :
Inductor is SRR1260 not SSR1260
Full partno for IC1 is LM22676TJ-ADJ
What tolerance would you suggest for the NPO caps?

Report to moderator Logged

Country:

Youtube channel:Taking wierd stuff apart. Very apart.
Mike's Electric Stuff: High voltage, vintage electronics etc.
Day Job: Mostly LEDs

mamalala
Supporter

Posts: 777
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #82 on:** January 02, 2013, 02:04:37 pm »

Say Thanks Reply Quote

> **Quote from: mikeselectricstuff on January 02, 2013, 12:48:22 pm**
>
> A few typos in instructions :
> Inductor is SRR1260 not SSR1260
> Full partno for IC1 is LM22676TJ-ADJ
> What tolerance would you suggest for the NPO caps?

Ahh, thanks for the corrections!

As for the caps, i used RS# 391-038, which is spec's ad +/- 10% tolerance.

Note to everyone about the caps:
In the instructions i said that that C20 and C30 are not used. For C20 this is still true. However, C30 should be installed _plus_ another one on top of it, so that in total there are 4 x 56p at the output of L5. This has improved has the output voltage by +10V (from 91Vampl to 101Vampl) when the tip is heated up and idling. I also reduced the number of turn on L5 from 10 to 8, which initially increased the output to 91Vampl. Reducing the turns on L3 also increases the output a bit, but also degrades the waveform itself a little. So i'm not sure if it is a good idea to do that or not. If you want to check for yourself, simply use only 10 or 9 turns instead of the original 11.

Since i am not a RF guy, the output filter is something that probably can be refined somewhat. If anyone has the proper knowledge and wants to build such a unit, it would be great if you could look into that. The goal is to get the maximum possible output voltage swing for a given supply voltage from the buck converter, while keeping the output waveform as sine-like as possible.

Greetings,

Chris

Report to moderator Logged

mamalala
Supporter

Posts: 777
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #83 on:** January 02, 2013, 02:10:20 pm »

Say Thanks Reply Quote

For what it's worth:

I used RS# 723-6596 for C14 to C19, and instead of one 33n for C13 i used 3 x 723-6593 in parallel.

Greetings,

Chris

Report to moderator Logged

mamalala
Supporter

Posts: 777
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #84 on:** January 02, 2013, 02:50:00 pm »

Say Thanks Reply Quote

Just for fun i did a small comparison run now.

I took 2 fresh cartridges, STTC-036. 1 mm from the tip end i placed 1 turn of solder wire on each. On my original Metcal supply, the STSS-PS2V-002, it took 10 seconds until the solder was molten. With my RF-Gen it only took 8 seconds. Repeated that several times after cooling down the tips to room temp (20°), same results always.

I have a peak voltage of 23.5 volts, and an idle voltage of 19.5 volts on my circuit. Dunno what the STSS has.

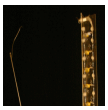
The Vampl values i gave above are probably not really correct. As already mentioned, i have a really lousy probe and a half-broken scope. From the timing results i got here it seems that my unit dumps a bit more power (and thus higher peak voltage) into the tip than what my scope tells me.

Greetings,

Chris

Report to moderator Logged

mikeselectricstuff
Super Contributor



Posts: 11971
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #85 on:** January 02, 2013, 03:25:27 pm »

Say Thanks Reply Quote

> **Quote**
>
> Since i am not a RF guy, the output filter is something that probably can be refined somewhat. If anyone has the proper knowledge and wants to build such a unit, it would be great if you could look into that. The goal is to get the maximum possible output voltage swing for a given supply voltage from the buck converter, while keeping the output waveform as sine-like as possible.

I would think max power as opposed to max peak-to-peak would be the optimum, depending on how far the waveform shape deviates from a sine.
I'd guess you may also get more power with no filter at all, as well as a ton of noise!
Once I start playing I'll hook up a specrtum analyser - this may be a useful away to tweak filters.

Report to moderator Logged

Youtube channel:Taking wierd stuff apart. Very apart.
Mike's Electric Stuff: High voltage, vintage electronics etc.
Day Job: Mostly LEDs

mamalala
Supporter

Posts: 777
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #86 on:** January 02, 2013, 04:14:51 pm »

Say Thanks Reply Quote

> **Quote from: mikeselectricstuff on January 02, 2013, 03:25:27 pm**
>
> I would think max power as opposed to max peak-to-peak would be the optimum, depending on how far the waveform shape deviates from a sine.
> I'd guess you may also get more power with no filter at all, as well as a ton of noise!

Yes, but since the load is the same, a higher peak voltage automatically means higher power. And indeed, the current draw from the overall circuit rises with that as well. [Edit: the voltages i got were on the output while a tip was connected, of course.]

BTW, still had no chance to measure the current consumption on the 12V rail. But if it of any help, my circuit consumes about 40mA when powered with 30V, when the RF part is turned off. Disconnecting the FET's drain, and powering up the driver, has it rise to 100mA. All that according to my bench supply.

I should really get some fresh fuses to have some meaningful measurements there....

> **Quote from: mikeselectricstuff on January 02, 2013, 03:25:27 pm**
>
> Once I start playing I'll hook up a specrtum analyser - this may be a useful away to tweak filters.

Indeed. A network analyzer would be great as well, to figure out what impedance those tips have when cold and hot.

Greetings,

Chris

« Last Edit: January 02, 2013, 04:43:11 pm by mamalala »

Report to moderator Logged

mamalala
Supporter

Posts: 777
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #87 on:** January 13, 2013, 06:54:54 pm »

Say Thanks Reply Quote

Just a quick update.

The boards are all gone, thanks to all who were interested in them.

As for the supply/controller board and firmware, i hope to get back to it in a week or two. I'm rather busy with a customers project at the moment and thus don't really have the time to do much on this one. However, i added some functions to the firmware, as well as the core of a state-machine to handle power-up, sleep, power-down, etc. with various options. It will be fully user configurable as well.

What it can do is to start at different power up modes, normal, limited and boost. "Limited" means to limit power uptake during initial heatup, "boost" means increased power during that. After a given time the unit can go into sleep, at which point it will go into "limited" mode, reducing power consumption. It will auto-detect any thermal load changes, and upon reaching a threshold will wake-up again, optionally in "boost" mode to decrease recovery time from sleep. Also, after staying a given amount of time in sleep, it will shut-down the RF stage completely.

Wakeup is then done by pushing/handling the encoder. Of course the state-machine also restarts

when the tip is changed. What's left to do is to implement some software-based protection features, for example against too high SWR, supply, etc. And finally, of course, packaging it all together with a decent UI. Al settings will be stored in the internal EEPROM of the µC. Speaking of which, for development i currently use the PIC 18F2620. It can probably be scaled down later, once i know what the final memory usage will be. Also, i added a RS232 interface to the board, so that the µC can later be updated through the bootloader (i use TinyBLD here) without needing a PIC programmer. Of course the BL has still to be programmed using a regular programmer.

Greetings,

Chris

« *Last Edit: January 13, 2013, 06:56:25 pm by mamalala* »

Report to moderator Logged

cwalex
Frequent Contributor
Posts: 302
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #88 on:** January 13, 2013, 11:44:53 pm »

Say Thanks Reply Quote

Can you sign me up for a set of boards when you get more?

Report to moderator Logged

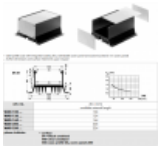
plesa
Frequent Contributor

Posts: 965
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #89 on:** January 13, 2013, 11:52:44 pm »

Say Thanks Reply Quote

I was looking for enclosure and found WAG 100.
http://www.fischerelektronik.de



WAG100.PNG (142.04 kB, 755x709 - viewed 980 times.)

Report to moderator Logged

cwalex
Frequent Contributor
Posts: 302
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #90 on:** January 14, 2013, 12:38:52 am »

Say Thanks Reply Quote

> **Quote from: plesa on January 13, 2013, 11:52:44 pm**
>
> I was looking for enclosure and found WAG 100.
> http://www.fischerelektronik.de

That looks like a perfect enclosure!

Report to moderator Logged

mamalala
Supporter

Posts: 777
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #91 on:** January 14, 2013, 12:56:44 am »

Say Thanks Reply Quote

> **Quote from: cwalex on January 13, 2013, 11:44:53 pm**
>
> Can you sign me up for a set of boards when you get more?

Thanks, but i'm not sure that i will get another batch done. My main goal was to get myself another supply for my Metcal handpieces, and also to get a usable circuit out in the open. Considering what it had cost me so far i could have gone and bought a used STSS, or even two of them, but where would be the fun in that

In any case, the current supply/controller board would have to change then anyways. Right now i used parts that i had at hand. The result is that the DC/DC converter circuits there for the +5 and +12 volt rails are extremely oversized. On a redesign i would go for a 12V switcher followed by a 5 volt linear regulator. Also i made a stupid mistake on them. I connected the boost/limit trimpots to GND on one side, while it should have been open there. Plus i forgot two series resistors after them. While all that can be corrected on the actual boards, it's something that should change for the next version.

But as said, not sure if i will get another batch produced. If anyone is willing to jump in on that, be my guest. I will definitely change the circuitry/layout to reflect these changes, so that someone else can

have batch done. After all it's not that expensive, it was 35 US$ per 10 boards in red at iTead, plus a bit over 30 US$ for the DHL express shipping. Oh, and plus taxes of course...

If i should decide to have another batch done, i'll surely give some notice here

Greetings,

Chris

Report to moderator Logged

mamalala
Supporter

Posts: 777
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #92 on:** January 14, 2013, 01:00:00 am »

Say Thanks Reply Quote

> **Quote from: plesa on January 13, 2013, 11:52:44 pm**
>
> I was looking for enclosure and found WAG 100.
> http://www.fischerelektronik.de

Hey, that's a great find! Thanks very much, i'll check where i can get one here. Shouldn't be too big of a problem, since Fischer Elektronik is a german company.

Greetings,

Chris

Report to moderator Logged

cwalex
Frequent Contributor

Posts: 302
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #93 on:** January 14, 2013, 01:47:04 am »

Say Thanks Reply Quote

> **Quote from: mamalala on January 14, 2013, 12:56:44 am**
>
> > **Quote from: cwalex on January 13, 2013, 11:44:53 pm**
> >
> > Can you sign me up for a set of boards when you get more?
>
> Thanks, but i'm not sure that i will get another batch done. My main goal was to get myself another supply for my Metcal handpieces, and also to get a usable circuit out in the open. Considering what it had cost me so far i could have gone and bought a used STSS, or even two of them, but where would be the fun in that
>
> In any case, the current supply/controller board would have to change then anyways. Right now i used parts that i had at hand. The result is that the DC/DC converter circuits there for the +5 and +12 volt rails are extremely oversized. On a redesign i would go for a 12V switcher followed by a 5 volt linear regulator. Also i made a stupid mistake on them. I connected the boost/limit trimpots to GND on one side, while it should have been open there. Plus i forgot two series resistors after them. While all that can be corrected on the actual boards, it's something that should change for the next version.
>
> But as said, not sure if i will get another batch produced. If anyone is willing to jump in on that, be my guest. I will definitely change the circuitry/layout to reflect these changes, so that someone else can have batch done. After all it's not that expensive, it was 35 US$ per 10 boards in red at iTead, plus a bit over 30 US$ for the DHL express shipping. Oh, and plus taxes of course...
>
> If i should decide to have another batch done, i'll surely give some notice here
>
> Greetings,
>
> Chris

Thanks for sharing the project! Sounds like a really challenging job so I'm sure you were really satisfied when you melted some solder for the first time

If you make the mods and release the gerbers I'll get a batch done at itead and sell the rest to any aussies interested, I think it is only fair I add $5 to the cost of each board set and send the proceeds to you. Do you have a paypal account?

Report to moderator Logged

plazma
Frequent Contributor

Posts: 443

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #94 on:** January 14, 2013, 12:01:58 pm »

Say Thanks Reply Quote

Any ideas for a switch? I would like to have two connectors and a switch between them.

The schematic got multiple sheets. Is it done with eagle hobby or standard/pro license?

I could do a fixed version with eagle. Just need to go trough the thread for all changes/bugs.

Country:

Report to moderator Logged

mamalala
Supporter

Posts: 777
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #95 on:** January 14, 2013, 04:57:57 pm »

Say Thanks Reply Quote

> **Quote from: cwalex on January 14, 2013, 01:47:04 am**
>
> Thanks for sharing the project! Sounds like a really challenging job so I'm sure you were really satisfied when you melted some solder for the first time
>
> If you make the mods and release the gerbers I'll get a batch done at itead and sell the rest to any aussies interested, I think it is only fair I add $5 to the cost of each board set and send the proceeds to you. Do you have a paypal account?

Yes, it was indeed quite satisfying. The biggest challenge wasn't so much the circuitry, but the fact that i have almost no suitable equipment to make proper measurements. So it was a lot of trial&error here.

Would be fantastic if you had another batch of boards produced. Most of the changes/bugs i have already fixed in the schematics and layouts, since i usually fix such stuff while building/testing the prototypes. Just have to drop the 5V dc/dc converter section and put a linear one in there. Then i'll recheck everything and prepare the files to upload them here. Should be able to do that rather quickly, since it's only little stuff/changes, and as such can do it in the evening hours. Yes, i do have PayPal.

Greetings,

Chris

Report to moderator Logged

mamalala
Supporter

Posts: 777
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #96 on:** January 14, 2013, 05:04:21 pm »

Say Thanks Reply Quote

> **Quote from: plazma on January 14, 2013, 12:01:58 pm**
>
> Any ideas for a switch? I would like to have two connectors and a switch between them.
>
> The schematic got multiple sheets. Is it done with eagle hobby or standard/pro license?
>
> I could do a fixed version with eagle. Just need to go trough the thread for all changes/bugs.

Basically any switch will do, as long as it has sufficient current and voltage handling capacity. Just run the coax from the board to the switch, and from there to the connectors. Make sure to have a good ground connection throughout, but you only need to switch the "hot" one, however. You could also use a suitable relay if you want. There are two pins available from the µC that otherwise end up on the ICSP header, one of them could be used to toggle the relay then (using a small signal N-FET or NPN for switching).

I use a standard license for Eagle here, and Eagle version is the old 4.16. Never came around to update it to the newer version, since it still does all i want it to do and thus have no requirement to spend money on the newest version update.

But as said to cwalex, i have most of the changes already done, so you don't really need to work on that. I'll look forward to get the updated stuff uploaded here ASAP.

Greetings,

Chris

Report to moderator Logged

cwalex
Frequent Contributor

Posts: 302
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #97 on:** January 15, 2013, 01:05:18 pm »

Say Thanks Reply Quote

> **Quote**
>
> But as said to cwalex, i have most of the changes already done, so you don't really need to work on that. I'll look forward to get the updated stuff uploaded here ASAP.

Awesome! Thanks a lot for sharing all this. I'll order them from itead (snailmail to keep cost down) and sell the pcbs I don't use at my cost + $5 (our community donation to you for your trouble). Hopefully there will be enough interest for the boards to sell them all otherwise no big deal Always

handy to have spares! If there is going to be lots of interest from ausies hopefully they will all chime in here so I know to order more than the standard 10qty.

Report to moderator Logged

Fsck
Super Contributor

Posts: 1157
Country:
sleep deprived

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #98 on:** January 18, 2013, 02:19:39 am »
Say Thanks Reply Quote

For North America, I found a source for the RF toroids at http://www.kitsandparts.com/index.php
They're American but do ship to Canada, since I couldn't find a Canadian source.

Report to moderator Logged

"This is a one line proof...if we start sufficiently far to the left."

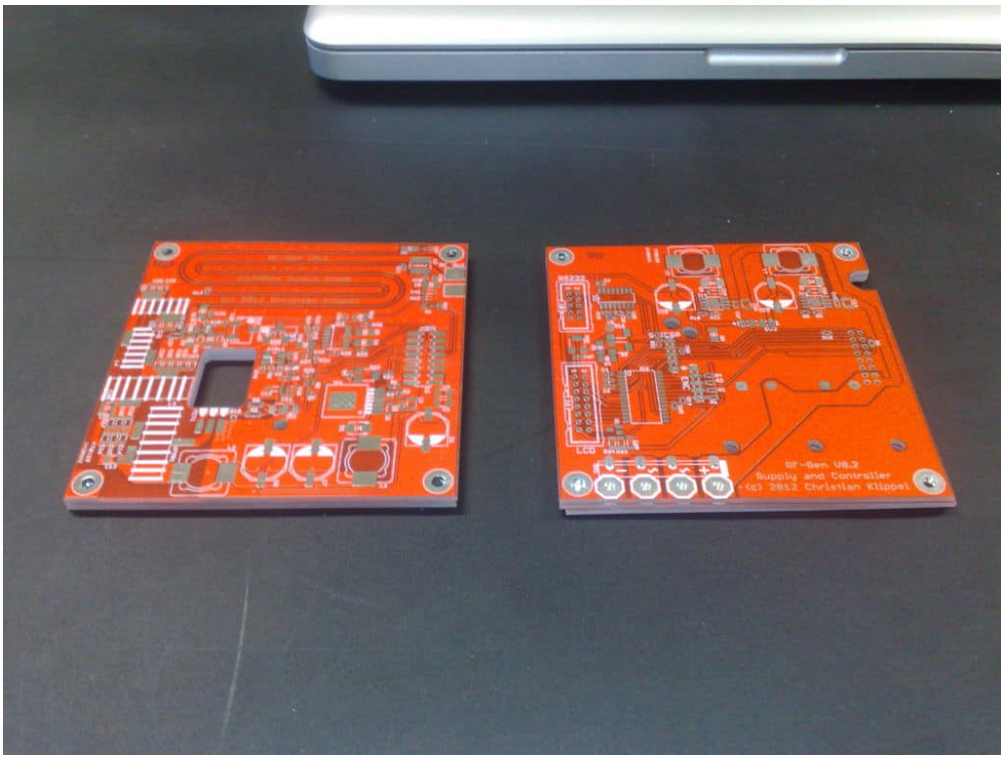
Paulinho19
Contributor

Posts: 42
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #99 on:** January 22, 2013, 05:25:59 pm »
Say Thanks Reply Quote

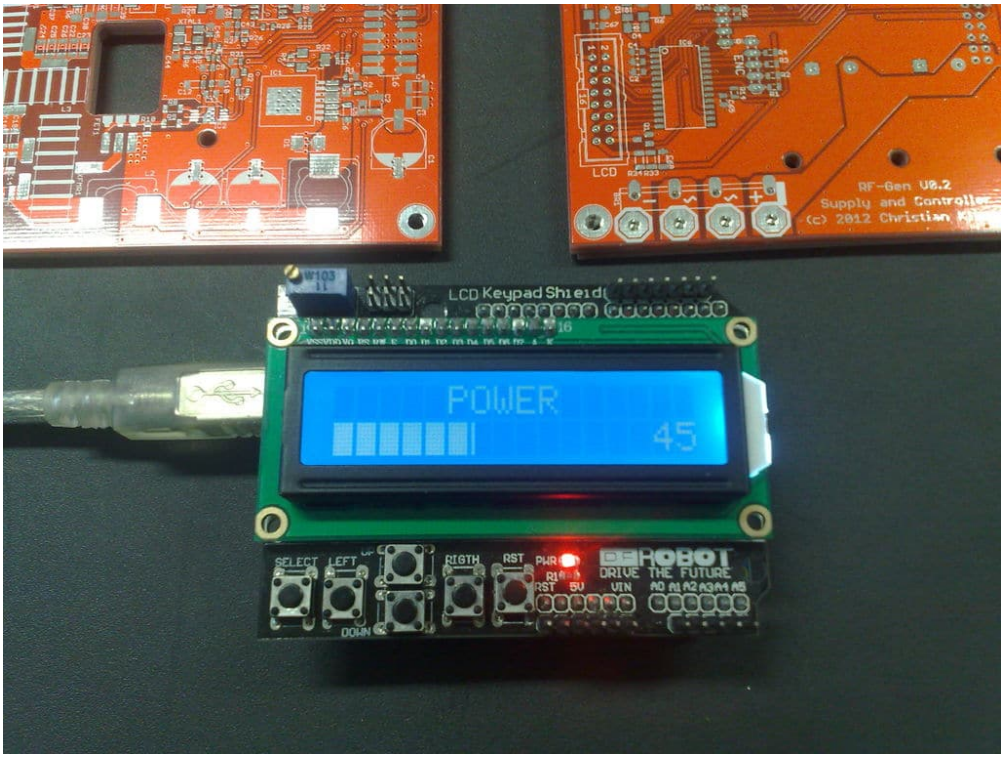
Hi Chris,

My boards just arrived safely here in Portugal, they look great, ones again thank you very much.



Like I told you earlier I will not use your Supply and Controller board, I'll create one based on the atmega328p-au to be Arduino compatible.

I already started writing some code to do all the stuff you do with the PIC. On the LCD I'm trying to get it to look almost like the Metcal MX5000 Series.



I have almost all components to assemble the output stage board, so I hope I will finish it this week.

For the enclosure I went for the WAG220SA bought here:

https://www.buerklin.com/default.asp?kwd=Heat-dissipating-cases-type-Fischer-Wag-Sa&event=ShowDvNr(H848000)&l=e

Should arrive also this week.

as for the power supply, I looked at these options on eBay:

http://www.ebay.co.uk/itm/36V-2-5A-110V-220V-Adapter-Power-Supply-Converter-AC-DC-/321051713046?pt=LH_DefaultDomain_3&hash=item4ac02c5e16

http://www.ebay.co.uk/itm/NEW-100W-High-Power-LED-Light-lamp-Driver-Power-Supply-Output-30V-36V-/320799719473?pt=LH_DefaultDomain_0&hash=item4ab1274031

but at the end I went for a simple toroid transformer 230V to 25V 80VA.

Paulo Almeida

Report to moderator Logged

cwalex
Frequent Contributor
Posts: 302
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #100 on:** January 23, 2013, 11:58:45 am »
Say Thanks Reply Quote

Hi Chris,

Have you had a chance to fix the board yet. I don't use eagle but if you just upload the gerbers I will just send them as is to itead. Hope you don't think I'm trying to rush you, I just thought I'd check in and see how you got on.

cheers,

Alex

Report to moderator Logged

mamalala
Supporter

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #101 on:** January 23, 2013, 03:07:48 pm »
Say Thanks Reply Quote

Quote from: cwalex on January 23, 2013, 11:58:45 am

> Hi Chris,
>
> Have you had a chance to fix the board yet. I don't use eagle but if you just upload the gerbers I will just send them as is

Posts: 777
Country:

to itead. Hope you don't think I'm trying to rush you, I just thought I'd check in and see how you got on.

cheers,

Alex

Hi Alex,

damn, forgot to create and upload the Gerbers... Here they are, V0.3, each fits in the 10cm x 10cm service.

What changed in V0.3:

Controller:
- Replaced +5V DC/DC converter with 7805 linear regulator in SMD
- Moved filter caps so they don't interfere with the caps on the RF board
- Added 100n to the backlight pins of the LCD connector
- Added 22k pullups for unused data lines of LCD
- Swapped pin1 & 2 of the LCD connector.

Since i drive the LCD backlight with PWM, some displays had trouble with data corruption if there was no 100n cap there. The pullups are normally not required, but i had one display that needed them. The display i initially used had pin1 & 2 swapped, that is, VCC on pin1 and GND on pin2. Most displays have GND on pin1 and VCC on pin2, however.

RF-Board:
- Added extra caps for filter section, so no more stacking of caps required

OK, that's it for now. I'll prepare the controller board doc in the next days, a combined one for the V0.2 and 0.3 boards. Hope to finish the firmware soon as well.

Greetings,

Chris

RF-Gen_RF-Stage.zip (81.16 kB - downloaded 752 times.)
RF-Gen_Controller.zip (72.63 kB - downloaded 742 times.)

Report to moderator Logged

mamalala
Supporter

Posts: 777
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #102 on:** January 23, 2013, 03:20:47 pm »

Say Thanks Reply Quote

Quote from: Paulinho19 on January 22, 2013, 05:25:59 pm

Hi Chris,

My boards just arrived safely here in Portugal, they look great, ones again thank you very much.
...

Paulo Almeida

Hi Paulo,

thanks for the feedback!

Regarding the readouts, i have my adc.c source attached. Note that this is for a PIC18 chip, but you should get the idea anyways. Basically it constantly reads the ADC inputs and sums the last 16 samples of each channel, this is done in adc_process(), which is called from the ADC interrupt periodically. adc_get_reading() returns either the 16x reading for forward/reflected, or the voltage of the DC/DC output of the RF gen board, depending on the given argument. In the latter case, the value is in 0.01V steps, i.e. 2200 means 22.00 volts.

calc_rf_data() calculates the SWR from the forward/reflected values. It also calculates a value to display for the RF power, altough that one is not really the exact power but made so that it looks nice when displayed as a bar.

Hope that helps a bit.

As mentioned previously, i hope to have the firmware completed soon, so that i can upload the sources here as well.

Greetings,

Chris

adc.c (3.66 kB - downloaded 495 times.)

Report to moderator Logged

mamalala
Supporter

Posts: 777
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #103 on:** January 23, 2013, 03:30:54 pm »

Say Thanks Reply Quote

And here are the Eagle files, plus PDF of the schematics. The tValues/bValues stuff in the Eagle files is not cleaned up yet, since i usually only put the tNames/bNames stuff on the silkscreen anyways.

Greetings,

Chris

RF-Gen_RF-Stage_Eagle.zip (56.07 kB - downloaded 649 times.)
RF-Gen_RF-Stage.pdf (741.18 kB - downloaded 805 times.)
RF-Gen_Controller_Eagle.zip (54.73 kB - downloaded 594 times.)
RF-Gen_Controller.pdf (724.38 kB - downloaded 750 times.)

Report to moderator Logged

Paulinho19
Contributor

Posts: 42
Country:

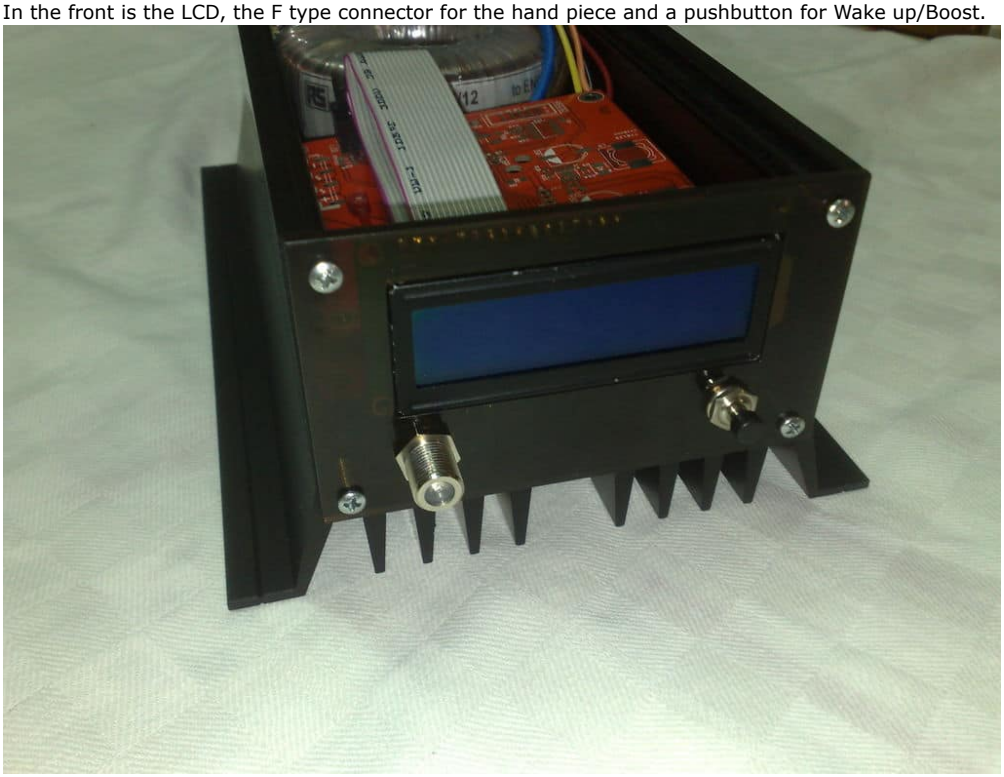
Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #104 on:** January 24, 2013, 12:47:17 am »

Say Thanks Reply Quote

My WAG220SA enclosure arrived today!!!

I also Laser cut some Plexiglas tops to test my layout, fits like a charm.

In the front is the LCD, the F type connector for the hand piece and a pushbutton for Wake up/Boost.



In the back a power switch and a PC power connector with a 0,5A fuse.

Everything fits inside.

Next Step, assemble the RF stage board.

Paulo

Report to moderator Logged

mamalala

Supporter

Posts: 777

Country:

Re: DIY Metcal 13.56 MHz RF Supply

« **Reply #105 on:** January 24, 2013, 01:03:26 am »

Say Thanks Reply Quote

Looks good! But i would not use Plexiglas here. Keep in mind that, after all, this is a RF generator. The 13.56 MHz is also used by RFID systems. The first harmonics is 27.12 MHz, which is in the 11 meter CB band. Having non shielded sides will surely allow quite a lot of RF emission which may interfere with other stuff. If possible you should really use the aluminium plates there.

You may also want to use some type of filtering on the AC line connector, or at least put the AC leads to the transformer through some ferrite beads. There is a lot of wire on the transformer, which will act as an antenna to pick up the RF emissions, and thus couple them into the mains.

Greetings,

Chris

Report to moderator Logged

Paulinho19
Contributor
Posts: 42
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #106 on:** January 24, 2013, 02:37:20 am »
Say Thanks Reply Quote

Hi, the Plexiglas is just to test my layout, in the end I will use the aluminum tops that came with the enclosure.

Thanks for the tip about the Filter, hadn't thought of that yet.

I will keep you updates.

Paulo

Report to moderator Logged

dfnr2
Regular Contributor
Posts: 227
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #107 on:** January 25, 2013, 08:34:19 pm »
Say Thanks Reply Quote

Chris,

This is, in my opinion, by far the coolest project I've seen on this forum, and the coolest I've seen in a long time, based on its general utility. And very nicely thought out with the self-contained RF module and the optional controler module.

Very well done!!!

« Last Edit: January 26, 2013, 12:12:29 am by dfnr2 »

Report to moderator Logged

Paulinho19
Contributor
Posts: 42
Country:

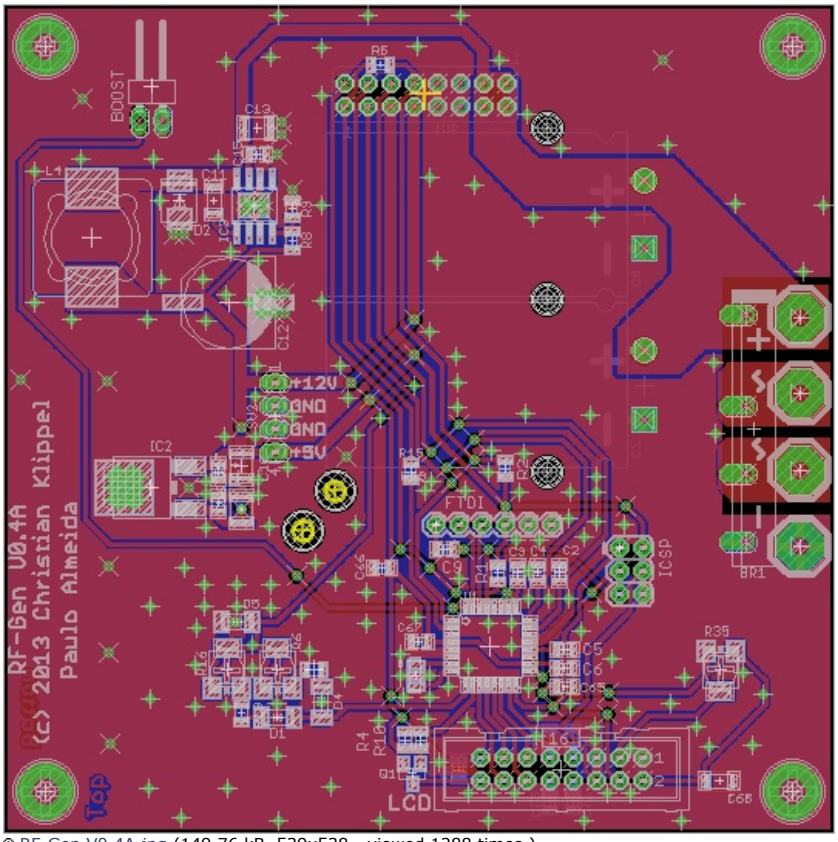
Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #108 on:** January 26, 2013, 02:06:16 am »
Say Thanks Reply Quote

Hi everyone,

here is my fist take on te controller board now compatible with Arduino based on the ATMEGA 328P-AU.

Attached is also the Firmware for the ATMEGA.

Paulo Almeida



RF-Gen V0.4A.jpg (149.76 kB, 539x538 - viewed 1288 times.)

RF-Gen_Controller.zip (63.37 kB - downloaded 579 times.)
RF-Gen_Controller.pdf (38.93 kB - downloaded 856 times.)

Report to moderator Logged

mamalala
Supporter

Posts: 777
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #109 on:** January 26, 2013, 03:28:19 am »

Say Thanks Reply Quote

Quote from: dfnr2 on January 25, 2013, 08:34:19 pm

> Chris,
>
> This is, in my opinion, by far the coolest project I've seen on this forum, and the coolest I've seen in a long time, based on its general utility. And very nicely thought out with the self-contained RF module and the optional controler module.
>
> Very well done!!!

Thank you, much appreciated!

Greetings,

Chris

Report to moderator Logged

mamalala
Supporter

Posts: 777
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #110 on:** January 26, 2013, 03:39:23 am »

Say Thanks Reply Quote

Quote from: Paulinho19 on January 26, 2013, 02:06:16 am

> Hi everyone,
>
> here is my fist take on te controller board now compatible with Arduino based on the ATMEGA 328P-AU.
>
> Attached is also the Firmware for the ATMEGA.
>
> Paulo Almeida

Hi Paulo,

nice! However, you may want to keep that "notch" in the controller board's upper-left that was originally there, and move the reset connector a bit instead. In case someone want to use a smaller enclosure, like a 100 x 100 mm type, or wants to mount the RF/controller board stack on a 100 x 100 mm heatsink and enclose that with aluminium sheets, that notch makes space for the RF coax cable of the RF board underneath it so it can exit to the top.

Greetings,

Chris

Report to moderator Logged

Paulinho19
Contributor

Posts: 42
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #111 on:** January 26, 2013, 05:54:24 am »

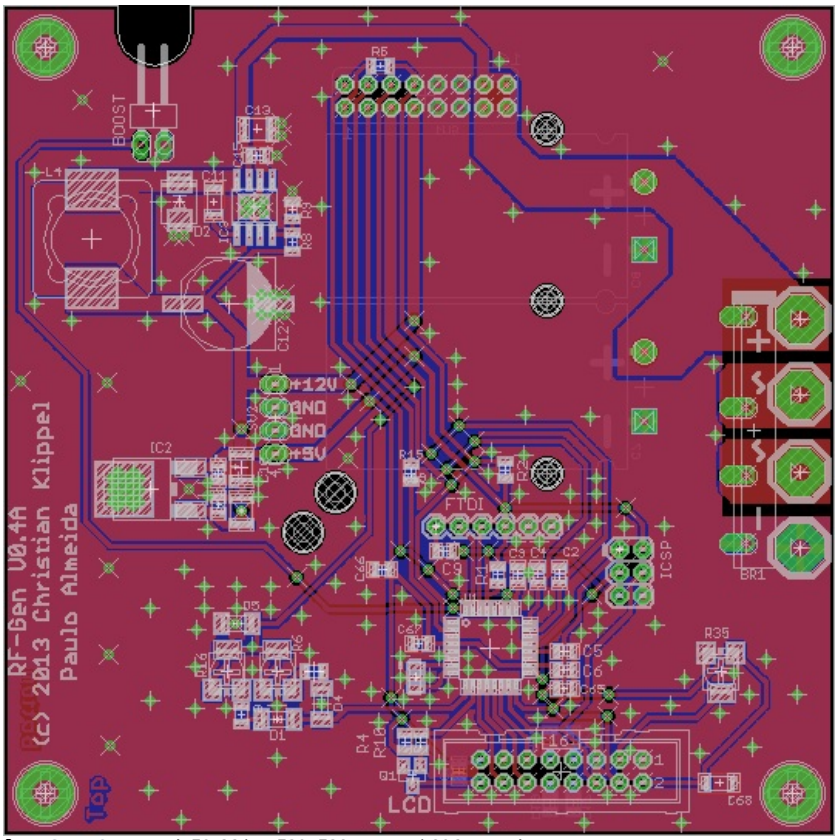
Say Thanks Reply Quote

Hi Chris,

Ones again you are right.

Done, The "BOOST" pinheader can be a vertical one.

Paulo



RF-Gen V0.4A.jpg (150.66 kB, 539x538 - viewed 896 times.)
RF-Gen_Controller.zip (63.44 kB - downloaded 447 times.)

Report to moderator Logged

Paulinho19
Contributor
Posts: 42
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #112 on:** February 05, 2013, 06:04:08 pm »
Say Thanks Reply Quote

Hi Chris,

I just finished the assembly of the first part of the RF Stage board and I'm getting 12.35 volts at the output of L2, do you think its ok?

Paulo

Report to moderator Logged

notsob
Frequent Contributor
Posts: 632
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #113 on:** February 06, 2013, 05:46:12 am »
Say Thanks Reply Quote

Just to add some historical info - as I have a Metcal PS2E in pieces atm. The mains transformer is 115V/28VCT 100VA 3.6A RMS rated secondary.
It is a custom version of a Signal Transformers 241-8-28 and as far as I can see, the only difference is that the metal mounting frame has been removed and it is bolted down via the existing holes in the EI core. It weighs 2.75 lb

If you are non US a similar transformer would be a DP-241-8-28 (it has 2 x 115V primaries, so you can use it as 115V or 230V). Both transformers are approx $US30 new.

Cheers

Peter

Report to moderator Logged

notsob
Frequent Contributor
Posts: 632
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #114 on:** February 06, 2013, 06:07:48 am »
Say Thanks Reply Quote

I forgot to add the Signal Transformers pdf

Signal Transformer 241.pdf (282.86 kB - downloaded 633 times.)

Report to moderator Logged

HeliEye
Newbie
Posts: 3

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #115 on:** February 06, 2013, 05:11:28 pm »
Say Thanks Reply Quote

hi all

My first post here... I'm watching this one with interest, as I have 2 Metcal soldering stations.. an MX500 and MX5000, plus Talon and desoldering gun with compressor etc.

The old MX500, is only used as a backup now, still handy as the both take the same tips..
I've not been tempted to open up my MX5000 yet, as it's still under warranty ;-)

After using Metcals now for many years, I could never go back to the Toy Irons with conventional heater tech, yuk..
I even binned 2x Weller stations, as they couldn't keep up on one manual soldering production run.
I'm still amazed at the speed my 5mm heavy tip melts solder in under 4 seconds from stone cold ;-)

This project would be cool if it can be made to run on 12VDC for field work ;-)

Steve

Report to moderator Logged

Paulinho19
Contributor
Posts: 42
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #116 on:** February 06, 2013, 10:01:26 pm »
Say Thanks Reply Quote

For a 12VDC version you could use a Step up converter like this one:

http://www.ebay.de/itm/Convertidor-fuente-step-up-d-10v-a-12v-hasta-35v-regulable-dc-power-supply-BOOST-/221178279108?pt=LH_DefaultDomain_186&hash=item337f40b4c4#ht_3763wt_1344

Paulo Almeida

Report to moderator Logged

mamalala
Supporter

Posts: 777
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #117 on:** February 10, 2013, 09:14:39 pm »
Say Thanks Reply Quote

Quote from: Paulinho19 on February 05, 2013, 06:04:08 pm

> Hi Chris,
>
> I just finished the assembly of the first part of the RF Stage board and I'm getting 12.35 volts at the output of L2, do you think its ok?
>
> Paulo

Hello Paulo,

i assume that you mean just the DC/DC converter section, with no other sections assembled yet.

Did you put a load between the output of L2 and GND? When i did the measurement i connected the GND of the load to the GND pad for the output FET. When measuring unloaded i can imagine the output voltage to be a bit higher. Under load there will be a slight voltage drop across L2 (and due to the copper traces, etc.) Add to that the tolerances of the resistors and the regulator IC itself. 11.7 Volts is what i had here, using a cheap and old handheld DMM, so i wouldn't worry about it too much. 12.35 Volts is in the same ballpark.

Greetings,

Chris

Edit: And sorry for the late reply. I'm quite busy currently, so i mostly read the forum between compiler/jtag-upload runs at the moment...

« *Last Edit: February 10, 2013, 09:23:32 pm by mamalala* »

Report to moderator Logged

mamalala
Supporter

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #118 on:** February 10, 2013, 09:18:25 pm »
Say Thanks Reply Quote

Posts: 777
Country:

> **Quote from: HeliEye on February 06, 2013, 05:11:28 pm**
>
> This project would be cool if it can be made to run on 12VDC for field work ;-)

From what i understand, Mike (mikeselectricstuff) wants to check the circuit to redesign it for 12 Volts. Basically it's just replacing the DC/DC converter with a boost converter type, instead of the buck converter it currently uses.

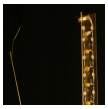
Greetings,

Chris

Report to moderator Logged

mikeselectricstuff

Super Contributor



Posts: 11971
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #119 on:** February 12, 2013, 12:15:25 am »

Say Thanks Reply Quote

> **Quote from: mamalala on February 10, 2013, 09:18:25 pm**
>
> > **Quote from: HeliEye on February 06, 2013, 05:11:28 pm**
> >
> > This project would be cool if it can be made to run on 12VDC for field work ;-)
>
> From what i understand, Mike (mikeselectricstuff) wants to check the circuit to redesign it for 12 Volts. Basically it's just replacing the DC/DC converter with a boost converter type, instead of the buck converter it currently uses.
>
> Greetings,
>
> Chris

If I ever get time, what I'd like to do is use a buck/boost front end so it will run from either a 12V-ish battery or a 20v laptop charger. I also want to do the regulation & PWM on a MCU to slash the parts count & cost. May be a while though....

Report to moderator Logged

Youtube channel:Taking wierd stuff apart. Very apart.
Mike's Electric Stuff: High voltage, vintage electronics etc.
Day Job: Mostly LEDs

Paulinho19

Contributor

Posts: 42
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #120 on:** February 13, 2013, 10:33:08 pm »

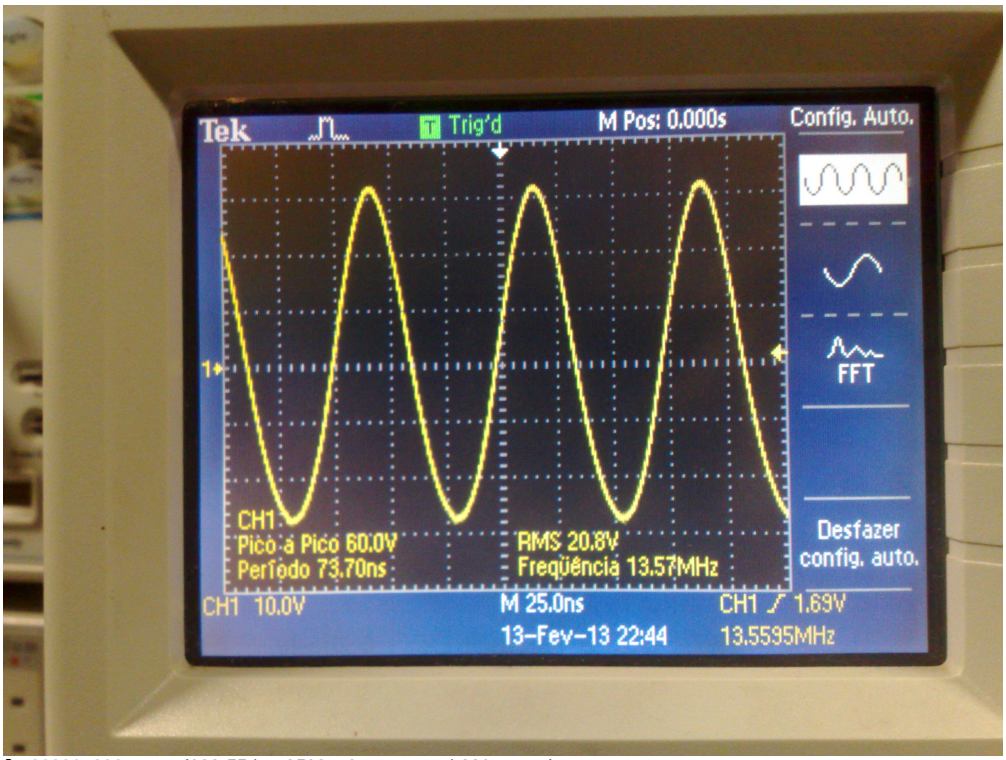
Say Thanks Reply Quote

Hi, Greetings from Portugal,

I just finished the assembly of the RF Stage board. But I don't seem to be able to adjust the output voltage at L2 with R19, it won't go over 5.6V. I double checked everything and I think the problem is my RF dummy load. I used a 50ohm 15W that I had here. My question is, can I use a dummy load with more than 50W (like 100W) or are the 50W important for this adjustment?

Thanks,

Paulo



130220132847.jpg (922.55 kB, 2592x1944 - viewed 839 times.)

130220132851.jpg (664.8 kB, 1944x2592 - viewed 1101 times.)

130220132853.jpg (609.44 kB, 2592x1944 - viewed 859 times.)

« *Last Edit: February 14, 2013, 12:42:02 am by Paulinho19* »

Report to moderator Logged

The following users thanked this post: Ig_sherwood

mamalala
Supporter

Posts: 777
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #121 on:** February 14, 2013, 01:39:03 am »

Say Thanks Reply Quote

Hi Paulo,

could you post an image from the assembled board viewed from top? Sharp (non-shaky) and having the board fill out all of the image area? Maybe i can see something then...

In any case, some pointers:

- You have used a trimpot for R25 instead of two equal SMD resistors. Make sure that you have half the 5V supply voltage at the center pin of that trimpot. It adjusts the offset of the OpAmp used for the control loop. If that is off too much you will not get the proper values.

- The dummy load just needs to be big enough to handle the output power, which can be way over 30 watts. A smaller dummy is OK if you only use it for short periods of time. If you want to test for long(er) periods, you need 50 watts or bigger. In any case, it must be a purely resisitve load. That means you can _not_ use things like wirewound resistors, since they are way too inductive.

- Verify that the supply voltages are all OK and stable. Check the main supply and see if it keeps up under load.

- Are you sure that you have 5.6 volts at L2? In the scope screenshot there is 60 volts peak-peak, unlikely to reach that with only 5.6 volts supply into the RF output transformer. At least not when there is a proper 50 ohms dummy load connected to the RF output.

- Check the RF signal at the junctions between L3/L4 and L4/L5. The concept of the regulation is to keep the RF voltage at the junction of L4/L5 more or less constant. A mismatch at the output will cause more RF energy to be reflected back, increasing the level there. Which in turn will cause the buck regulator to decrease it's output voltage. A matched load will cause a drop at L4/L5, causing the buck to increase it's output voltage. If you see a much higher voltage between L4/L5 than what you have at the output, then something is wrong with the load.

- Have you done the inital adjustment of R32 properly? It sets the maximum possible DC output from the buck regulator.

- Also make sure that no external signal is connected to the VLIM input (pin 3 on SV1). Applying a voltage there will cause the buck regulator to decrease the output voltage. Pin 5 is next to it and has the +5V rail, so make sure that there is no short or something.

In any case, as said, please upload a clear hi-res image of the board, so i can check things out and compare to what i have here. After all, there is always the chance that i made a mistake in the docu or such.

Greetings,

Chris

Report to moderator Logged

Paulinho19
Contributor
Posts: 42
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #122 on:** February 14, 2013, 02:30:21 am »
Say Thanks Reply Quote

Hi Chris,

Here are some pics I took today, the first is the voltage on L2 (with the 50ohm 15W dummy load and 60V p-p RF output).

I will take some better photos tomorrow.

- I checked R25 and I have 2.5V there.

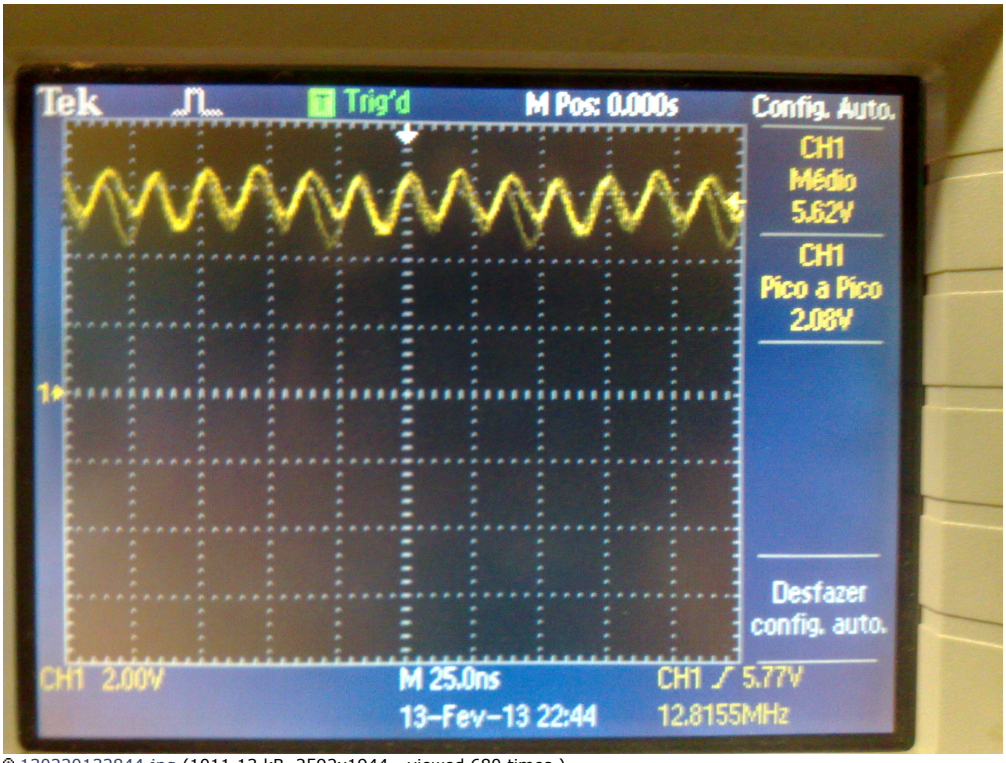
- Power Supply is Stable

- I Adjusted R32

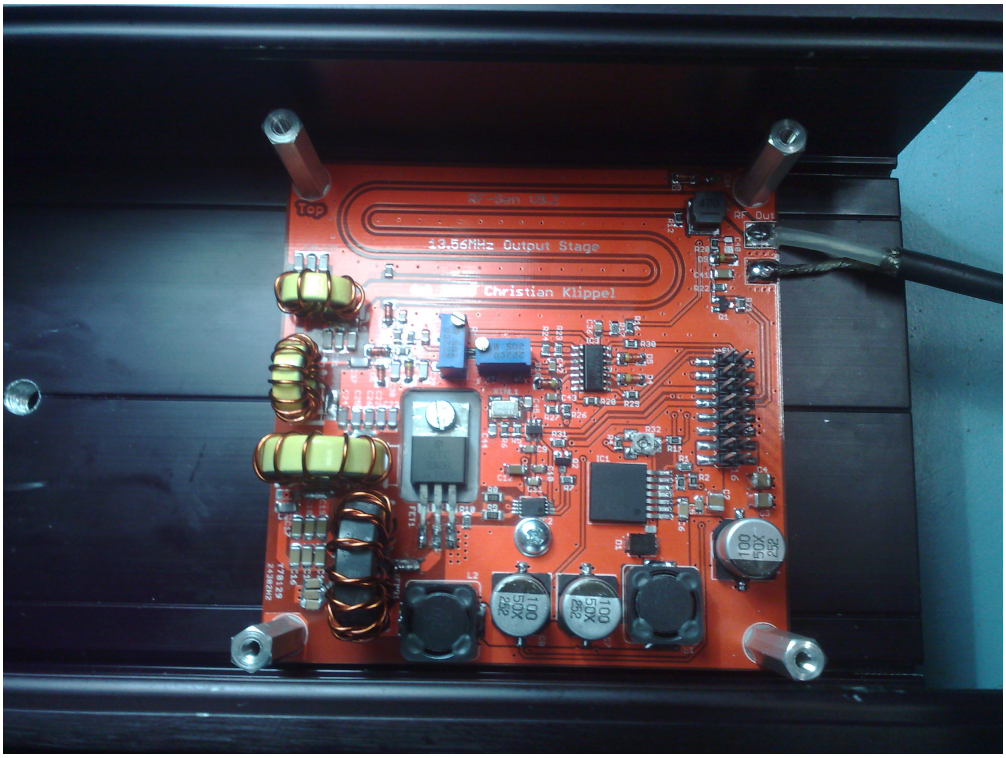
I will try the rest tomorrow.

Thanks,

Paulo



130220132844.jpg (1011.13 kB, 2592x1944 - viewed 680 times.)



130220132850.jpg (775.08 kB, 2592x1944 - viewed 859 times.)

Report to moderator Logged

Paulinho19
Contributor
Posts: 42
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #123 on:** February 14, 2013, 02:35:07 am »
Say Thanks Reply Quote

Couldn't it be the dummy load reflecting back some power being only rated for 15W?

Paulo

Report to moderator Logged

mamalala
Supporter

Posts: 777
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #124 on:** February 14, 2013, 12:29:06 pm »
Say Thanks Reply Quote

Hi Paulo,

i just rechecked my circuit against the doc i wrote. In the doc i had 2k2 for R23, and 22k for R24 (the two resistors next to the OpAmp, going to the R25 trimpot). However, on my actual circuit i have 22k for both, so please change R23 to 22k. However, this actually reduces the gain (from ~2 to ~1.1) of that stage, so you should have been able to get the proper DC output anyways.

Instead of the trimpot R25 i have populated the fixed resistors R33 and R34, each with 2k2.

What FET did you use in the RF stage? Doesn't look like an IRF510. The IRF510 has a rather low gate charge, suitably fast turn on/off time and a rather "high" RDSon at 540 miliohms. Be aware that you can not just drop in any other FET.

Greetings,

Chris

Edit: the 15 watts dummy load would not reflect more or less than a 50 or 100 watts dummy. However, it would have problems whith continued operation when putting more than the 15 watts into it: it will overheat, and eventually burn out. So, check that the dummy is still 50 ohms!

BTW, what kind of dummy load do you actually use?
« *Last Edit: February 14, 2013, 12:33:53 pm by mamalala* »

Report to moderator Logged

mamalala
Supporter

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #125 on:** February 14, 2013, 12:46:55 pm »
Say Thanks Reply Quote

Posts: 777
Country:

As for the FET ... It switches the center tap of the RF transformer to GND, while one end of that transformer is connected to the supply voltage. From a DC perspective that is like a short circuit there.

If the FET can not completely switch off in the required time, the FET will switch between "half on" and "full on", allowing a lot of DC current to flow through that half of the RF transformer. This _could_ result in too much current draw, so that the buck regulator tries to limit that, since it has builtin current limiting.

Remove the FET and check that you still get a high enough output voltage at L2, around 22 Volts. Apply a load there to check that the buck regulator is still OK, it should stay stable even whenn you draw 2-3 amperes.

Double check that there are no shorts or similar in the output path, especially across the capacitors in the filter section. If that is OK, place a IRF510 as the output FET in there and try again.

Greetings,

Chris

Report to moderator Logged

mamalala

Supporter

Posts: 777
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #126 on:** February 14, 2013, 01:10:09 pm »

Say Thanks Reply Quote

Just checked the datasheet for the 30N06L that you put into the circuit. It is completely unusable!

At 13.56 MHz you have a period time of about 73 nS. However, the switching times of that FET are far slower: 60nS turn-off delay plus 110nS turn-off fall time, 15nS turn-on time plus 210nS turn-on rise time. The IRF 510 has 15nS turn-off delay, 12nS fall time, 8nS turn-on delay and 25nS rise time. Next is the gate charge, 15nC for the 30N06L vs. 5nC for the IRF510. The Ciss/oss/rss are way higher as well: 800/270/50pF for the 30N06L vs. 135/80/20pF for the IRF510.

Last but not least, the voltage rating is too low as well. It is spec'd for 60 volts only, the IRF is for 100 volts. There can be voltages in excess of 60 volts appearing at the FET, depending on load match/mismatch and supply voltage. So in the worst case it could just blow.

Really, you need to change the FET to the specified IRF510. The one you selected is completely unusable for that application.

Greetings,

Chris

Report to moderator Logged

mamalala

Supporter

Posts: 777
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #127 on:** February 14, 2013, 02:25:01 pm »

Say Thanks Reply Quote

Attached are some scope images of how the waveforms should look like in this circuit. For all images the supply voltage into the buck regulator is 30 Volts. It draws 3 Amperes. A 50 Ohms dummy load is connected to the RF output during the first 7 scope images. In the last image an actual tip was connected, a STTC-147, and the image was taken after the tip heated up completely.

- Output_L2 shows the ripple on the output of L2. It is about 1 Volt peak-peak, and you can clearly see the RF ripple waveform.

- XFMR_Center shows the waveform at the center tap of the RF transformer. Since that is connected to the FET's drain pin, this is also what the FET "sees". At a 50 Ohms load it is already 40 volts peak-peak.

- XFMR_Output is the signal that appears at the output of the RF transformer, before it goes into the filter section. This is about 90 Volts peak-peak.

- L3_Input is at the input side of L3, after the output capacitors of the RF transformer. A bit over 90 Volts peak-peak.

- L4_Input is at the input side of L4 (output side of L3). My scope only goes up to 160 Volts, and this signal is in excess of that.

- L5_Input is the signal at the input side of L5 (output of L4). Roundabout 80 Volts peak-peak.

- L5_Output is the output side of L5 (which goes through the SWR bridge/coupler to the actual RF output). About 100 Volts peak-peak.

Now, all these waveforms are with a 50 Ohms dummy load, which is probably not a perfect match for this circuit (i.e. it differs from the load that a real tip cartridge presents). Using a real tip, the output voltage can get higher than that!

To show why a 60 Volts rated FET is not suitable for the output stage, look at XFMR_Center_with_Tip. This is the signal that appears at the center-tap of the RF transformer (drain of the FET) when using a STTC-147 tip cartridge, after it has completely heated up. As you can see it already reaches about 60 volts peak-peak. This rise of 20 volts compared to the dummy load is due to the reflected RF energy. It also varies depending on the actual tip used, as well as what stage of the heatup process it is in.

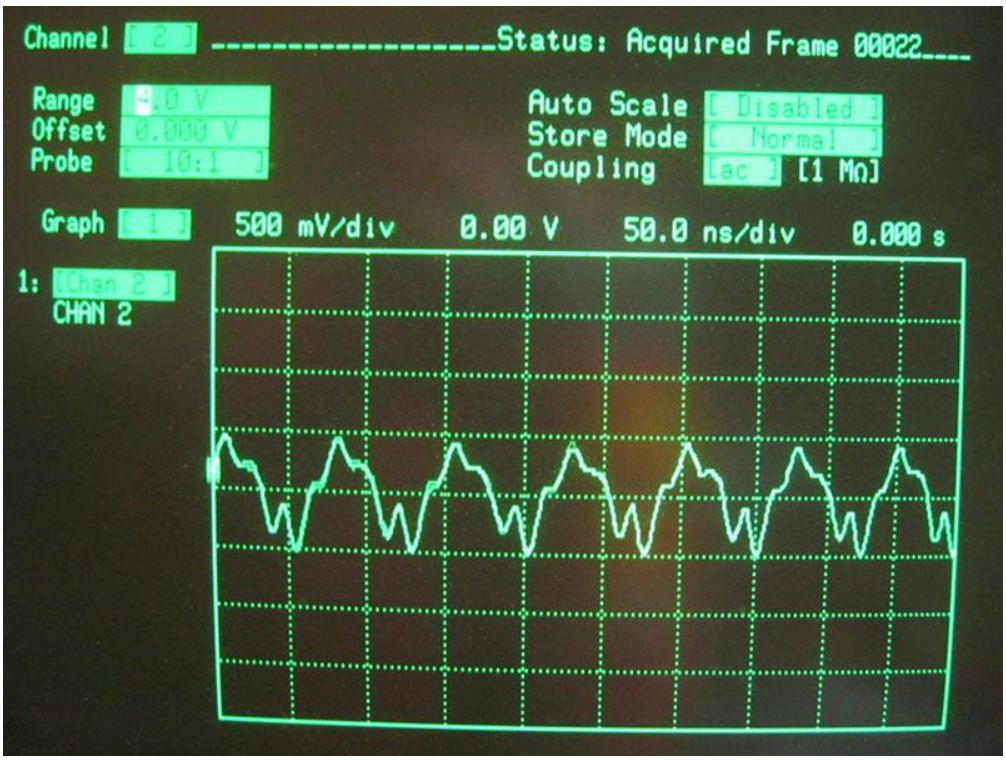
Greetings,

Chris

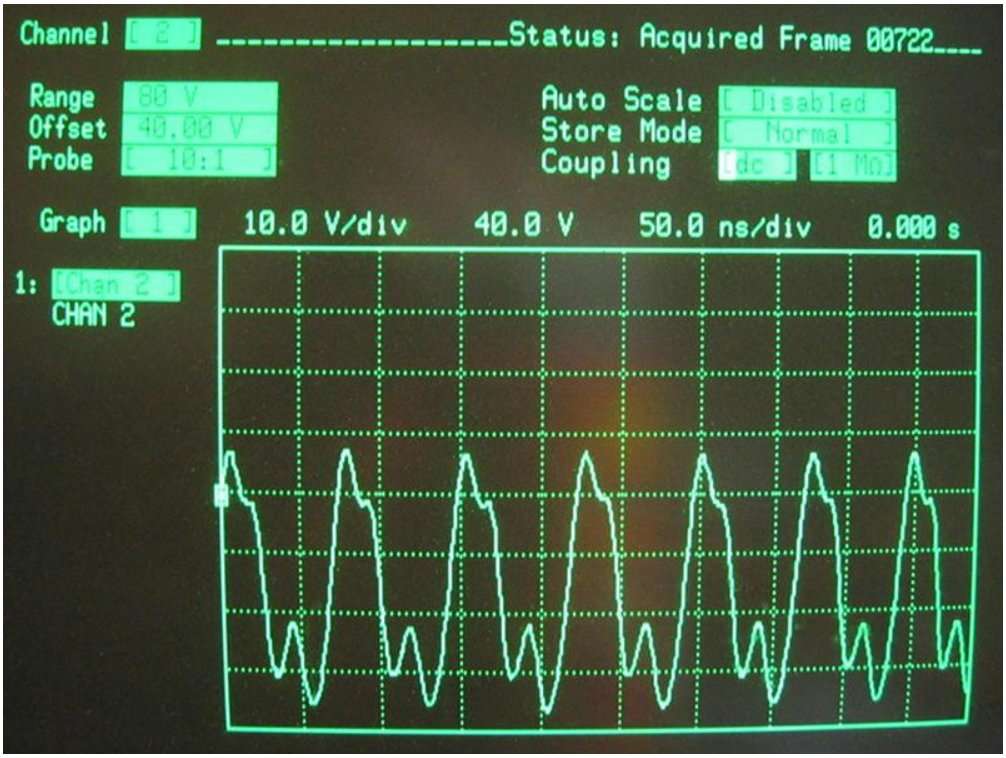
Edit: With the dummy load, the output voltage at L2 is about 23.3 Volts. I used the ground connection/mountin hole in the lower-right (when looking at the layout file), next to C47, as ground reference for all the measurements.

Edit 2: Take the readings with a huge grain of salt! My scope is half broken, i only have a shitty probe, and it's not properly compensated as well. So it's quite possible that the readings are too low or high.

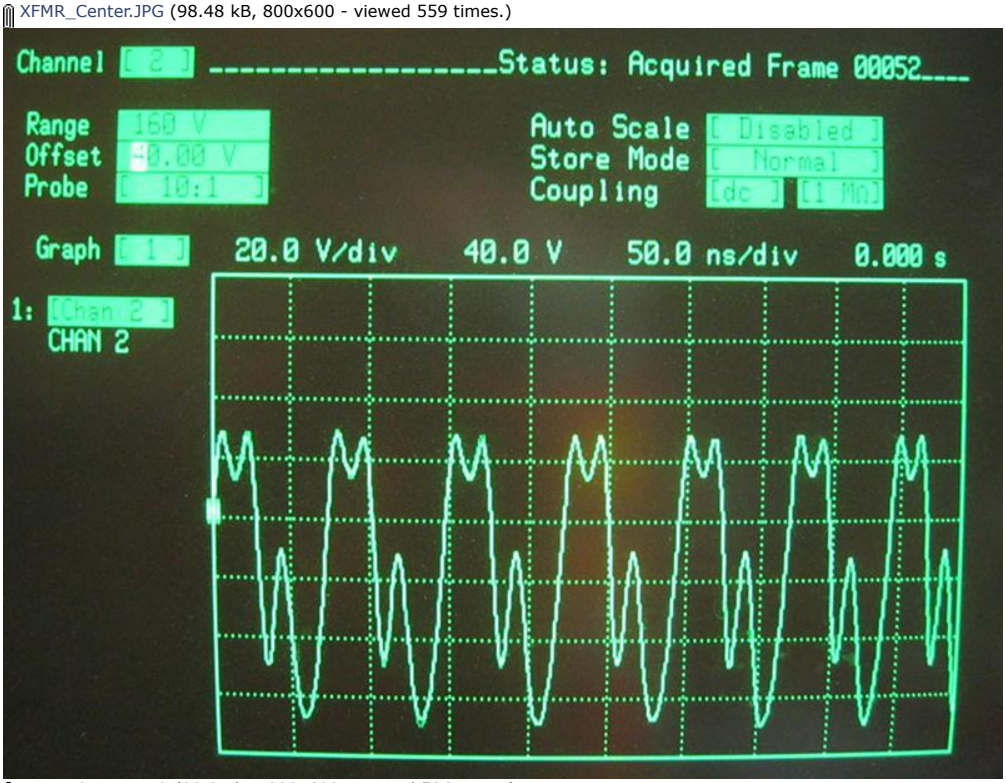
Just checked another probe (again a cheap one) and the output of L5 now shows 120 Volts peak-peak instead of 100 Volts into a 50 Ohms dummy load. So, the readings in the scope images are just very rough "somewhere around that" values.



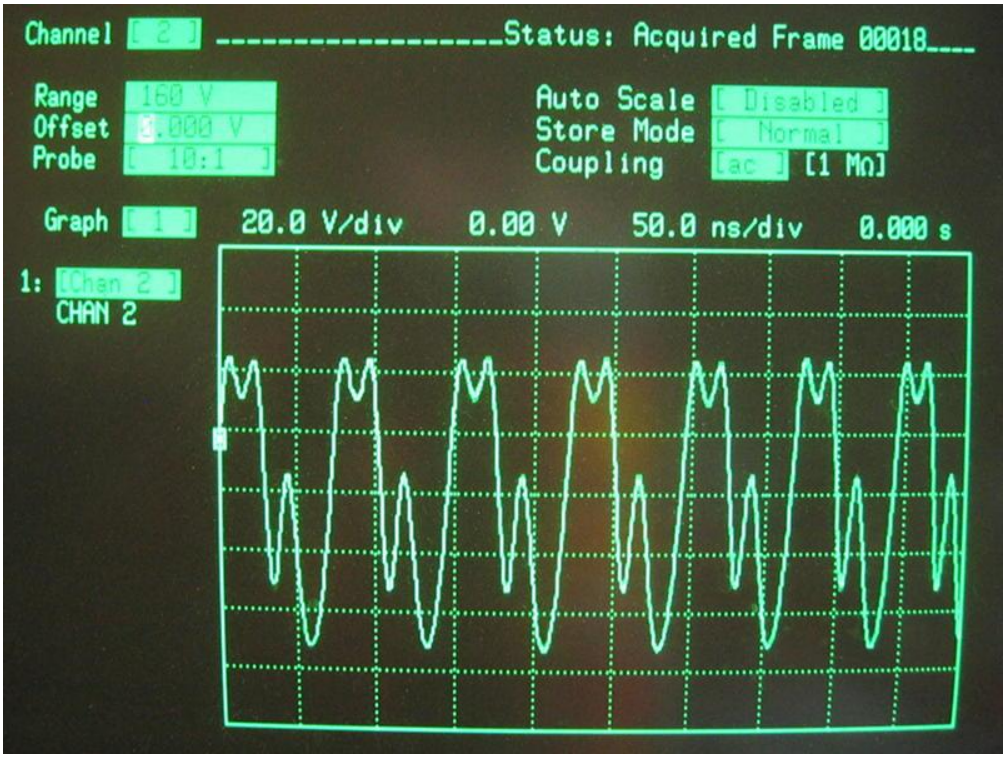
Output_L2.JPG (93.13 kB, 800x600 - viewed 577 times.)



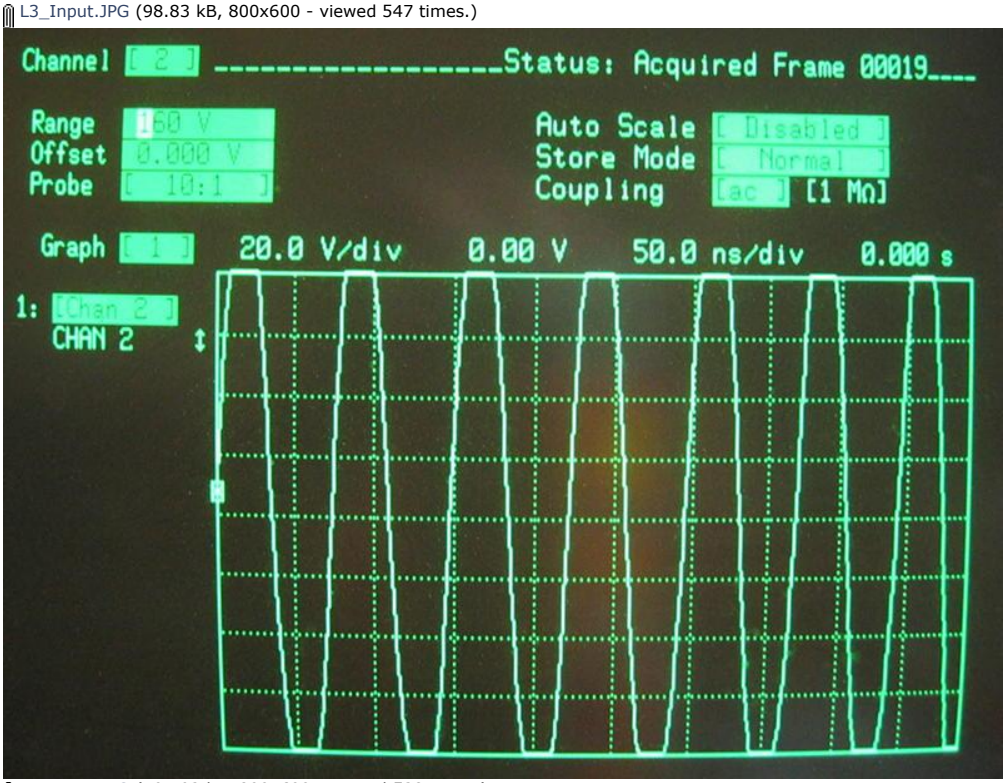
XFMR_Center.JPG (98.48 kB, 800x600 - viewed 559 times.)



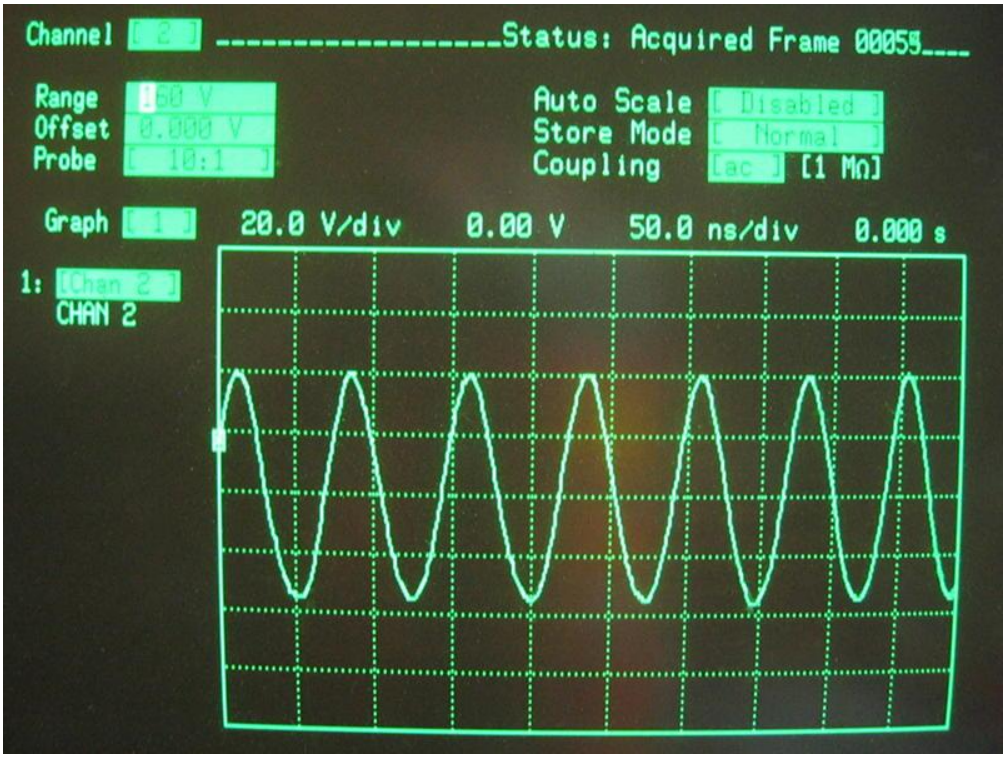
XFMR_Output.JPG (98.34 kB, 800x600 - viewed 536 times.)



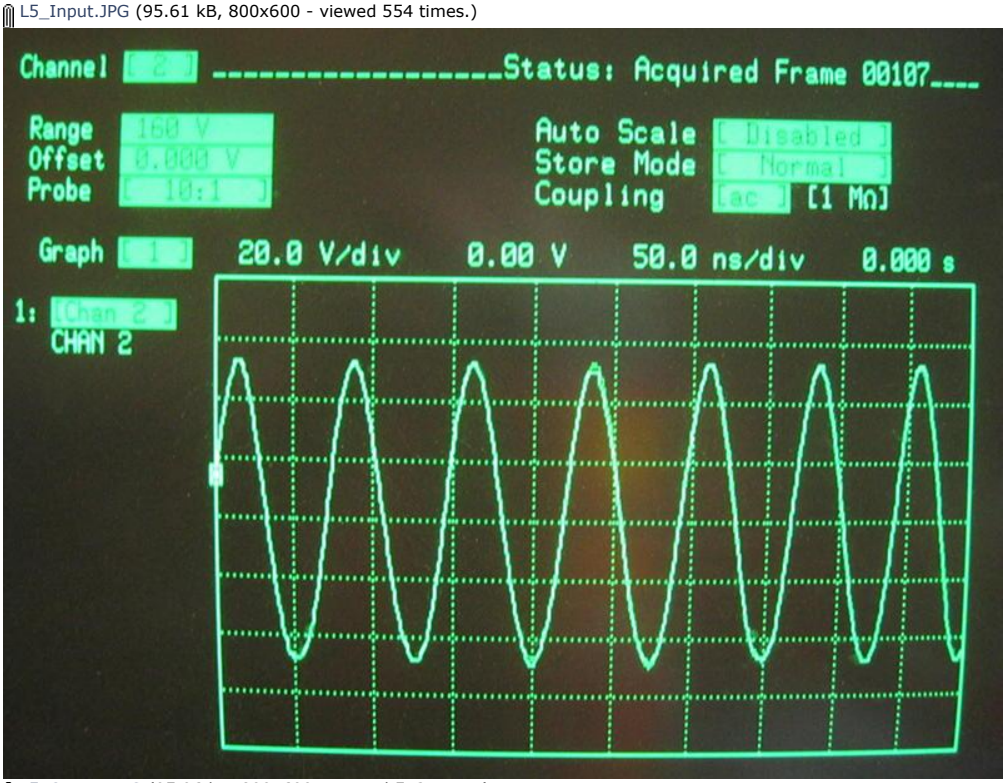
L3_Input.JPG (98.83 kB, 800x600 - viewed 547 times.)



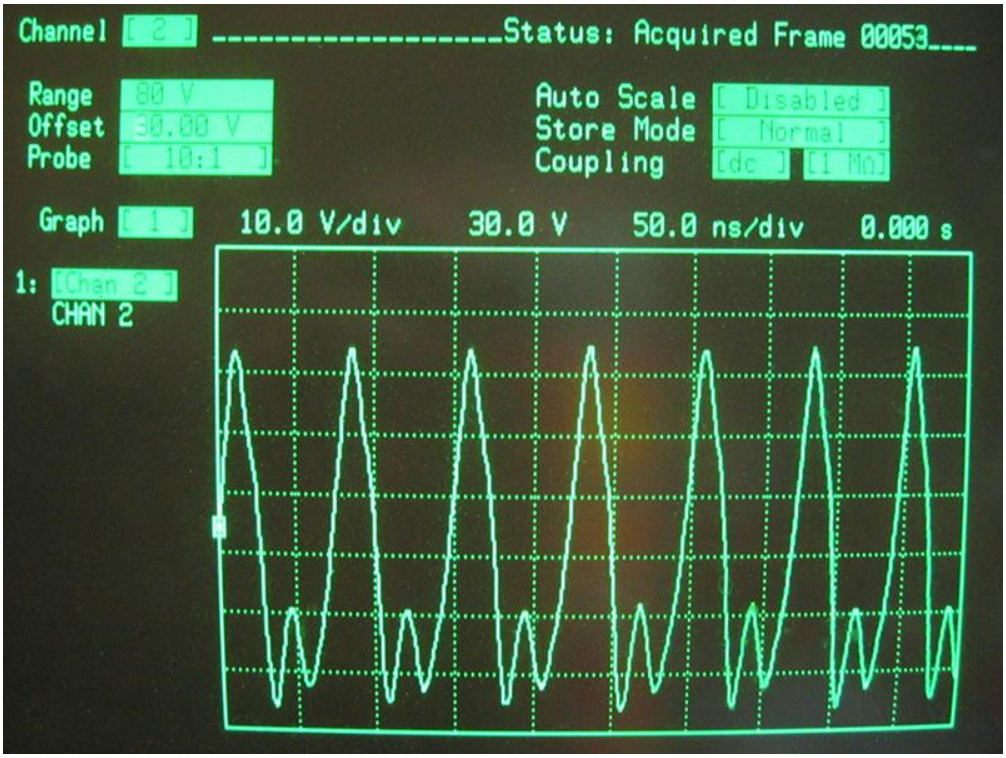
L4_Input.JPG (101.02 kB, 800x600 - viewed 538 times.)



L5_Input.JPG (95.61 kB, 800x600 - viewed 554 times.)



L5_Output.JPG (95.96 kB, 800x600 - viewed 543 times.)



XFMR_Center_with_Tip.JPG (99.25 kB, 800x600 - viewed 562 times.)

« *Last Edit: February 14, 2013, 03:10:24 pm by mamalala* »

Report to moderator Logged

Paulinho19

Contributor

Posts: 42

Country:

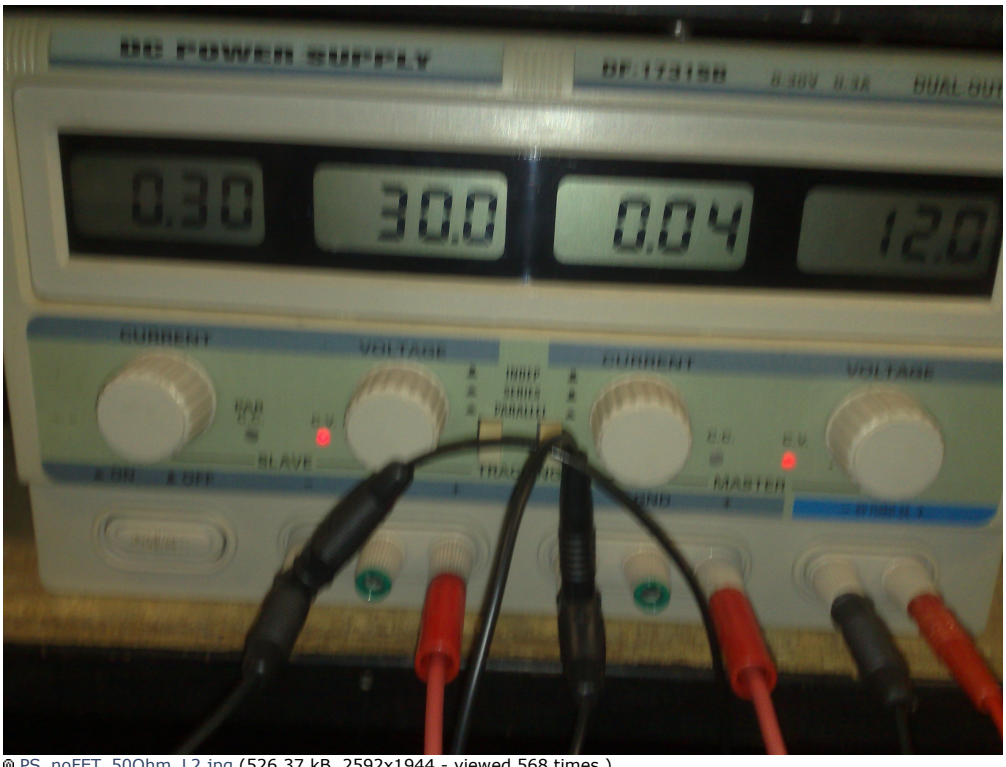
Re: DIY Metcal 13.56 MHz RF Supply

« **Reply #128 on:** February 14, 2013, 08:00:04 pm »

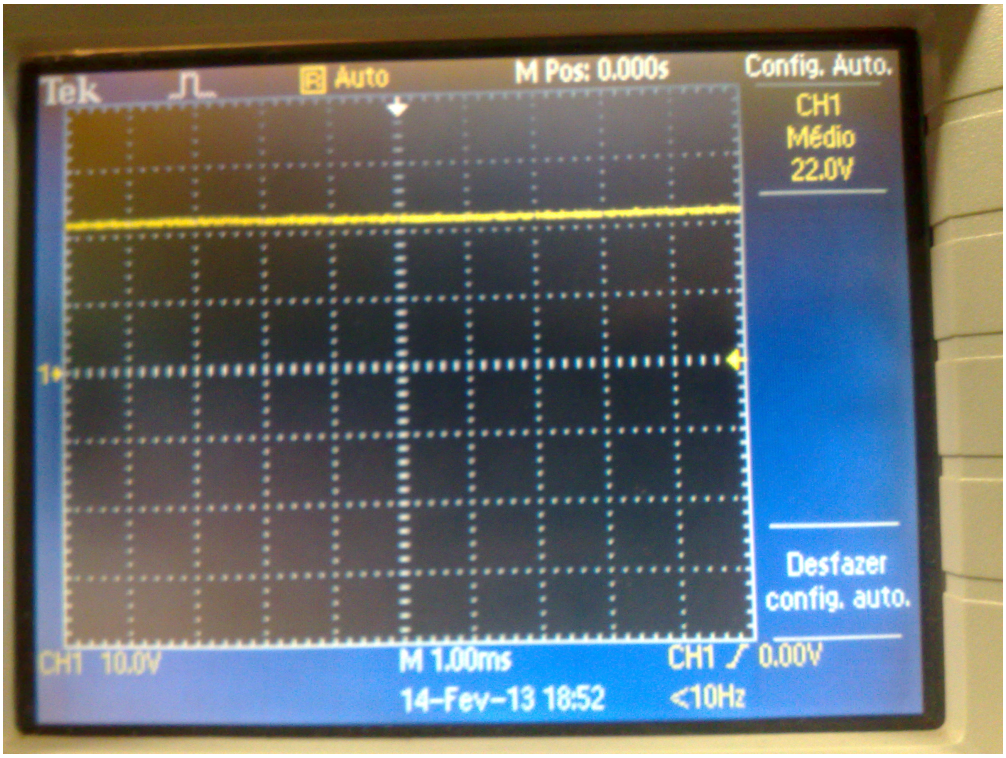
Say Thanks Reply Quote

Ok, here are the results from today.

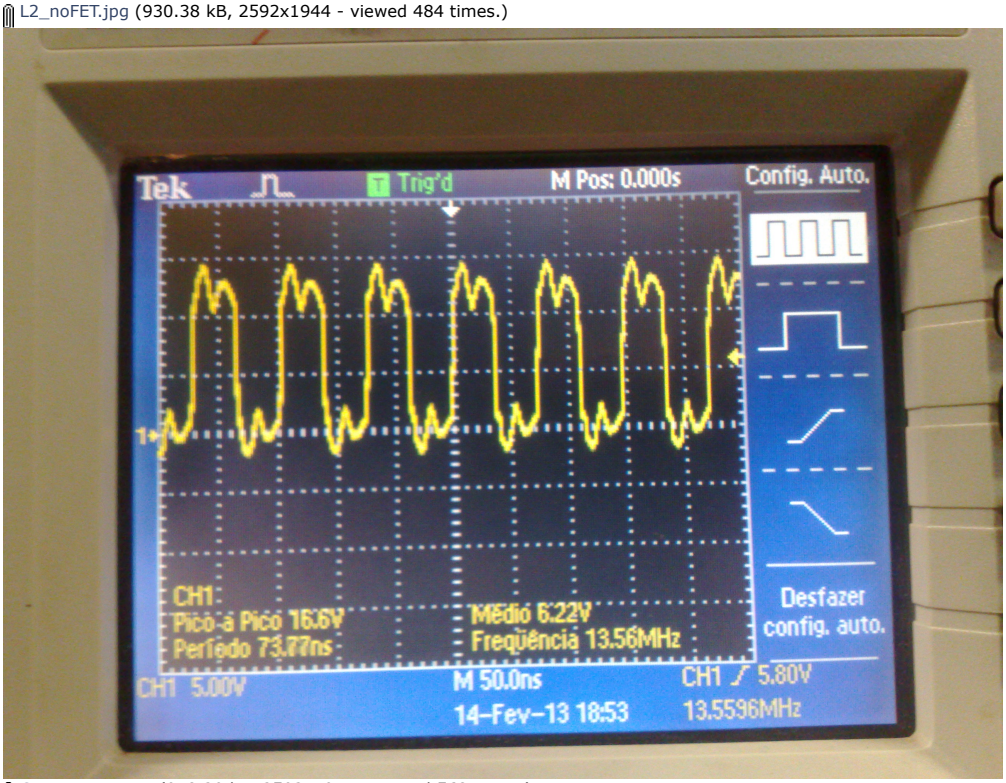
First I removed the FET and testes the L2 Output. First with no Load and then with the 50ohm dummy load connected there, everything seems fine.



PS_noFET_50Ohm_L2.jpg (526.37 kB, 2592x1944 - viewed 568 times.)



L2_noFET.jpg (930.38 kB, 2592x1944 - viewed 484 times.)



GATE_noFET.jpg (948.29 kB, 2592x1944 - viewed 568 times.)

Report to moderator Logged

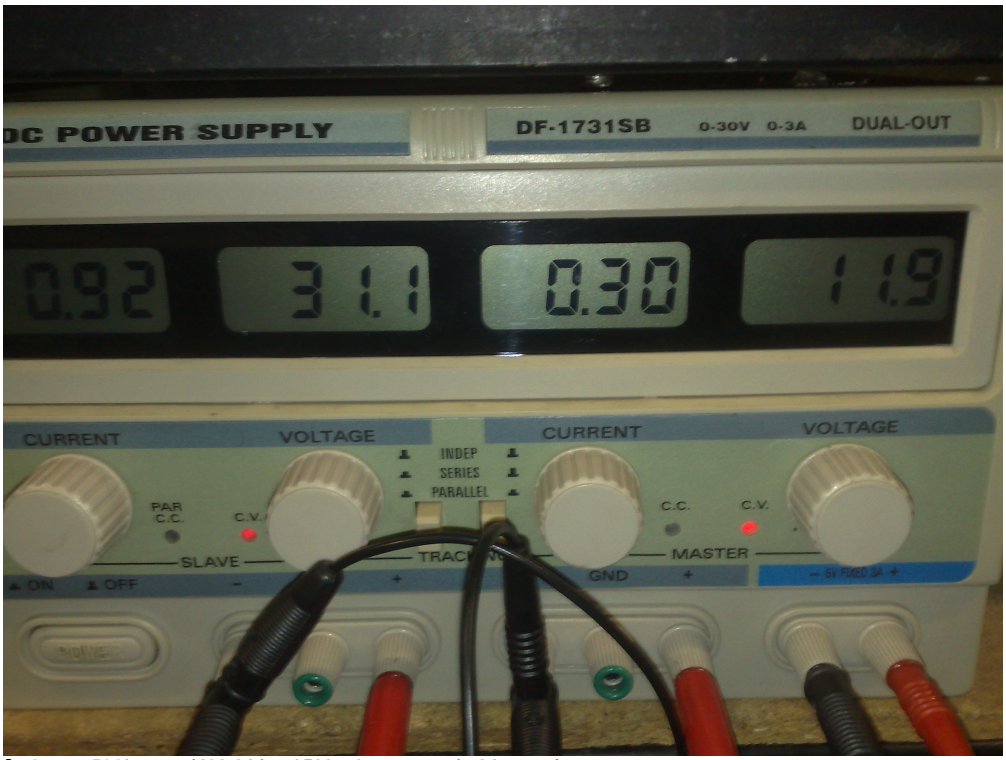
Paulinho19
Contributor
Posts: 42
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #129 on:** February 14, 2013, 08:03:08 pm »

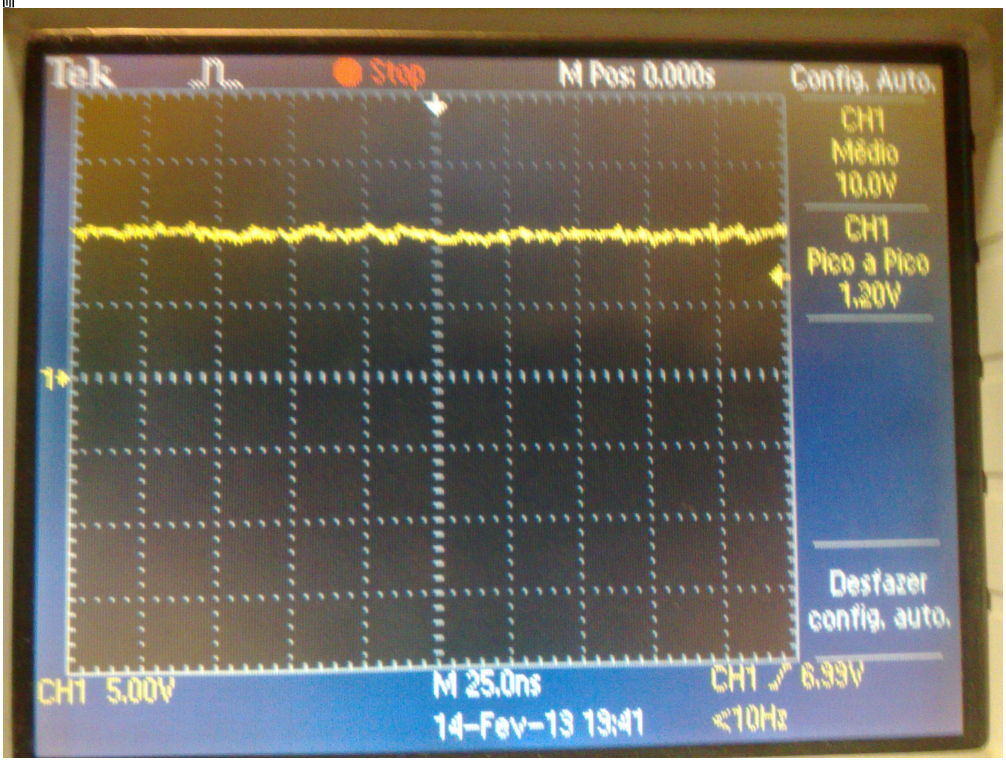
Say Thanks Reply Quote

Next I soldered a proper IRF510 and put the dummy load on the RF Output.

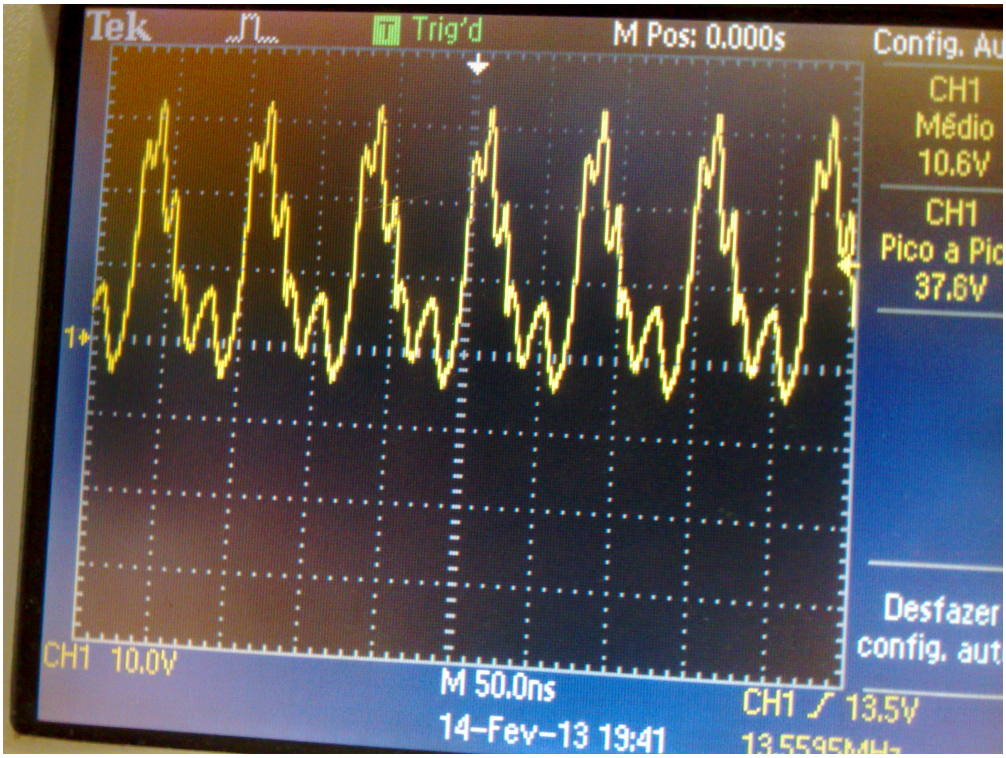
Turned R19 all clockwise and powered the unit.



PS_FET_50Ohm.jpg (603.36 kB, 2592x1944 - viewed 486 times.)



Output_L2.jpg (1043.41 kB, 2592x1944 - viewed 501 times.)



XFMR_Center.jpg (1129.74 kB, 2592x1944 - viewed 494 times.)

Report to moderator Logged

Paulinho19

Contributor

Posts: 42

Country:

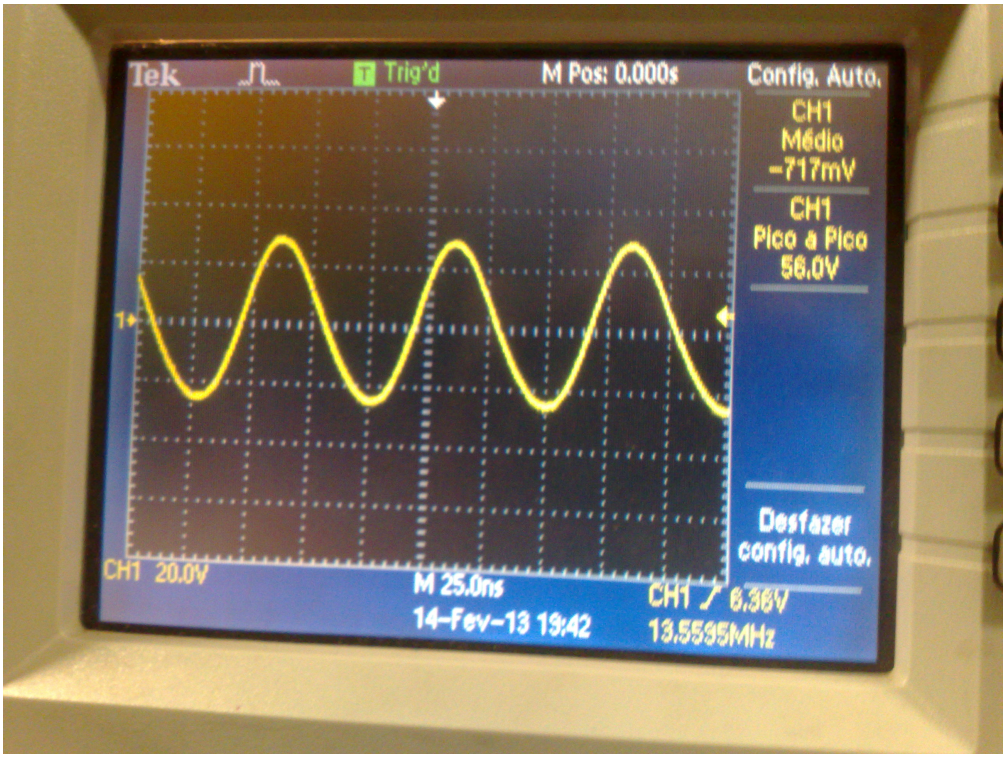
Re: DIY Metcal 13.56 MHz RF Supply

« **Reply #130 on:** February 14, 2013, 08:04:45 pm »

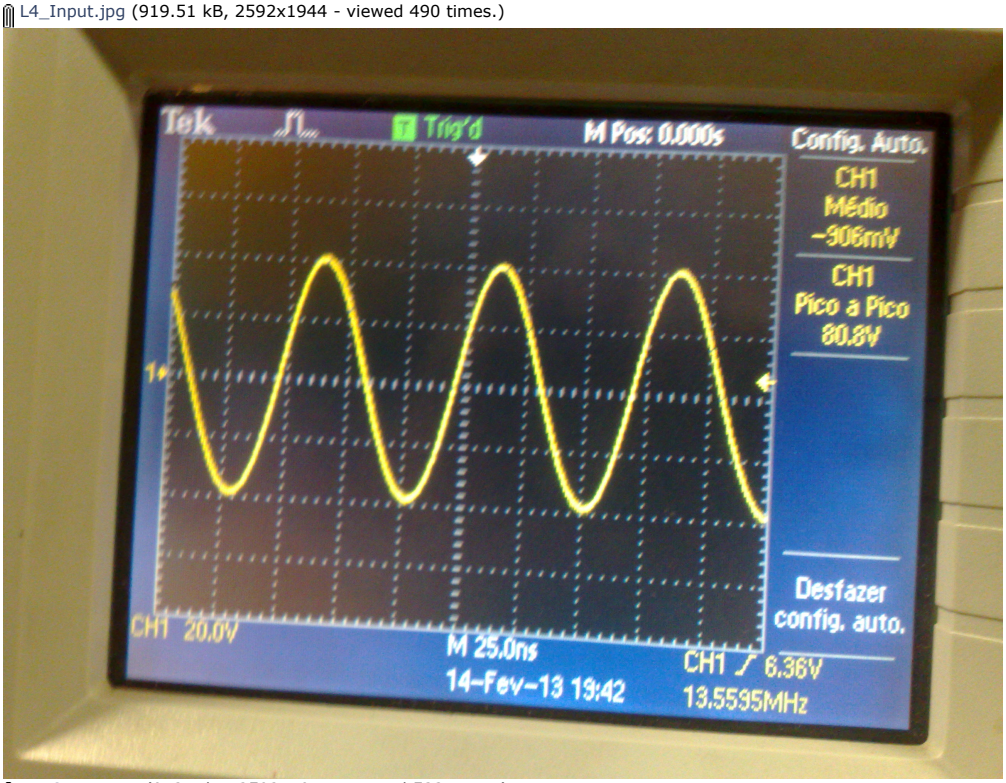
Say Thanks Reply Quote

Everything looked good to me.

XFMR_Output.jpg (1006.09 kB, 2592x1944 - viewed 478 times.)



L4_Input.jpg (919.51 kB, 2592x1944 - viewed 490 times.)



RF_Output.jpg (942.1 kB, 2592x1944 - viewed 533 times.)

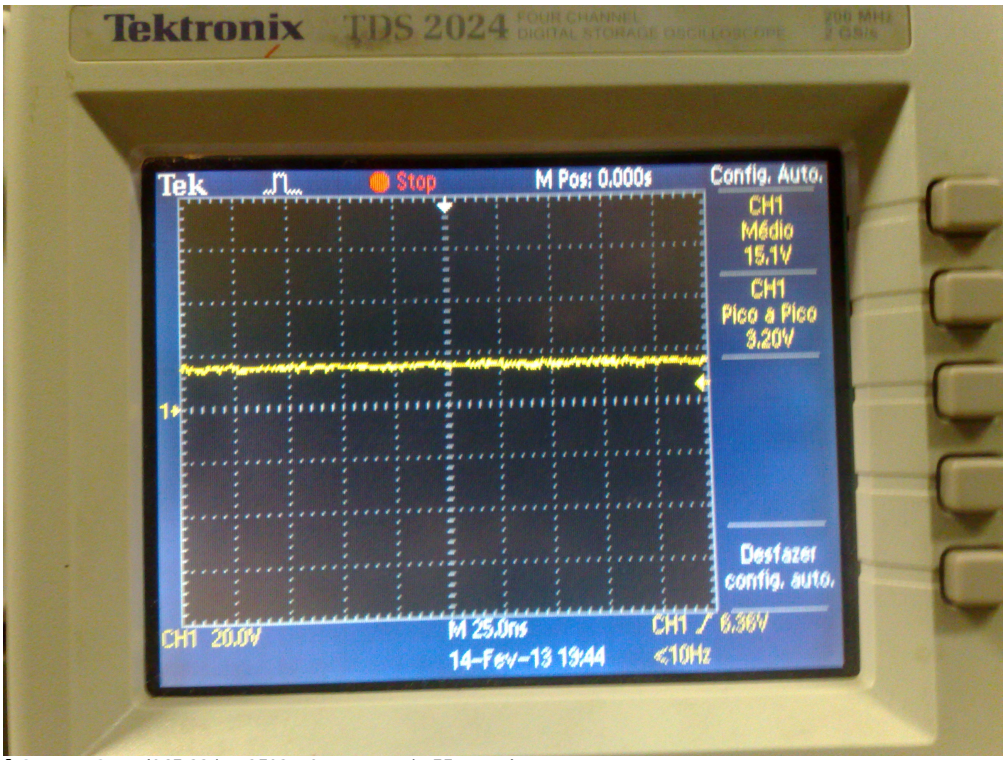
Report to moderator Logged

Paulinho19
Contributor
Posts: 42
Country:

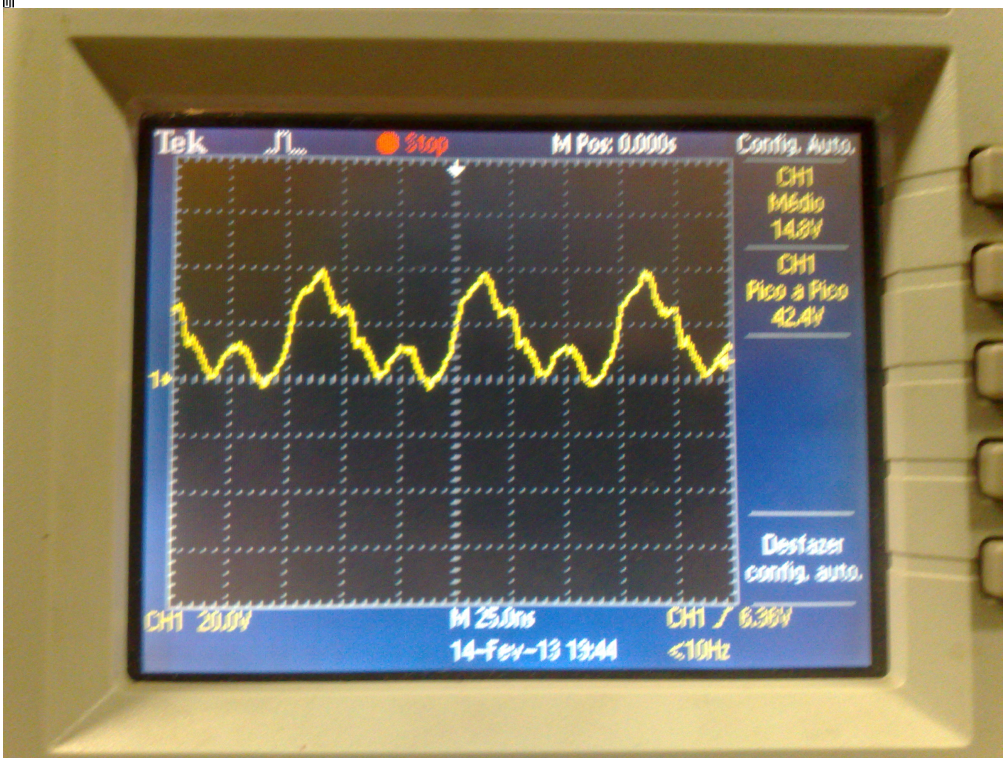
Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #131 on:** February 14, 2013, 08:07:26 pm »

Say Thanks Reply Quote

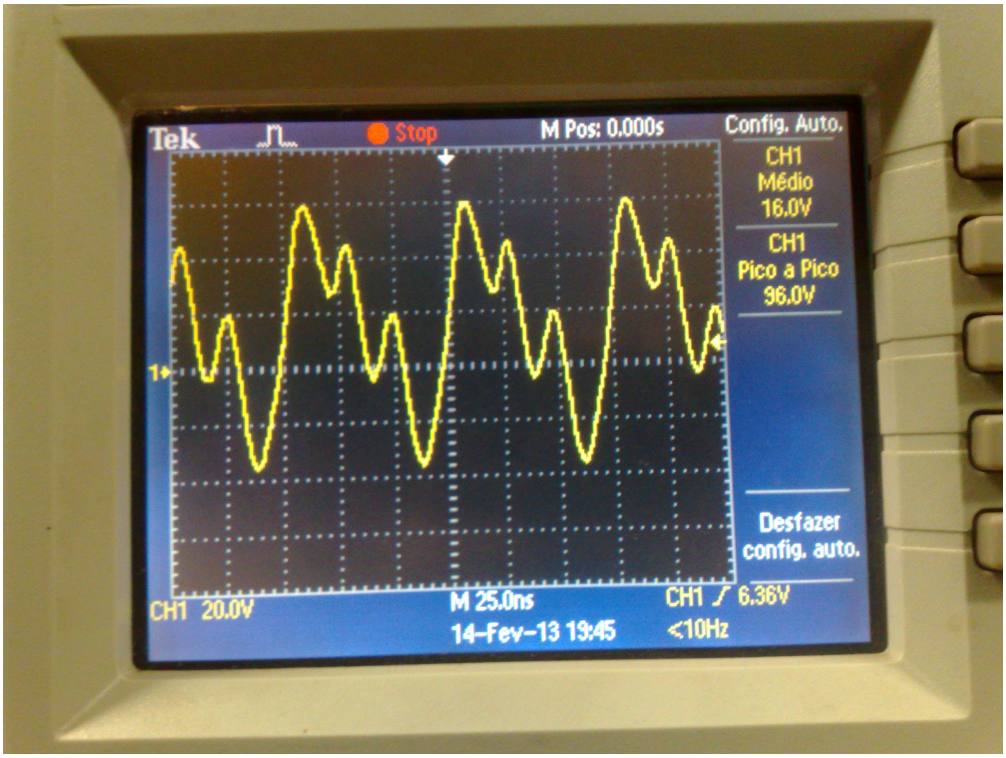
Next I started to turn R19 counter-clockwise and the voltage on L2 started to rise.



Output_L2.jpg (965.33 kB, 2592x1944 - viewed 455 times.)



XFMR_Center.jpg (939.58 kB, 2592x1944 - viewed 448 times.)



XFMR_Output.jpg (916.08 kB, 2592x1944 - viewed 470 times.)

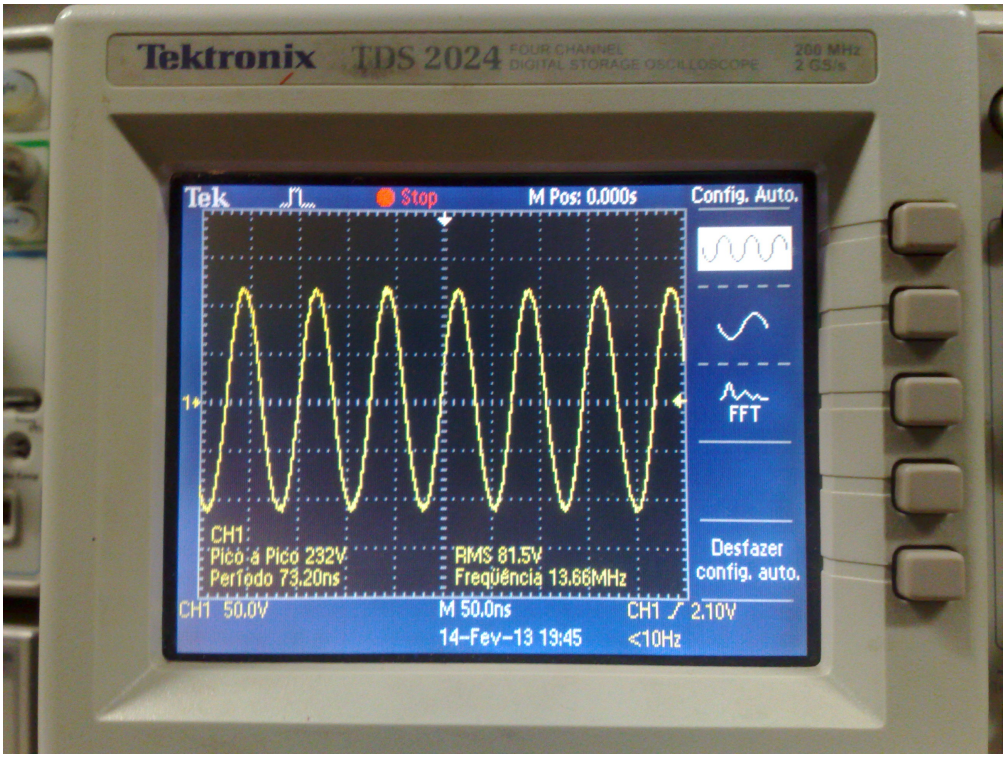
Report to moderator Logged

Paulinho19
Contributor
Posts: 42
Country:

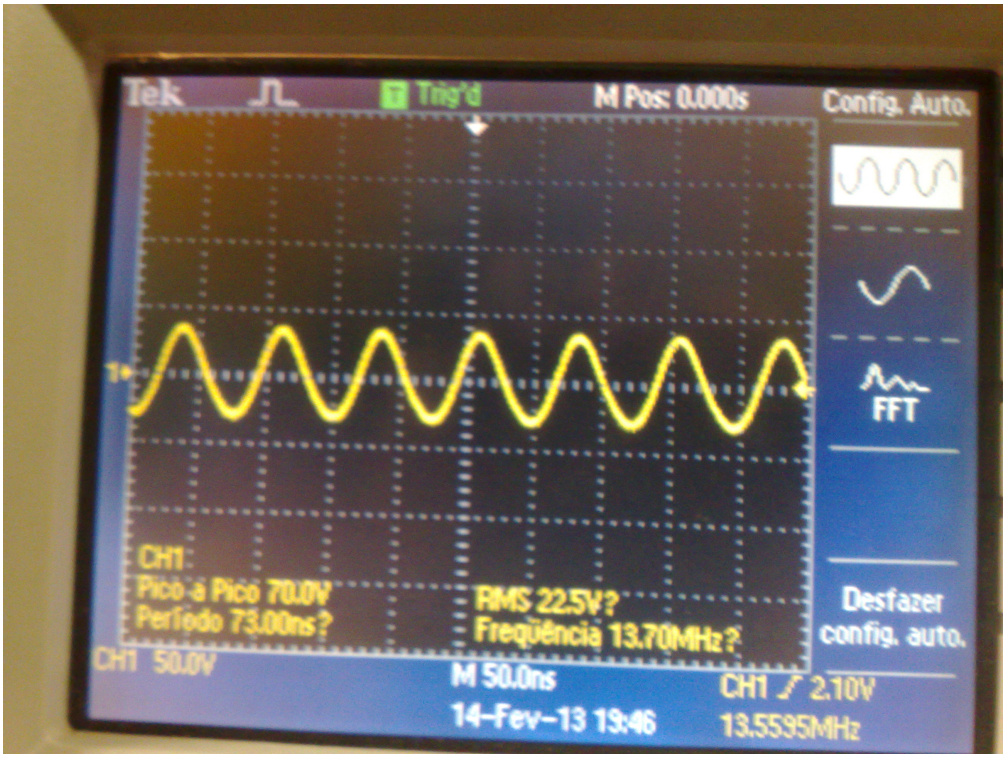
Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #132 on:** February 14, 2013, 08:08:42 pm »

Say Thanks Reply Quote

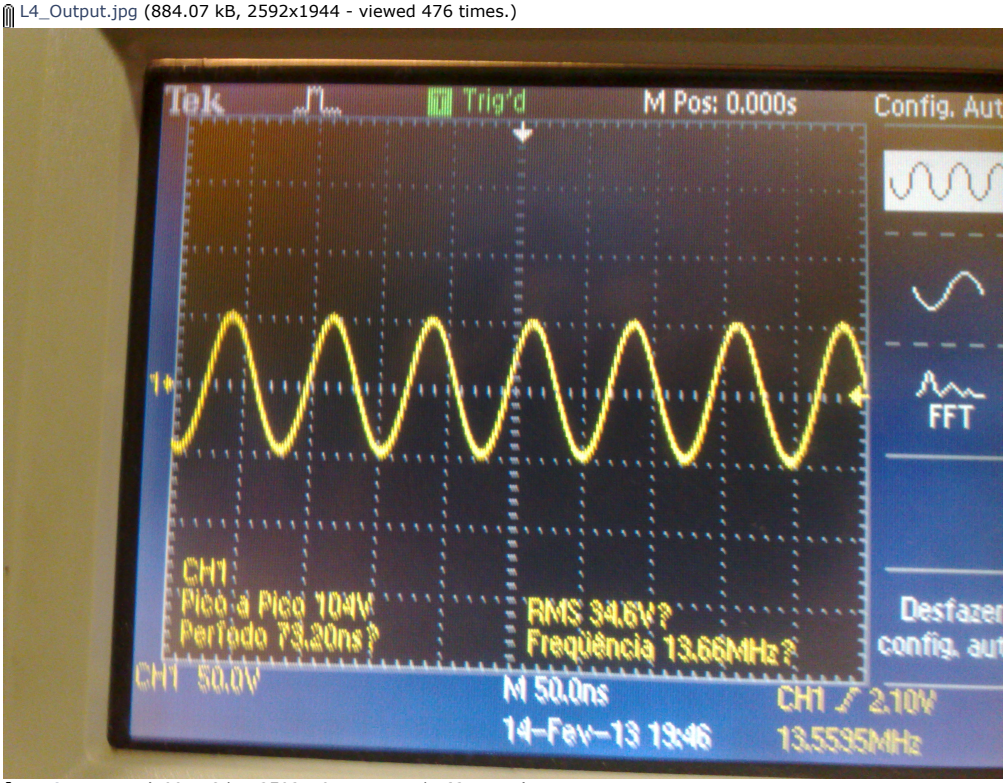
Everything still looked good.



L3_Output.jpg (936.34 kB, 2592x1944 - viewed 508 times.)



L4_Output.jpg (884.07 kB, 2592x1944 - viewed 476 times.)



RF_Output.jpg (1004.78 kB, 2592x1944 - viewed 463 times.)

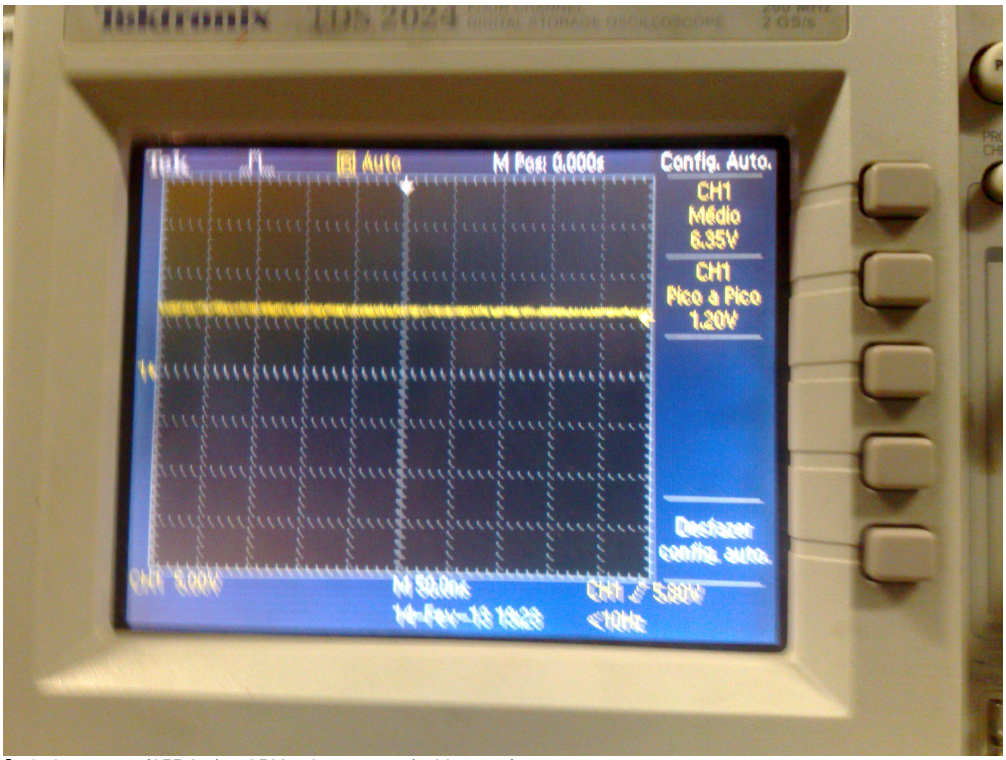
Report to moderator Logged

Paulinho19
Contributor
Posts: 42
Country:

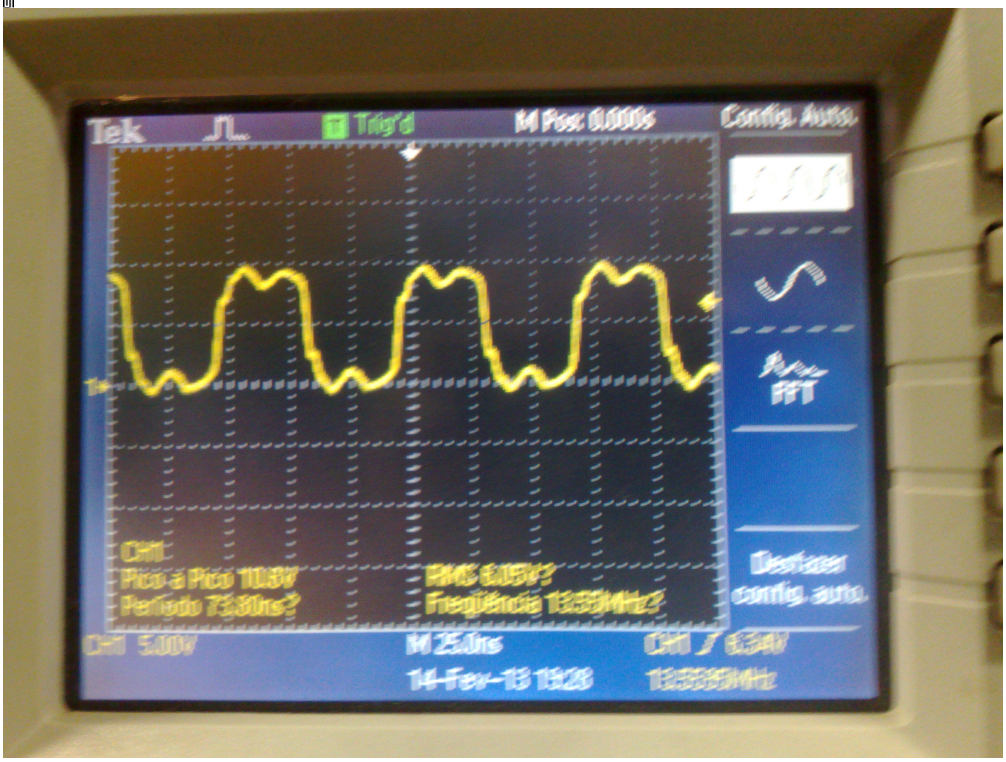
Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #133 on:** February 14, 2013, 08:10:42 pm »

Say Thanks Reply Quote

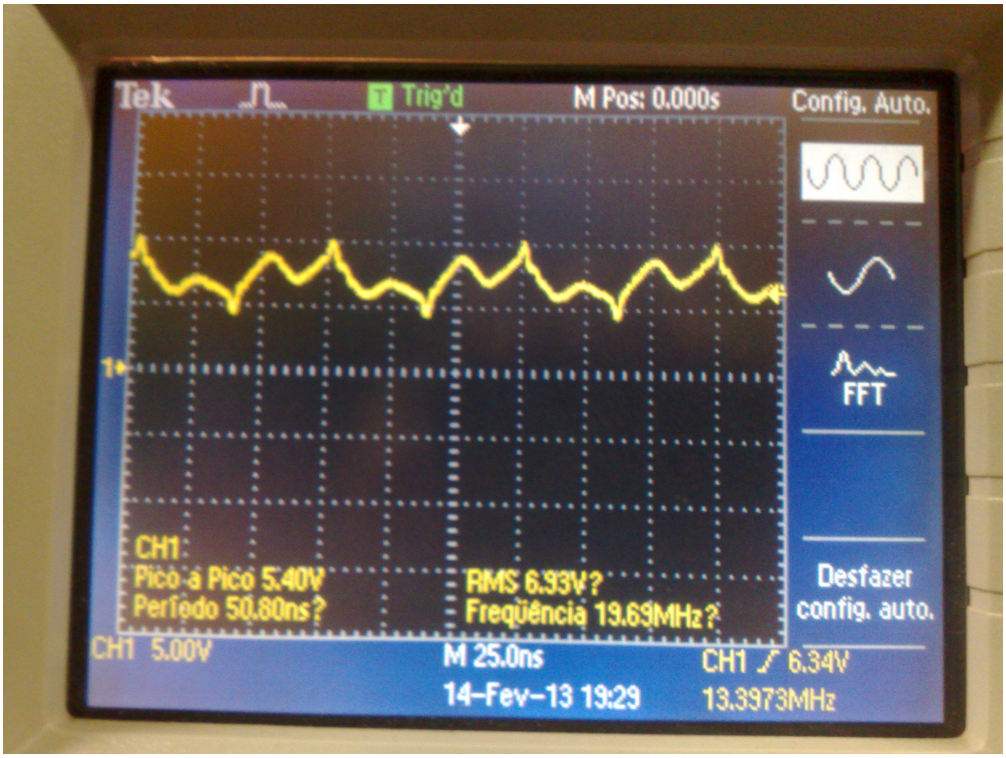
As I got over 16V on L2 the FET died.



L2_Output.jpg (955.21 kB, 2592x1944 - viewed 480 times.)



FET_GATE.jpg (903.42 kB, 2592x1944 - viewed 454 times.)



XFMR_Center.jpg (892.53 kB, 2592x1944 - viewed 488 times.)

Report to moderator Logged

Paulinho19

Contributor

Posts: 42

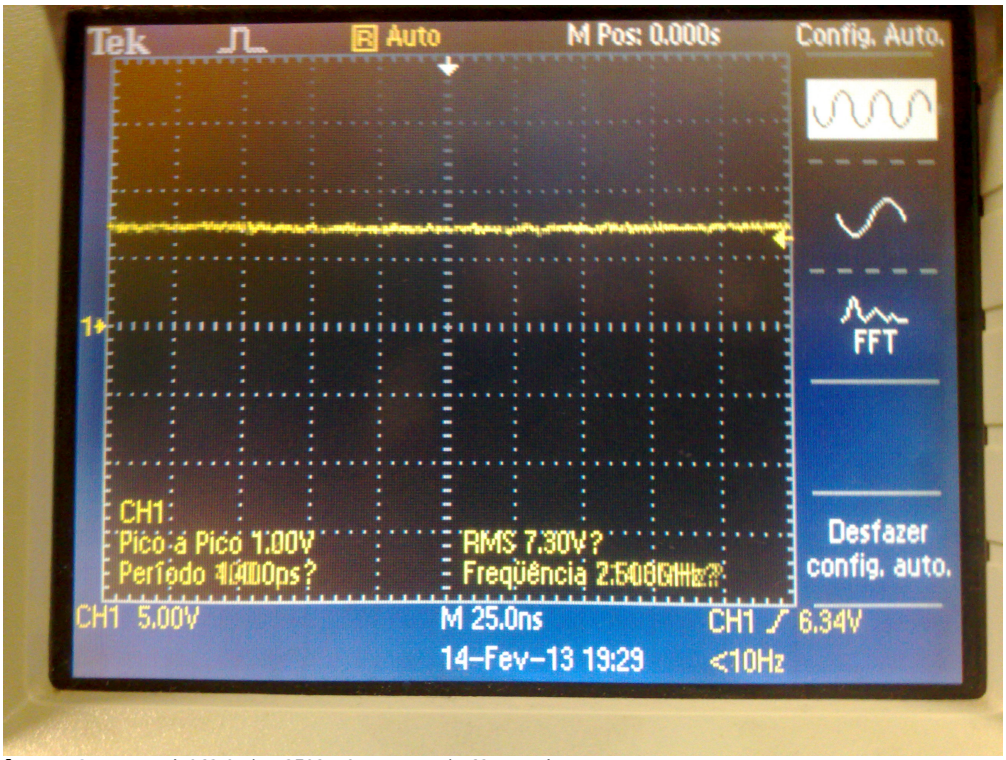
Country:

Re: DIY Metcal 13.56 MHz RF Supply

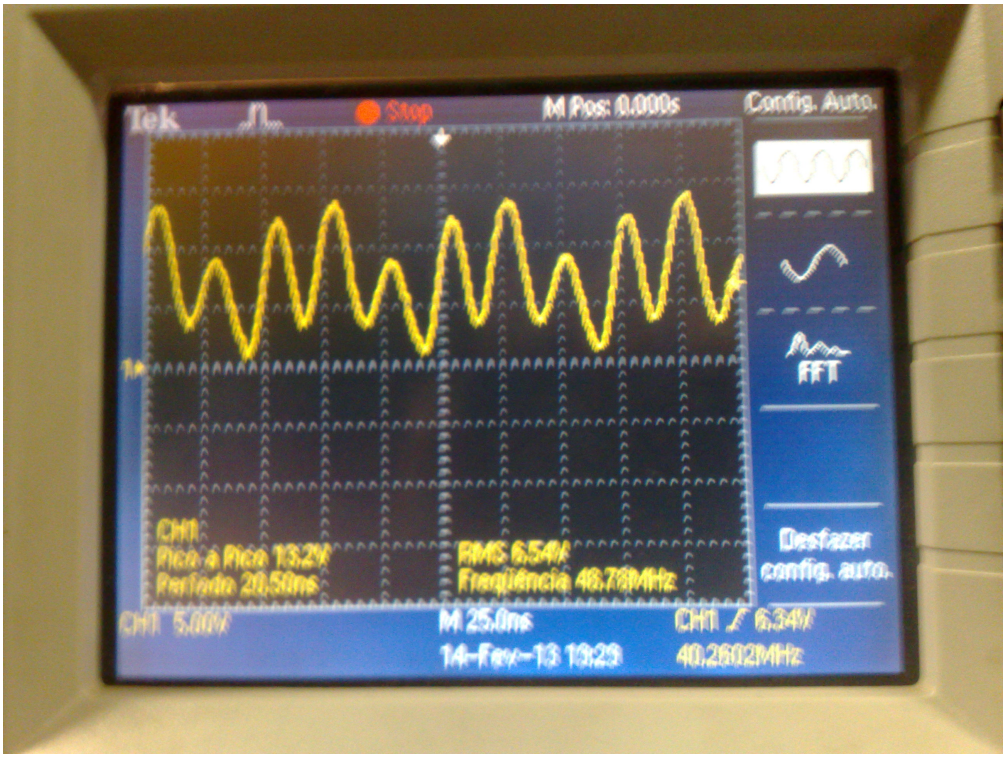
« **Reply #134 on:** February 14, 2013, 08:14:52 pm »

Say Thanks Reply Quote

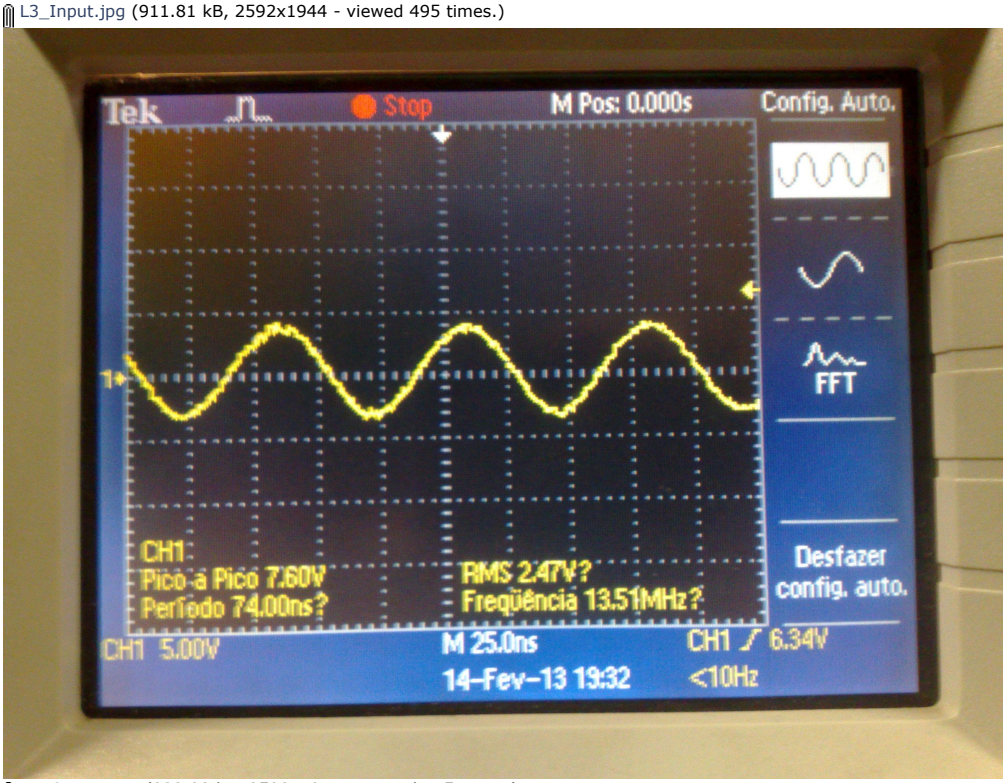
So I put in a new IRF510 and exactly the same happened. I reach 100V p-p with around 15V on L2 and when I increase the voltage there with R19 the FET dies.



XFMR_Output.jpg (1062.04 kB, 2592x1944 - viewed 462 times.)



L3_Input.jpg (911.81 kB, 2592x1944 - viewed 495 times.)



RF_Output.jpg (922.02 kB, 2592x1944 - viewed 475 times.)

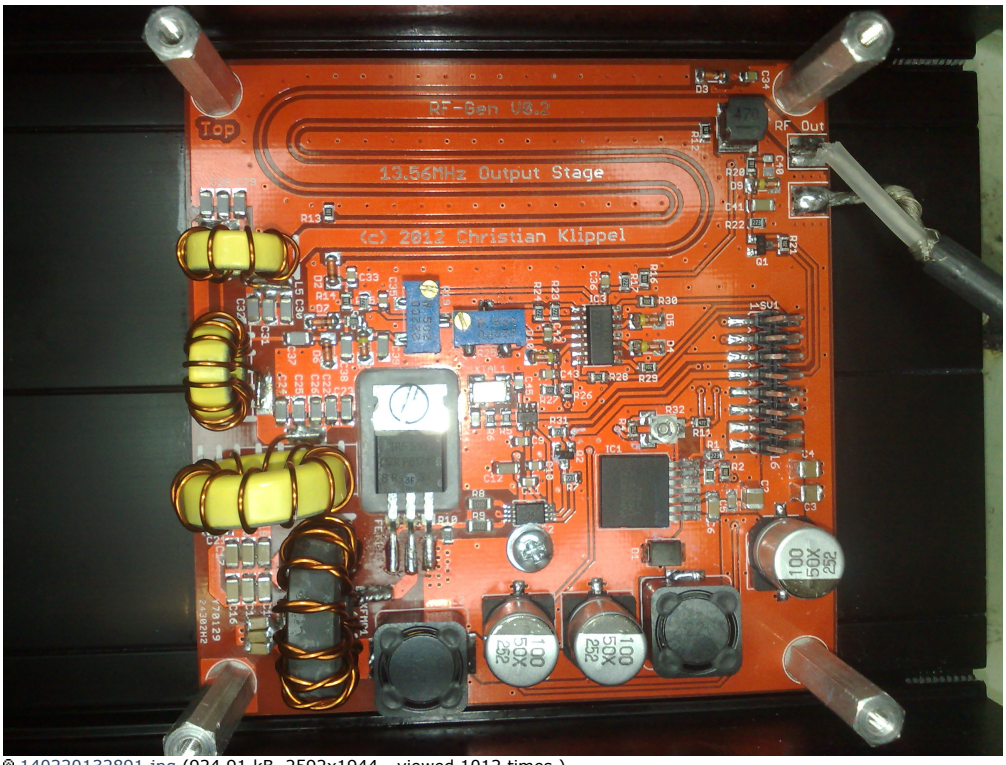
Report to moderator Logged

Paulinho19
Contributor
Posts: 42
Country:

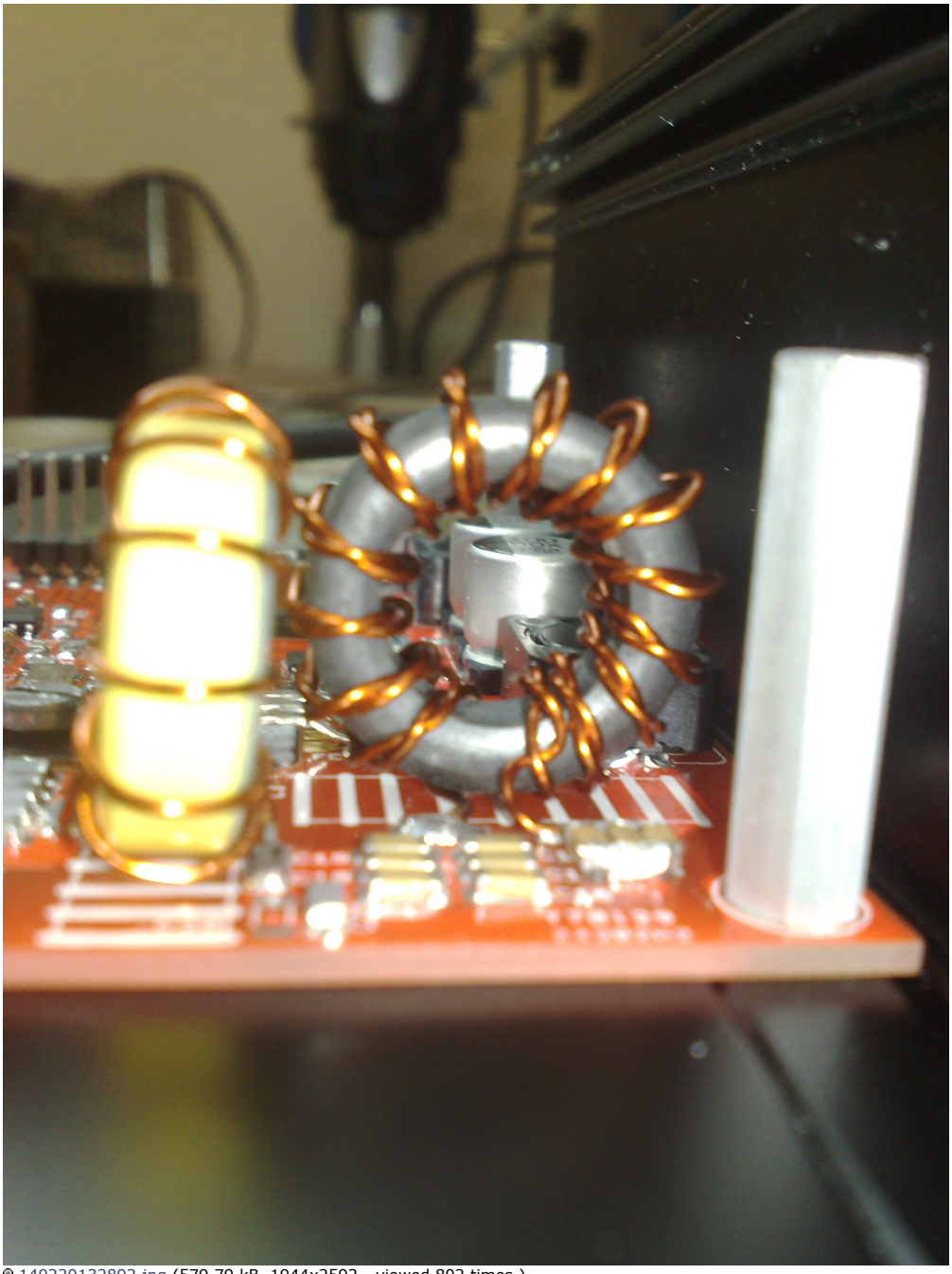
Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #135 on:** February 14, 2013, 08:16:28 pm »

Say Thanks Reply Quote

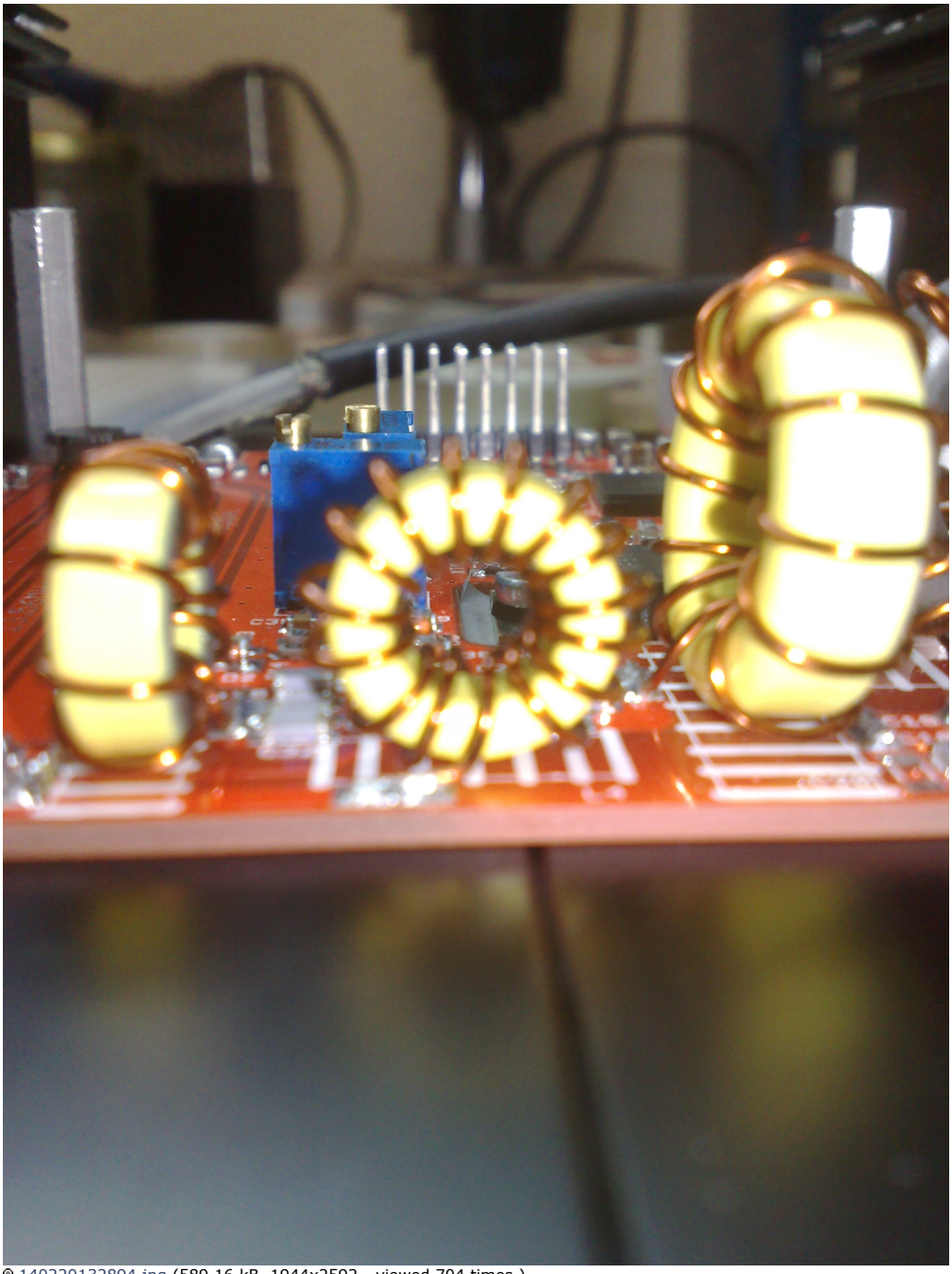
Here are some better pics from my board.



140220132891.jpg (924.91 kB, 2592x1944 - viewed 1012 times.)



140220132892.jpg (579.79 kB, 1944x2592 - viewed 802 times.)



140220132894.jpg (589.16 kB, 1944x2592 - viewed 704 times.)

Report to moderator Logged

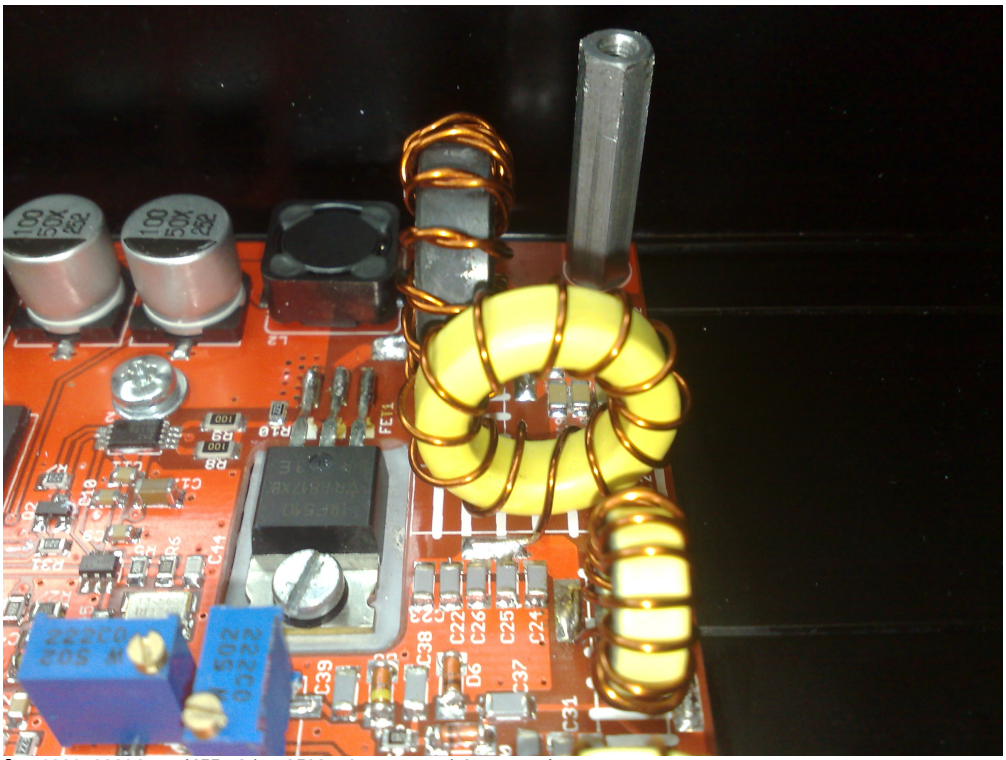
Paulinho19
Contributor
Posts: 42
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #136 on:** February 14, 2013, 08:17:10 pm »

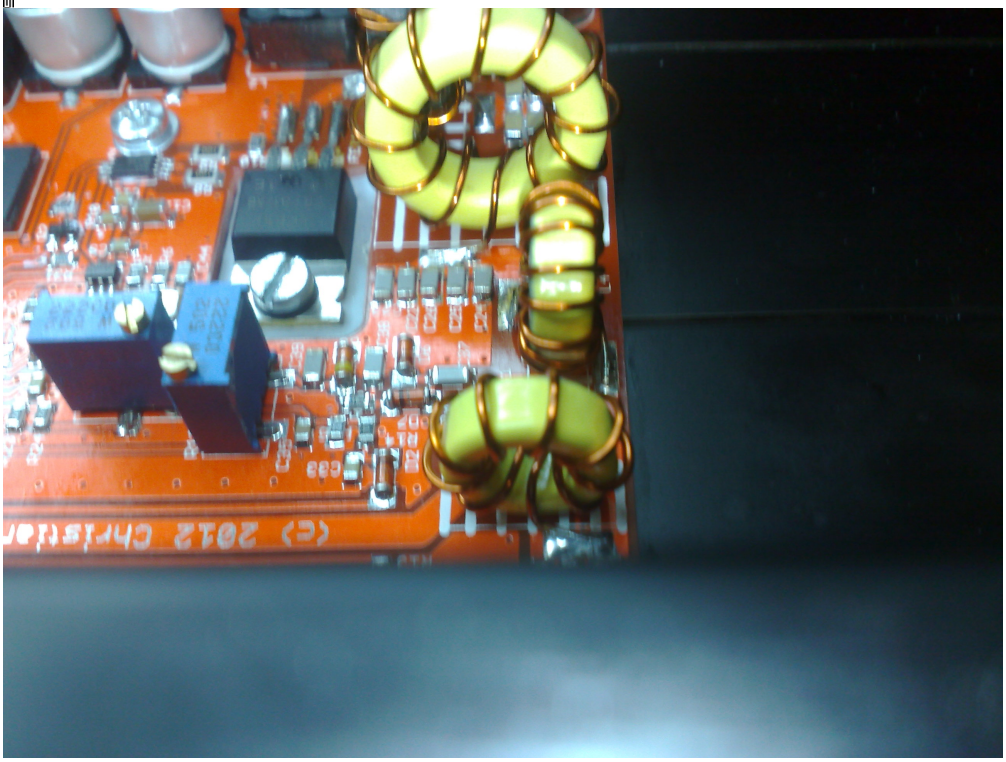
Say Thanks Reply Quote

Any sugestions?

The last pic is my Dummy Load.



140220132896.jpg (655.13 kB, 2592x1944 - viewed 677 times.)



140220132897.jpg (610.53 kB, 2592x1944 - viewed 601 times.)

130220132853.jpg (609.44 kB, 2592x1944 - viewed 680 times.)

« *Last Edit: February 14, 2013, 08:20:55 pm by Paulinho19* »

Report to moderator Logged

mamalala
Supporter

Posts: 777
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #137 on:** February 14, 2013, 10:47:33 pm »

Say Thanks Reply Quote

Hi Paulo,

hmm, you are getting closer, at least

OK, first i see that you have wound the coils rather loose. I have them tightly wound around the cores, as you can see in the images in the docu. This will affect the inductance to some extent, so that might be part of the reason.

Next, you have only 3 caps installed for C30/31/32. I have a third one placed on top of them, making a total of 4. I can't see it in you images, but at C20/21 only one cap has to be installed instead of two.

In your post #130, L4_Input shows 56 Volts pp, while RF_Output shows around 80 Volts pp. That can't be right. Are you sure you got those right?

In post #132, L3_Output it shows 232 Volts pp, which seems a bit high considering the output voltages. It might just be that there is too much RF reflected, which then kills the FET somehow. While i can't meassure the voltage there, a image interpolation with a lower voltage waveform tells me that i have around 200 Volts pp there in the image i posted here, resulting in about 85 Volts pp at L5 input, and about 100 Volts pp at the RF output.

Please install that extra capacitor, and make sure that there is only one installed at the input of L3 (positions C20/21), and rewind the toroids so that the windings sit really tight on the core. The XFMR looks fine already. Oh, and bend L3 away a bit from the XFMR1, in the image it literally leans onto it.

Other than that it already starts to look good. I assume you used a "trustworthy" supplier for the IRF510. I have seen cheap China FET's that didn't hold up to the specs in other projects... Keep an eye on the voltage/waveform at the drain of the IRF510, which goes into the center tap of the XFMR. It shouldnt go too much above 60 Volts pp. If it does, too much RF is reflected back somewhere.

Just to make sure, you can try to do the measurements with L6 (right at the RF Out pads) removed. There just might be something fishy going on in that section that throws of the matching. After all, that is the only part that is in direct contact with the RF output signal (besides the output filter obviously, of course).

When i was experimenting with the coils/caps in the output filter section, i blew a few FET's myself, so that filter section is a rather sensitive area.

Oh, and while it may sound stupid to ask, but i can assume you used proper capacitors in the filter

section? That is, with the proper voltage rating? As you can see, rather high voltages can appear there, so the caps must have a suitable rating.

At one point i blew the cap at C13, in the supply line to the XFMR, at the moment i switched the unit off. While the circuit still worked somewhat, it also messed with the FET (and overall signal quality). That's why i now have three in that position. Lot's of current draw there. So the caps are a really important factor here.

Greetings,

Chris

Edit: Oh, and you can scale down the scope images, for example to 800x600 like i did. There isn't more information in them than that anyways. Only eats up bandwidth

« *Last Edit: February 14, 2013, 10:49:18 pm by mamalala* »

Report to moderator Logged

mamalala

Supporter

Posts: 777
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #138 on:** February 14, 2013, 11:28:47 pm »

Say Thanks Reply Quote

Just for fun, here's a small video showing the waveform at the drain of the IRF510 from power-on until the tip reaches it's temperature. It starts high, goes down and then back up again. At the same time the voltage at L2 goes from the initial 23.3 volts down to 17.6 volts. This shows that the reflected RF increases the voltage at the drain, even with a decreasing supply voltage.

So, if there is a mismatch in the RF path, and too much RF gets reflected back into the IRF, that surely will kill that poor thing.

http://www.vidup.de/v/LjF47/

Greetings,

Chris

Report to moderator Logged

Paulinho19

Contributor

Posts: 42
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #139 on:** February 14, 2013, 11:55:47 pm »

Say Thanks Reply Quote

Hi again,

Yes I'm closer.

I have 4 caps on C30/31/32, there are 2 on C30, you can't really tell by that pic, but you can see them on the 140220132894 from post #135.

I also have only 1 cap on C20/C21, you can see that on the 140220132892 also from post #135.

Regarding L4_Input from post #130, it could actually be L4_Output, dose that make more sense?

I got the IRF510 from my local electronics part dealer. They are normally "trustworthy", but I will try to get some elsewhere.

I used the following caps on the RF Output Filter:

http://pt.rs-online.com/web/p/condensadores-ceramicos-multicapa/0391038/

I will fix coils tomorrow, and if I can find some new IRF510 I will try it again.

Thanks for all the help,

Paulo

The problem could also be the warm weather here in Portugal

Report to moderator Logged

mamalala

Supporter

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #140 on:** February 15, 2013, 12:04:04 am »

Say Thanks Reply Quote

Alright then. If the caps are all OK, the only thing left that i can think of are the coils and the FET (assuming no funny business is going on with L6/the tip-detection circuitry).

Just to make sure i did not mess up anything with the caps in the filter section, i will check them during the weekend for the values i used. But i'm pretty sure they are correct. Of course there is still

Posts: 777
Country:

the dummy load that may be faulty, but i think that is rather unlikely. However, just to make sure you could check if it still has 50 ohms. And watch the temperature of that thing. It's rated for 15 watts average only, while this circuit can easily deliver over 35 or 40 watts into a 50 ohms load.

I'm sorry that i can't provide more accurate scope measurements... Stupid broken HP scope here...

Greetings,

Chris

Report to moderator Logged

Paulinho19
Contributor
Posts: 42
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #141 on:** February 15, 2013, 12:04:34 am » Say Thanks Reply Quote

Can I use this IRF520 instead of the IRF510?

http://pt.farnell.com/international-rectifier/irf520npbf/mosfet-n-to-220/dp/9103031

Paulo

Report to moderator Logged

Paulinho19
Contributor
Posts: 42
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #142 on:** February 15, 2013, 12:12:00 am » Say Thanks Reply Quote

The dummy load looks ok, I measured its resistance and got 49.9 Ohm. It doesn't get very hot, the FET dies before it has time to heat up.

A friend will lend me a more powerful one just in case.

Paulo
« *Last Edit: February 15, 2013, 12:35:14 am by Paulinho19* »

Report to moderator Logged

mamalala
Supporter

Posts: 777
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #143 on:** February 15, 2013, 12:42:52 am » Say Thanks Reply Quote

> **Quote from: Paulinho19 on February 15, 2013, 12:04:34 am**
>
> Can I use this IRF520 instead of the IRF510?
>
> http://pt.farnell.com/international-rectifier/irf520npbf/mosfet-n-to-220/dp/9103031
>
> Paulo

Not really, i think. It also has a rather big turn-off delay and fall time, and higher gate charge.

IRF510 at RS:
http://pt.rs-online.com/web/p/transistores-mosfet/7085134/

At Farnell:
http://pt.farnell.com/vishay-siliconix/irf510pbf/transistor-mosfet-polarity-n/dp/1653658

Greetings,

Chris

Report to moderator Logged

mamalala
Supporter

Posts: 777
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #144 on:** February 15, 2013, 02:32:44 pm » Say Thanks Reply Quote

Just did a quick check for the cap values. As in the instruction, the C0G caps in the filter section are all 56p, the sic X7R at the XFMR output are all 47n, and for C13 i have 3 x 100n installed. The 3 caps in the peak detector (C37/38/39) are also 56p each.

The caps i got from RS are the same that you have. They actually meassure around 59pF here, but my capmeter is not that good. However, you may want to verify them as well. I already had several issues with RS, either the wrong parts in correctly labelled bags (like 4µ7 caps, when 10µ were ordered and 10µ is on the bags label), or no parts at all in sealed bags, etc. Interrestingly enough, every time that happens it is from their UK warehouse always.

So, all that's left now are the coils and the FET. And as said, temporarily remove the coil L6 from the tip detection circuitry, in case something is wrong with that section (it couls mess up the SWR if, for

example, Q1 or D9 have issues, or if something is wrong with C41/R22), however, it's rather unlikely, since the 47µH inductor should block virtually all of the RF. But then, who knows...

Greetings,

Chris

Report to moderator Logged

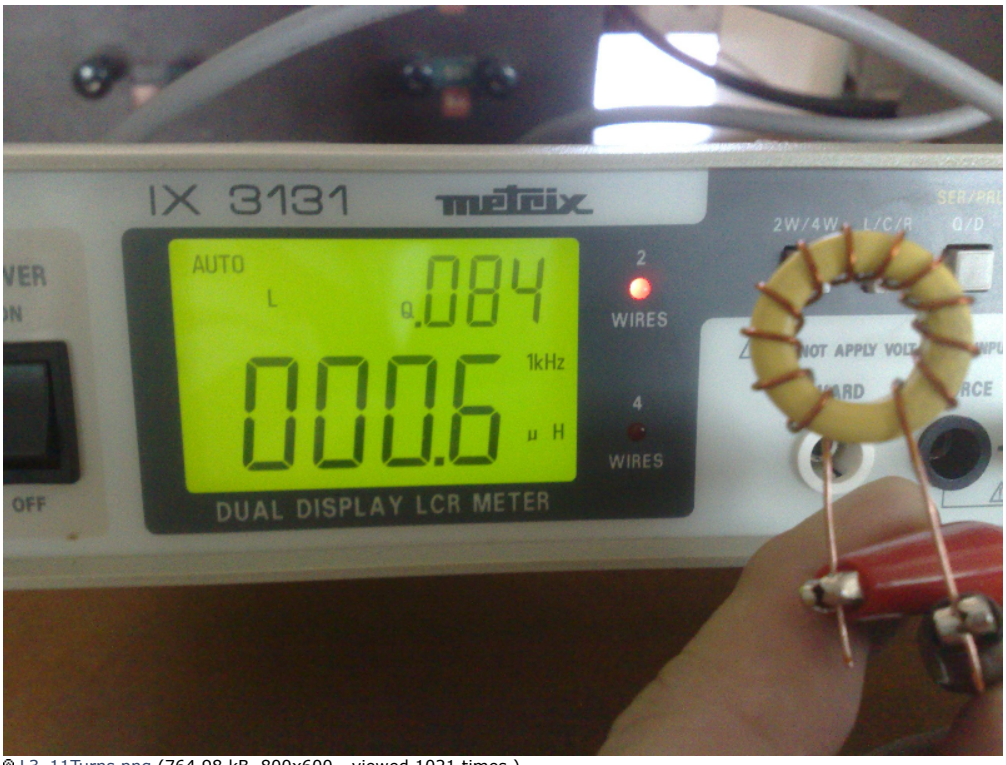
Paulinho19
Contributor
Posts: 42
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #145 on:** February 15, 2013, 02:42:27 pm »

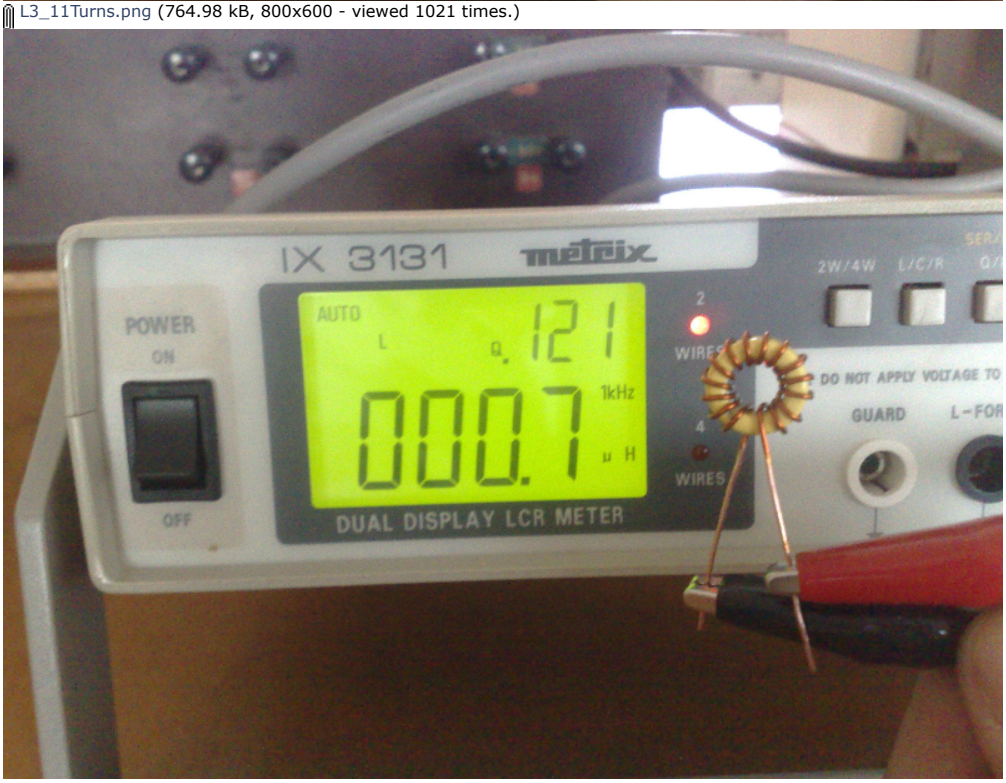
Say Thanks Reply Quote

Here are my new coils, nice and tight.

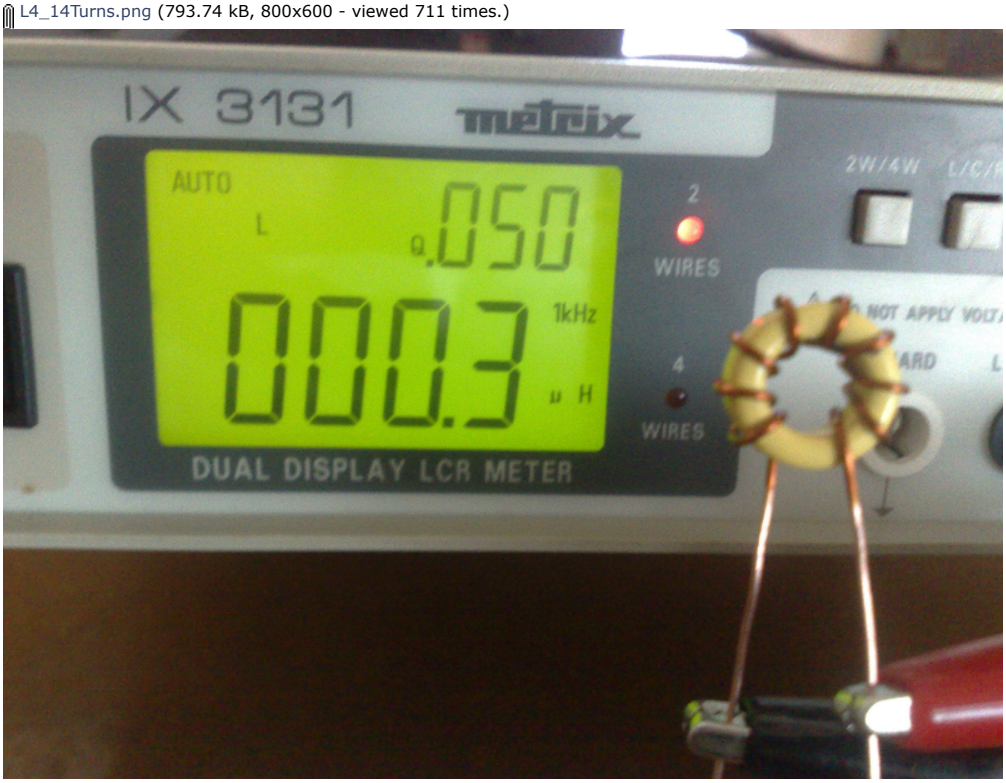
Paulo



L3_11Turns.png (764.98 kB, 800x600 - viewed 1021 times.)



L4_14Turns.png (793.74 kB, 800x600 - viewed 711 times.)



L5_8Turns.png (770.05 kB, 800x600 - viewed 680 times.)

Report to moderator Logged

mamalala
Supporter

Posts: 777
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #146 on:** February 15, 2013, 02:47:26 pm »

Say Thanks Reply Quote

> **Quote from: Paulinho19 on February 15, 2013, 02:42:27 pm**
>
> Here are my new coils, nice and tight.
>
> Paulo

Looks great! Hope you hadn't too many cramps in your fingers while winding them

Greetings,

Chris

Report to moderator Logged

Paulinho19
Contributor

Posts: 42
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #147 on:** February 15, 2013, 02:48:08 pm »

Say Thanks Reply Quote

My caps meassure around 61 pF.

Paulo Almeida

Report to moderator Logged

mamalala
Supporter

Posts: 777
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #148 on:** February 15, 2013, 02:56:27 pm »

Say Thanks Reply Quote

> **Quote from: Paulinho19 on February 15, 2013, 02:48:08 pm**
>
> My caps meassure around 61 pF.
>
> Paulo Almeida

Good. Just looking at your picture of the board above, and it seems that some solder joints at the caps are not properly flowed to the whole pads on the GND side of the caps. This could of course be misleading due to light reflections, but please double check those places. The GND pads have no thermals, and have vias nearby stitching them to the bottom GND plane. So theck away heat pretty

good, which in some cases may cause faulty solder joints. Just a precaution.

Greetings,

Chris

Report to moderator Logged

mamalala

Supporter

Posts: 777
Country:

Re: DIY Metcal 13.56 MHz RF Supply

« **Reply #149 on:** February 15, 2013, 03:05:14 pm » Say Thanks Reply Quote

Oh, and to check that nothing is wrong with the dummy load, you can measure the voltages VR (pin 2 of SV1) and VF (pin 4 of SV1) when the circuit is powered on. You should, if all is fine and properly adjusted, have virtually no volrage at pin 2, and over 2 volts on pin 4 (i have 0.4mV on pin 2 and 2.4V on pin 4). But even with a much lower output power you should still have basically no voltage at pin 2 and a much higher one at pin 4. So, if any notable voltage appears at pin 2, something is wrong with either the dummy or tip detection circuitry.

Greetings,

Chris

Report to moderator Logged

Paulinho19

Contributor

Posts: 42
Country:

Re: DIY Metcal 13.56 MHz RF Supply

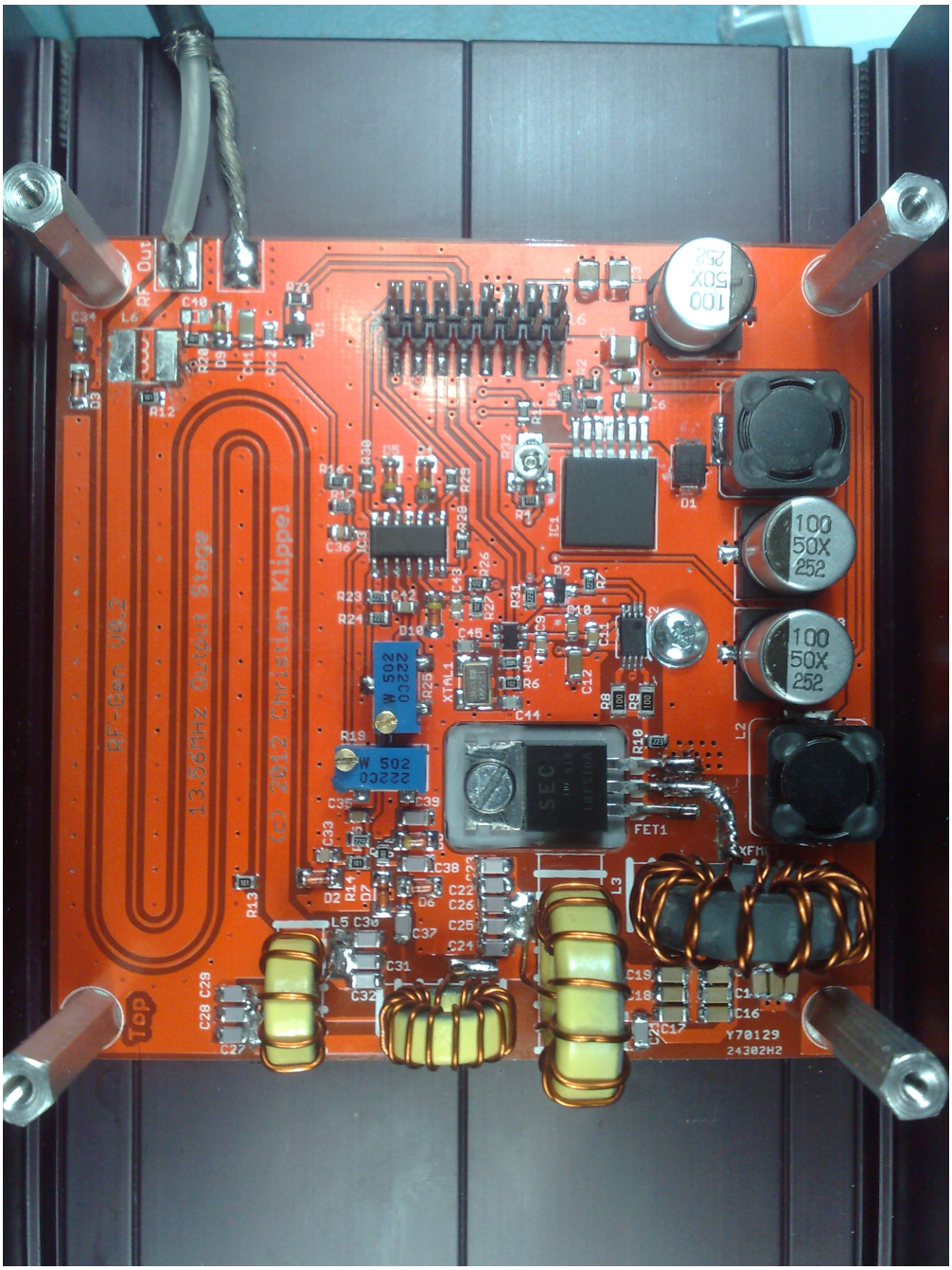
« **Reply #150 on:** February 15, 2013, 06:14:09 pm » Say Thanks Reply Quote

Today's result, 3 new FETs dead.

I installed the new coils, removed L6, improved soldering on the CAPs and the result is still the same, FET dies when voltage on the output on L2 goes over 15V. The voltage p-p on XFMR_Center is under 60V at the moment of death.

The only thing left to try is a different dummy load. Next week I will have one to test.

Paulo



150220132903.jpg (955.57 kB, 1944x2592 - viewed 1781 times.)

« *Last Edit: February 15, 2013, 06:16:14 pm by Paulinho19* »

Report to moderator Logged

mamalala

Supporter

Posts: 777

Country:

Re: DIY Metcal 13.56 MHz RF Supply

« **Reply #151 on:** February 15, 2013, 07:15:12 pm »

Say Thanks Reply Quote

Sorry to hear that. It's really strange.

Have you checked the VR and VF voltages to see if anything is reflected back from the dummy and/or connection to it? Thing is, when the output is matched, there should be a considerably lower Vpp at the drain at only 15 Volts at L2. I reach the 60 Volts only with a tip that has heated up, i.e. has a mismatch, but even then the voltage at L2 is around 18 Volts.

At a around 13 Volts i get a bit below 40Vpp at the drain, with the probe that reads a bit higher, and current consumption is 1.3 Ampere at 30 Volts supply input.

If everything else fails i can send you a set of coils and two or three of the FET's i use. While i highly doubt that my FET's here are some special magic version of the IRF510, who knows what your cores actually are. Look the same than the ones i have, but again, who knows....

Greetings,

Chris

Report to moderator Logged

Paulinho19
Contributor
Posts: 42
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #152 on:** February 15, 2013, 07:41:07 pm »
Say Thanks Reply Quote

No I didn't get to check the VR and VF voltages, I went out of FETs before I read your Post.

This is really a mystery, I'm confidante that the problem is the dummy load, and there is not much left. Next week we will see.

Thanks for all your help Chris.

By the way did anyone else assemble this board yet?

Paulo Almeida

Report to moderator Logged

mamalala
Supporter

Posts: 777
Country:

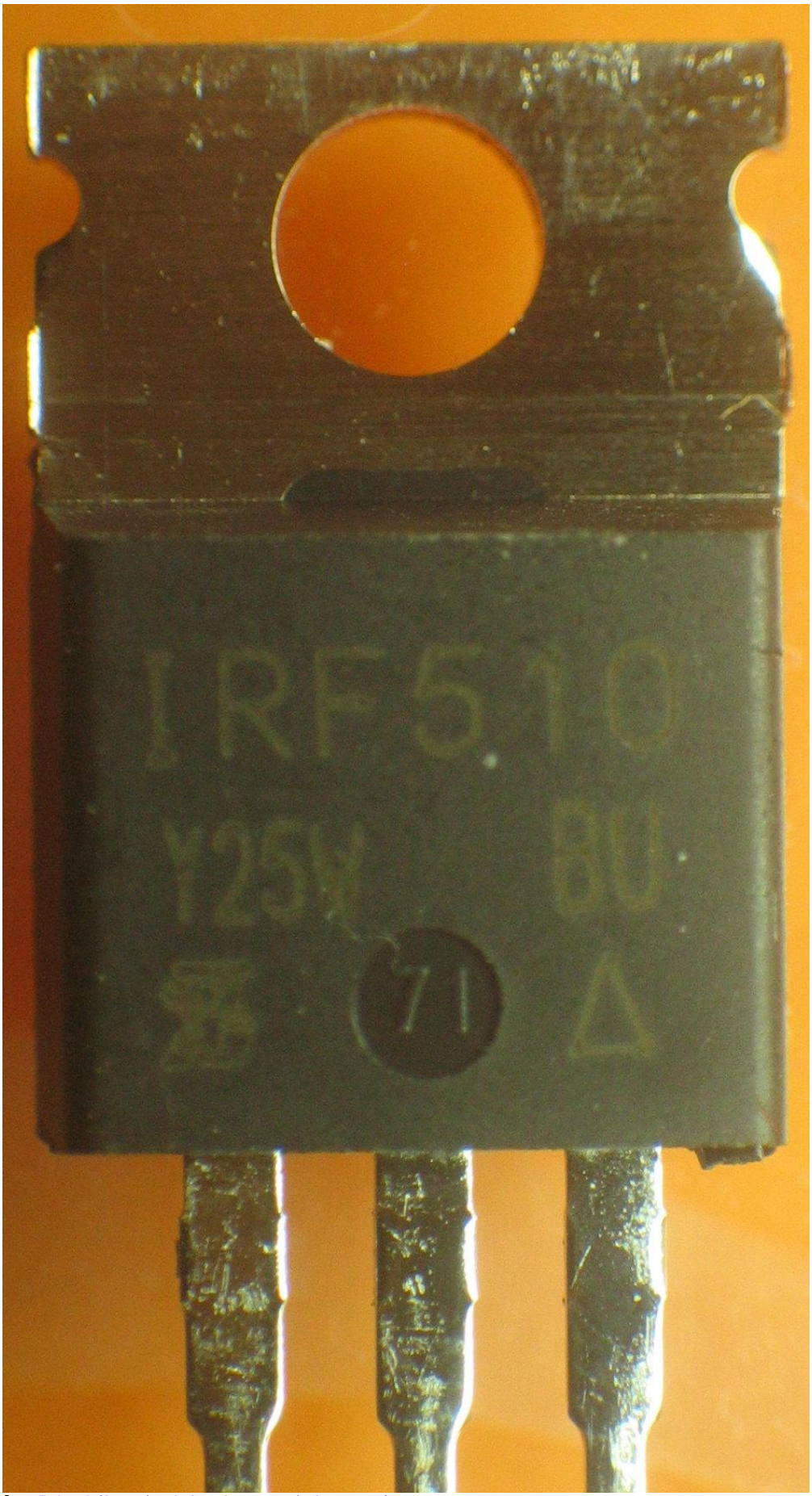
Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #153 on:** February 15, 2013, 07:59:00 pm »
Say Thanks Reply Quote

BTW,

attached is an image of the FET i use. Does anyone recognize the logo in the bottom-left?

Greetings,

Chris



IRF510.JPG (274.4 kB, 942x1737 - viewed 1074 times.)

Report to moderator Logged

Paulinho19
Contributor
Posts: 42
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #154 on:** February 15, 2013, 08:31:16 pm »
Say Thanks Reply Quote

Could be Vishay Siliconix, I'm not sure.

www.vishay.com/docs/91015/sihf510.pdf

Paulo

Report to moderator Logged

az113
Contributor
Posts: 6
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #155 on:** February 18, 2013, 12:13:29 am »
Say Thanks Reply Quote

Paulinho19
With big interest look for this theme.
Great project! May be will do a module to replace MX500 power unit...

P.S. Why you use IRF510?
It has a 0.5ohm internal resistance, may be something similar to IRFb4019 with 0.008ohm be more efficient?

P.P.S. Sorry, IRF630/IRF640/IRF740 i mean. Still, it is a UHF modulator

« Last Edit: February 18, 2013, 12:44:19 am by az113 »

Report to moderator Logged

mamalala
Supporter
Posts: 777
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #156 on:** February 18, 2013, 01:50:49 pm »
Say Thanks Reply Quote

Quote from: az113 on February 18, 2013, 12:13:29 am

> P.S. Why you use IRF510?
> It has a 0.5ohm internal resistance, may be something similar to IRFb4019 with 0.008ohm be more efficient?
>
> P.P.S. Sorry, IRF630/IRF640/IRF740 i mean. Still, it is a UHF modulator

Basically for two simple reasons:

- RF circuits are not really my field of expertise, so for the initial design i limited myself to the types that i had already used once in circuits operating at the same or higher frequencies, so i would know they should work in that application.

- Because i wanted to reduce the overall complexity of the circuit, i chose to use a readily available FET driver chip instead of the much more complex driver circuit used in the original Metcal supply. However, that chip is very tiny, and to avoid overheating i chose a FET with a really low gate charge and capacitance.

(Edit: Of course i might have been too paranoid with that. I just chose to stay on the safe side so i can get something to work correctly)

Of course that is not to say that only the IRF510 would work. But since i lack proper equipment to really evaluate other FET's, it would be up to others to see what else can be used there. The IRFB4019 that you mentioned looks interresting. It has even faster switching times, while still having a relatively low total gate charge. Might be worthwile to experiment with that one.

Greetings,

Chris

« Last Edit: February 18, 2013, 01:52:43 pm by mamalala »

Report to moderator Logged

az113
Contributor
Posts: 6
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #157 on:** February 18, 2013, 06:17:58 pm »
Say Thanks Reply Quote

Because yesterday i totally felt asleep, i mentioned a IRFB4019, but not think about frequencies, my primary job today is repairing DC-DC converters in notebooks and others equipment, here is a cause of recommendation.

Today i think more about FETs, and remember, 5 or 6 years ago, in CB power amplifiers we used same IRF510/540, but we have a lot of counterfeit in our stocks.
May be you got fake FETs? At the photo your IRFs looks slightly scratched (like scratches from sandpaper), it get me think, that is a fake.

Try to buy from a more trusted source? Or try IRF630/640, it works well in 17" and 19" monitors in B+ cirquits, that is more than 100V there.

Report to moderator Logged

mamalala
Supporter

Posts: 777
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #158 on:** February 18, 2013, 06:46:22 pm »

Say Thanks Reply Quote

> **Quote from: az113 on February 18, 2013, 06:17:58 pm**
>
> May be you got fake FETs? At the photo your IRFs looks slightly scratched (like scratches from sandpaper), it get me think, that is a fake.

Do you mean my image from this message:

https://www.eevblog.com/forum/projects/diy-metcal-13-56-mhz-rf-supply/msg192751/#msg192751

or Paulinho19's image? Mine appear scratched because they are stored in a simple bag, rubbing against each other. They looked just fine when i got them in a tube.

It is important to note that the FET is not used in a linear fashion here, but as "switcher", which makes the turn-on/off delays and rise/fall times so important. You can use an, for example, IRF530 just fine as a RF final in the 10/11 meter band (28/27 MHz, and quite some radios do indeed use the IRF530) when operating as linear amp, but it would very likely fail to work at the same frequency as a pure switcher, because the delay and rise/fall times are far too big for that frequency.

Greetings,

Chris

Report to moderator Logged

Paulinho19
Contributor

Posts: 42
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #159 on:** February 18, 2013, 08:21:24 pm »

Say Thanks Reply Quote

Yet another bad day,

Today I replaced C14-C19 just in case, and connected a Arduino with a LCD shield to monitor VF and VR. Started everything ok and I got to about 2V on VF and 0V VR when the FET died. So it didn't look like a problem with the load. Tried it again with another FET, the same result, but this time I also killed the FET driver and Q2, I really don't know what is going on here....

Paulo

Report to moderator Logged

Paulinho19
Contributor

Posts: 42
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #160 on:** February 18, 2013, 09:58:46 pm »

Say Thanks Reply Quote

I think the problem are the FETs, I ordered some new IRF510 from Farnell and I also got one IRF620, I will try that tomorrow, after I replace The driver and Q2.

Paulo

Report to moderator Logged

mamalala
Supporter

Posts: 777
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #161 on:** February 18, 2013, 10:02:58 pm »

Say Thanks Reply Quote

That is extremely strange. Maybe we are looking at the wrong place here. What i find suspicious, and why i was thinking of a problem with the filter/dummy, is that you reach so high RF voltages at such rather low supply voltages at L2.

Have you observed the voltage at L2 with a scope while increasing the output power with R19? I am now starting to wonder if there might be a problem with the buck converter, that for some reason it no longer regulates down when reaching a certain current draw from it. Or that for some reason it starts to oscillate wildly when reaching a certain current draw. A normal multimeter might not be able to catch that, if that transient is short enough, and surely not if there is some oscillation. The FET however would fail in a very short time under such conditions.

What about the +12V supply for the driver? It's really strange that not only the driver is fried, but that it also took down Q2, which is merely to enable/disable the driver using the powerdown-input.

Something is really fishy there. As said, i can send you a set of coils and some FET's, and probably a XFMR as well. Do you have a driver left? Otherwise i can send you one as well, and maybe a regulator

as well (not sure if i have any left). At least with the coils/transfomer, those would be tested and correctly working ones, and the FET's would be the same ones that i use and that work. However, it would take me a while until i can send the stuff, since i'm mostly in bed and on my sofa due to a massive flu i catched...

Greetings,

Chris

Report to moderator Logged

mamalala
Supporter

Posts: 777
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #162 on:** February 18, 2013, 10:13:55 pm »
Say Thanks Reply Quote

> **Quote from: Paulinho19 on February 18, 2013, 09:58:46 pm**
>
> I think the problem are the FETs, I ordered some new IRF510 from Farnell and I also got one IRF620, I will try that tomorrow, after I replace The driver and Q2.
>
> Paulo

As i wrote in my other post, i'm not that sure anymore that this is the (only) problem. You reach way too high RF voltages for the supply voltages at L2, compared to my unit here. Before you burn another batch of FET's, please try the following:

- Turn down the input supply to 22 volts.
- Monitor the voltage at L2 with the scope.
- Now increase the voltage at L2 with R19 again until it can no longer be increased.

If my theory about the buck regulator is right, it should not blow the FET this time. Now increase the input supply voltage by one volt, readjust R19 again to reach the maximum at L2.

Repeat the 1V increase and R19 readjustment until you get around 120 Volts peak-peak at the output. That is assuming the FET won't have been blown at this point.

At all times monitor the voltage at L2 with the scope. Check if there is anything unusual there, like big spikes, oscillations, etc. I get a maximum ripple of 1V peak-peak there, as you can see in the first scope-screenshot in this post: https://www.eevblog.com/forum/projects/diy-metcal-13-56-mhz-rf-supply/msg192370/#msg192370

Also, please make notes of the current consumption of the circuit. It should steadily increase as you turn up R19, no big jumps or the like. As mentioned earlier, mine draws about 3 Ampere at 30 Volts, with a dummy load connected, when the voltage at L2 reached around 23 Volts or thereabouts.

Greetings,

Chris

Report to moderator Logged

Paulinho19
Contributor

Posts: 42
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #163 on:** February 18, 2013, 10:38:39 pm »
Say Thanks Reply Quote

I successfully killed my first board.

Testing the buck converter I applied 12V to pin 5 by mistake and fried a whole section around the Cristal. So tomorrow I will start assembling a new board, maybe this time everything will work. I will keep you updated.

Paulo

Report to moderator Logged

az113
Contributor

Posts: 6
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #164 on:** February 19, 2013, 12:06:13 am »
Say Thanks Reply Quote

Guys, i am not a guru in RF technics, but here is an idea: do you think about SWR in this case?
As far i remember from 10/11meter radios, simply recalculate a length of a coaxial wire to antenna and properly done weldings give me additional power up from 9+5db to 9+10db and SWR was get lower from 1.25 to 1.15.
Paulinho19 What type of a coax you use?
Don't know surely, does Metcal's gun use a 50 ohm cable, or 75 ohm?
May me here is a problem?

Report to moderator Logged

mamalala
Supporter

Posts: 777
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #165 on:** February 19, 2013, 12:54:06 am »

Say Thanks Reply Quote

Quote from: az113 on February 19, 2013, 12:06:13 am

> Guys, i am not a guru in RF technics, but here is an idea: do you think about SWR in this case?

Just a few posts above, in #159, Paulo checked the VR (reflected signal of the RF) and it is at 0 Volts, so there is no problem with the SWR.

Also, during evaluation of the first circuit i made, i used varying lengths of cable between the board and the F connector, between none (i.e. the connector directly to the board) and around 20 cm. I checked RG58 and RG59, that is, 50 Ohms and 75 Ohms coax. There was virtually no difference.

Considering the length of that short cable in relation to the wavelength of the signal (around 22 meters), it wouldn't have any notable effect anyways. Plus, a slightly increased SWR does not kill the final. I had situation with a VSWR of at least 2 at full power. While the FET heated up more than normal, it did not blow.

Greetings,

Chris

Report to moderator Logged

Paulinho19
Contributor

Posts: 42
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #166 on:** February 19, 2013, 08:34:14 pm »

Say Thanks Reply Quote

Hi,

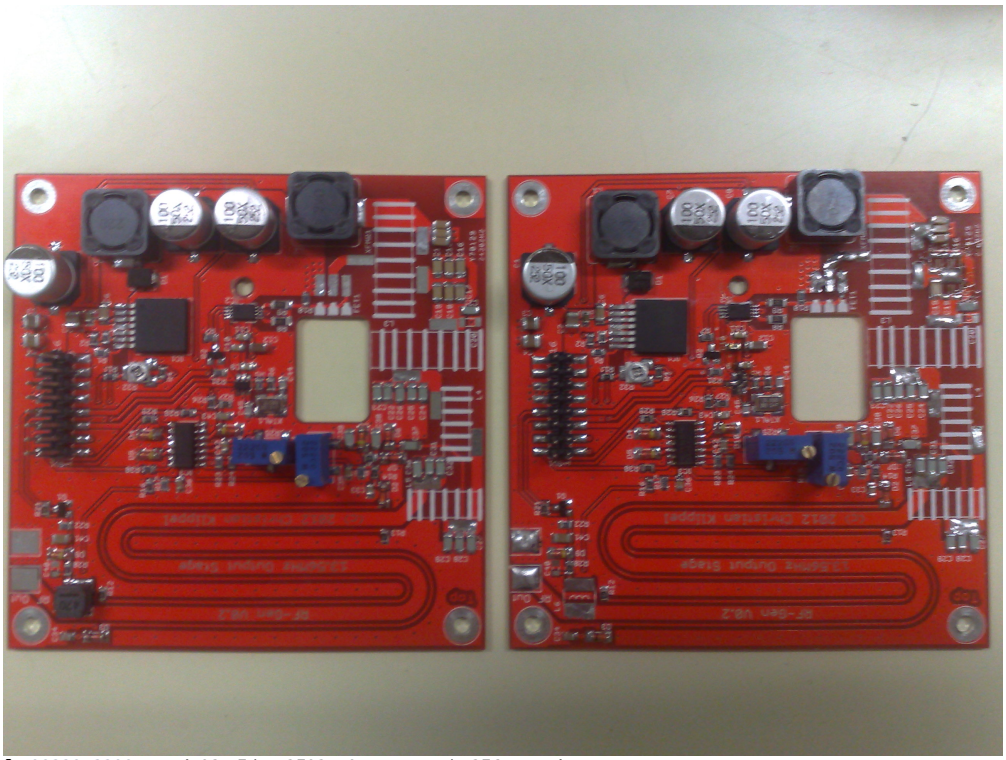
I'm using 90cm of RG58 coax.

Today I started assembling a new board, its almost finish, I tested the buck converter 30V 3A, no problems.

From the old board I only used 4 caps from C14-C19 and I will use also L3-L5. The XFMR I will do again just to be sure.

Tomorrow I'll have a 500W 50ohm dummy load and some new IRF510 from Farnell.

Paulo



190220132907.jpg (793.15 kB, 2592x1944 - viewed 1356 times.)

Report to moderator Logged

Paulinho19
Contributor
Posts: 42
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #167 on:** February 20, 2013, 07:35:15 pm »

Say Thanks Reply Quote

Hi,

All new, same old problem, FET dies before voltage on L2 gets to 21V.

I just tried the new Dummy load (1000W) and the new FET's,

http://pt.farnell.com/vishay-formerly-i-r/irl510pbf/mosfet-n-logic-to-220/dp/9102779?Ntt=9102779

with the new board I assembled yesterday and the result was exactly the same, the FET died at 20V on L2, VF 2V , VR 0V, output power around 30W.

This time I noticed that above 15V on L2 the voltage starts to rise without futher regulation on R19.

I have 4 more FETs to Kill, what should I do to try to find out were the problem is?

Paulo

200220132911.png (751.75 kB, 600x800 - viewed 669 times.)

Report to moderator Logged

mamalala
Supporter

Posts: 777
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #168 on:** February 20, 2013, 09:12:06 pm »
Say Thanks Reply Quote

Just for information:

Paulo and me had a chat, and i urged him to stop any further testing until he has sorted out what capacitors he used in the buck converter circuit. The fact that the buck's output voltage increases by itself by 5 volts just when the load gets higher could be a strong hint at a problem there.

Right now it is unclear what caps he used, first he thought some Panasonic EFK (which are completely wrong for this application, only 350 mA ripple current for example). But it turned out that someone else ordered them, and so we have no idea what they actually are.

Chances are that they are simply unsuitable for this application, causing the buck regulator to go haywire once a certain load is reached, which in turn kills the output FET. After all, the caps are under quite some stress here, not only the 500 kHz ripple from the buck converter, but also a 13.56 MHz ripple from the RF output stage.

Greetings,

Chris

Report to moderator Logged

Paulinho19
Contributor

Posts: 42
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #169 on:** February 21, 2013, 10:08:38 pm »
Say Thanks Reply Quote

Quick update,

the capacitors he used in the buck converter circuit were this:

http://pt.farnell.com/jsp/search/productdetail.jsp?sku=2069205

they are low ESR but not as low as the ones Chris used (340mOhm / 28mOhm) and they support also much less ripple current (670mA / 2000mA) :

http://pt.rs-online.com/web/p/condensadores-de-aluminio/7581272/

So I ordered some like Chris's today. Hopefully next Monday they are here and I can test the whole thing again.

Meanwhile I will finish my design on the Arduino based Controller board.

Paulo

Report to moderator Logged

amspire
Super Contributor

Posts: 3690
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #170 on:** February 22, 2013, 04:46:20 am »
Say Thanks Reply Quote

Quote from: Paulinho19 on February 20, 2013, 07:35:15 pm

> Hi,
>
> All new, same old problem, FET dies before voltage on L2 gets to 21V.

I haven't read through the thread, but I did see a circuit with a IRF510 going to a transformer. Is that the one blowing?

I don't have Eagle installed so I cannot open any Eagle schematics.

If that is the circuit, there are two things I noticed.

First, all transformers have leakage inductance and you usually need a snubber on the drain - otherwise the leakage inductance will cause the peak drain voltage rise to the point where it is limited by the FET's avalanche breakdown.

The second point is you have 10 ohm resistors from the mosfet driver IC to the IRF510 - why? Here is the problem. The reverse capacitance to gate capacitance ratio is probably something like 1:15. This means if you are switching any more then 30V, then when the FET is turning off, the reverse capacitance will turn the FET back on again during the low to high drain transition. This causes a momentary high dissipation in the MOSFET and I have seen this blow mosfets. Some mosfets handle this stress well - others do not. The two 10 ohm resistors may not low enough to stop this if you are switching more then 0.5A. Using one of the drivers without any resistor would probably do a much better job. It is often necessary to drive the gates of MOSFETS negative to stop the device turning on

again during low to high drain voltage transitions. Often the gate resistance is not low enough to ensure the mosfet stays off even if the gate is clamped to 0V, and it sometimes needs more like -10V at high currents to really switch the mosfet off during the low to high drain voltage transition. At the frequency you are operating at, this drain power spike is happening at a fast rate. If you were switching at 50KHz, it would be no problem, but you are not.

If you do get the mosfet switching hard off, there will be less transformer leakage inductance energy absorbed, so you will need a snubber circuit (usually a high speed diode, capacitor and resistor) even more.

Richard.

Report to moderator Logged

mamalala

Supporter

Posts: 777

Country:

Re: DIY Metcal 13.56 MHz RF Supply

« **Reply #171 on:** February 22, 2013, 06:32:49 am »

Say Thanks Reply Quote

Hello Richard,

all good points, but i don't think that those are what cause the problem here. I had and have the cirsuit running here without problems using two different brands of IRF510. During development i used gate resistors larger then 10 ohms without problems as well (22 ohms, to be exact). In every case it worked. Also, testing at high output powers i drove the supply above 25 Volts, with the voltage at the drain/xfmr rising above 80 or so volts, still no problem. If i had FET's dying in a similar way during that period, i would be inclined to agree with all/some of your points. But i never had. Again, with two different brands, so it couldn't really have been some fluke due to some "out of spec" variant of the IRF510 either. The ones i killed died due to other reasons: shorting stuff in the filter section by accident during testing, and non-working RF power feedback while load mismatches occurred, both of which are to be expected to kill the output final.

Also, the fact that in his ciruict the buck converters output voltage rises all by itself once a certain level is reached (and thus a certain current draw) to me strongly indicates that there is something wrong with it. It's just that this rise previously wasn't mentioned, so i assumed the supply was stable. It simply should not rise from 15V to 20V all by itself. And that is "only" what was observerd, could well be that it rises way beyond that very quickly. And in the end, there _is_ a limit as to how much supply voltage the RF stage can take. The FET it good for 100V max. "only", after all.

Greetings,

Chris

Report to moderator Logged

amspire

Super Contributor

Posts: 3690

Country:

Re: DIY Metcal 13.56 MHz RF Supply

« **Reply #172 on:** February 22, 2013, 07:30:13 am »

Say Thanks Reply Quote

Chris,

Why are the 10 ohms resistors there at all? You have a driver that has a rise fill time under 2nS and 3.5A capacity, and that is great. But then you slow it down with the 10 ohm resistors. I do not get it. I understand putting 10 ohms gate resistors in a linear circuit to prevent oscillations, but in this case, the only purpose is to make the mosfet switch slower and get hotter. Are you slowing down the mosfet so it acts as the snubber for the transformer?

About stress caused by letting the FET turn back on during switch off, I have seen cases where a circuit works fine with IR parts, but blows with an equivalent Harris, ST or several other brands. All of the devices that blew were 100% healthy and fully met the published specs. Admittedly it was a more extreme case - IRF450s and 460s switching 350V. In these cases, if you build enough circuits, you find that the failures with the IR devices is unacceptably high. My suspicion is that when the gate drive is marginal, the heat when the mosfet switches on again during turn off gets dumped into a small percentage of the mosfet cells in the device, and it is these cells that fail. you are using a device in linear mode that is only designed for switching mode. With a good gate drive, this situation does not occur.

Let us say this turn off conduction only occurs for 5ns. Since you are running at 13MHz, this means that for over 65mS per second, the mosfet is still conducting as the drain voltage is increasing. You also get a slower turn on, so that is more stress. You end up with a small part of the mosfet exceeding the SOA even though the device is not even very hot.

About my first point, are you sure that the drain voltage never spikes up near the device limit? It can be a very fast spike. I do not know the parameters of the circuit, and it is possible that the amount of leakage inductance can be absorbed by the drain capacitance of the mosfet limiting the peak voltage

on the drain.

> **Quote from: mamalala on February 22, 2013, 06:32:49 am**
>
> Also, testing at high output powers i drove the supply above 25 Volts, with the voltage at the drain/xfmr rising above 80 or so volts, still no problem.

That is getting up towards maximum. What stops it from getting higher then 80V particularly under fault conditions? Are you getting ringing? (Which often radiates noise like crazy). I still think a snubber may be needed - or a 200V device.

Is there anything to limit the peak transformer current so that the transformer cannot saturate under fault conditions?

« *Last Edit: February 22, 2013, 07:38:54 am by amspire* »

Report to moderator Logged

Paulinho19
Contributor
Posts: 42
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #173 on:** February 22, 2013, 12:12:34 pm »

Say Thanks Reply Quote

Hi Richard,

so in or opinion we should replace the two 10 Ohm resistors with two 0 Ohm resistors and also replace the FET with a IRF620 for example, correct?

Paulo

Report to moderator Logged

amspire
Super Contributor
Posts: 3690
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #174 on:** February 22, 2013, 12:46:05 pm »

Say Thanks Reply Quote

> **Quote from: Paulinho19 on February 22, 2013, 12:12:34 pm**
>
> Hi Richard,
>
> so in or opinion we should replace the two 10 Ohm resistors with two 0 Ohm resistors and also replace the FET with a IRF620 for example, correct?
>
> Paulo

First start with a low supplied voltage to the mosfet, and gradually increase. Record some peak drain voltages with a known load.

Replace 10 ohm with a short, leave the other open. One driver probably has the power, and they may not be designed to work in direct parallel.

Look at the drain voltage - see if it is higher. If it is, then the mosfet was definitely absorbing extra power during the transitions, and as I tried to explain, conduction in the linear mode is the most difficult power for the mosfet to handle safely.

If it is higher, you could use a higher voltage mosfet, but the better solution is to get the peak drain voltage under control if possible. I do not know the transformer ration, the voltages, and the circuit on the transformer output, so it is hard for me to suggest something. Based on the transformer ratios and peak expected flyback voltage of the transformer when the mosfet turns off, what would the calculated peak voltage be (excluding and leakage inductance - assume the transformer is ideal)?

If the mosfet is allowed to go into avalanche breakdown, it will mean that for a very short time perhaps half the peak drain current at 100V plus is flowing into the mosfet for probably a few nanoseconds, but 13 million times a second. If most of this current is going though a few cells in the mosfet, those are the cells that will fail first which will destroy the whole mosfet.

A simple drain snubber circuit is a capacitor and resistor in parallel connected to the mosfets + supply rail. The other end is connected to a switching diode (it will have to be very fast - perhaps a 100V schottky diode) from the mosfet drain (anode) to the capacitor-resistor (cathode). The voltage across the capacitor will rise to a point when the average current from the leakage inductance equals the average current through the resistor. The bigger the resistor, the higher the voltage but the less power is probably being wasted. The resistor is picked so that under worse case conditions, the drain voltage never exceeds the maximum.

There are more sohpisticated snubbers that are more efficient, but start simple. It could even be that a capacitor and series resistor without the diode is sufficient, especially is the leakage inductance of the transformer is very low. (Probably is at 13MHz).

If it does not look like you can keep the peak drain voltage is under 100V under all load conditions, you may have to go to a 200V mosfet.

The IRF620 has substantially more capacitance. Can you use a IRF610? (I do not know your drain current). The greater capacitance is not necessarily a bad thing - the greater capacitance may slow down ringing on the drain.

Report to moderator Logged

mamalala
Supporter

Posts: 777
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #175 on:** February 22, 2013, 03:15:00 pm »

Say Thanks Reply Quote

> **Quote from: amspire on February 22, 2013, 07:30:13 am**
>
> Chris,
>
> Why are the 10 ohms resistors there at all? You have a driver that has a rise fill time under 2nS and 3.5A capacity, and that is great. But then you slow it down with the 10 ohm resistors. I do not get it. I understand putting 10 ohms gate resistors in a linear circuit to prevent oscillations, but in this case, the only purpose is to make the mosfet switch slower and get hotter. Are you slowing down the mosfet so it acts as the snubber for the transformer?

When i tried using only one driver channel and no resistor, which is what i did in the very first test circuit, i pretty much always ended up with a dead driver after while: it simply got way too hot. After all, this is only a very small chip with no thermal pad to act as a heatsink.

Plus, it still does not explain how the buck's output voltage can rise all by itself once a certain load is reached, i.e. from 15V to 20V and probably beyond.

Sure, it may have been the rather poor quality layout that i had in the very first circuit that caused the driver to fail after a while always. There is no problem using different/no resistors to check that out in the current one. As i have repeatedly said, i'm no expert in RF circuits anyways, so there surely is lots of room for improvement there. All i can say for sure is that it works just fine for me, in more than one of these supplies that i built, with at least two different brands of the IRF510, and under more "extreme" conditions. I can only go by what i have working, and only compare to what i have working, after all.

Greetings,

Chris

Report to moderator Logged

gnif
Administrator

Posts: 1105
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #176 on:** March 07, 2013, 01:11:29 am »

Say Thanks Reply Quote

All those that were trying to read/respond to page 12 of this thread, it is working again. It seems that the last post by mamalala was the cause of the issue, not sure as to what it was, but by pruning it from the database and manually re-inserting it, the issue was resolved.

Logged

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https://hostfission.com/
https://twitter.com/HostFission

I volunteer my time to manage this server, if you would like to support this work I have a patreon here:
https://www.patreon.com/gnif

amspire
Super Contributor

Posts: 3690
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #177 on:** March 07, 2013, 03:14:19 am »

Say Thanks Reply Quote

I was wondering why I was getting a blank page. Thanks for fixing it.

Report to moderator Logged

mamalala
Supporter

Posts: 777
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #178 on:** March 07, 2013, 12:33:00 pm »

Say Thanks Reply Quote

Many thanks from me to gnif as well for looking into (and fixing) the issue. Great job!

Greetings,

Chris

Report to moderator Logged

Paulinho19
Contributor
Posts: 42
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #179 on:** March 08, 2013, 12:16:33 am »
Say Thanks Reply Quote

Great, we are back.

What's new, My RF-Borad is finely working, the problem seem to be the XFMR, chris send me one of his and all problems went away. He only explanation that I can find is that RS send me the wrong ones. I will test them both next week with a network analyser to see what's the diference. I will also test a few Metcal tips.

Meanwhile I finished my controller board design placed an order at iTead, my board are already on there way to Portugal.

Paulo

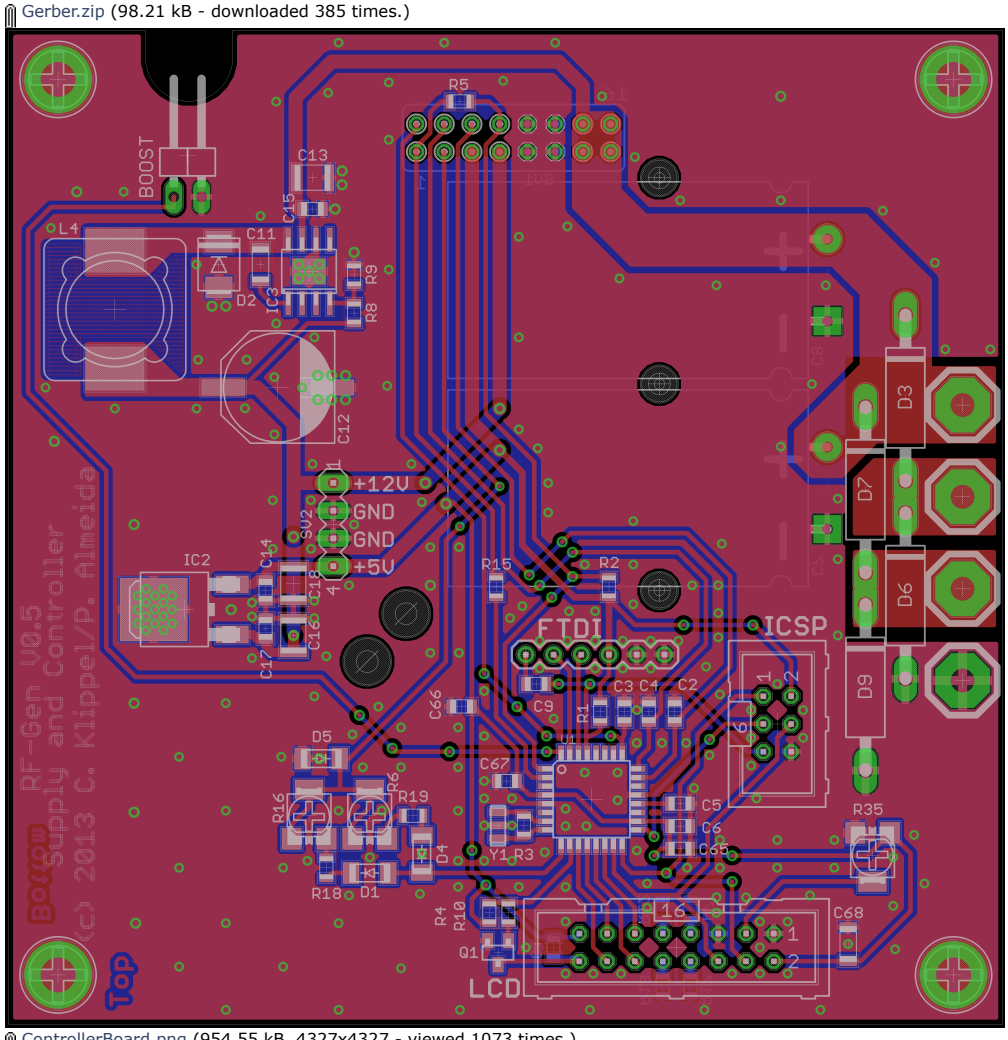
Report to moderator Logged

Paulinho19
Contributor
Posts: 42
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #180 on:** March 08, 2013, 12:19:58 am »
Say Thanks Reply Quote

My Board.

Eagle.zip (62.5 kB - downloaded 456 times.)
Gerber.zip (98.21 kB - downloaded 385 times.)



ControllerBoard.png (954.55 kB, 4327x4327 - viewed 1073 times.)
Arduino.zip (1.71 kB - downloaded 387 times.)

« *Last Edit: March 08, 2013, 05:36:31 pm by Paulinho19* »

Report to moderator Logged

EEVblog
Administrator

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #181 on:** March 08, 2013, 02:08:32 am »
Say Thanks Reply Quote

PLEASE READ
There is something wrong with this thread in SMF, it is giving technical troubles. No idea why.
Thread locked unless a fix can be found.

Posts: 29492
Country:

Dave.

Logged

gnif
Administrator

Posts: 1105
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #182 on:** March 08, 2013, 02:46:01 pm »
Say Thanks Reply Quote

Unlocked and fixed, problem was the large image upload. We will have to see if we can impose an image size limit on uploads, people need to be a little less lazy and prepare their images for the web.

Logged

HostFission - Full Server Monitoring and Management Solutions.
https://hostfission.com/
https://twitter.com/HostFission

I volunteer my time to manage this server, if you would like to support this work I have a patreon here:
https://www.patreon.com/gnif

Paulinho19
Contributor

Posts: 42
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #183 on:** March 08, 2013, 05:34:44 pm »
Say Thanks Reply Quote

My fault

In fact the image is very large, I must have done something wrong, but still it is less than half the maximum size allowed (2000kb)

Anyway I will be more careful with that,

Thanks and ones again sorry for all the trouble,

Paulo

Report to moderator Logged

mamalala
Supporter

Posts: 777
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #184 on:** March 22, 2013, 11:03:06 am »
Say Thanks Reply Quote

Hi all,

a few notes and status updates here.

First of all, i noticed somethig weird regarding the power output. Either the supply voltage radings found in the MX500 document are wrong, or my circuit is way more efficient/better-tuned. If i set the idle voltage to around 18 volts, i get some of the tips glowing dark-red around where the coil is! That means way too much power is pumped into the cartridge for too long. Setting the idle voltage to around 12.5 to 13.5 volts, which is way lower than what can be found in the document, makes everything work nice again. Of course this value is for small/medium sized tips. Larger tips idle at a slightly higher voltage (13.5 to 14.5 volts).

Anyways, during heatup (or boosted power at wakeup) a supply of around 21.5 volts goves a nice, fast heatup time.

I also made slight modifications to some part values. The reason is that i am currently very busy working on the firmware, and thus found out a few things. Here are the changes:

- On the RF board, use a 100 Ohms resistor for R11 (this one involves the µC-controlled power limit/boost function)

- Again on the RF board, change R8/R9 to 4.7 Ohms. Those are the gate resistors of the IRF510.

- Still on the RF board, change R33/R34 to 100 ohms each. This provides a lower impedance of the VCC/2 voltage for the OpAmp in the control-loop.

- The last change on the RF board is to use 22 Kilo-Ohms for R23 and 1 Kilo-Ohm for R24. These are also for the control-loop OpAmp, setting a higher gain.

- On the controller board, the variable resistor to set the boost power should be 1 Kilo-Ohms, that way a nice adjustment is possible. The one for the limited power is 10 Kilo-Ohms.

The maximum supply voltage as given by adjusting R32 on the RF board should be around 21.5 volts (no boost/limit active, purely the control loop). Regarding the idle voltage fo the tips, here is a rough overview for some tips:

Between 12.5 and 13.5 volts_

STTC-147
STTC-126
STTC-037
STTC-025

Between 13.5 and 14.5 volts:

STTC-011
SMTC-147

As for the limited and boosted voltages, it turns out that in limit-mode a voltage of around 10 volts, and in boost mode a voltage of around 18 volts give good results. For example, adjusting with a STTC-147 tip would be done the following way:

- Insert the cold tip. Power up in normal mode and monitor the voltage. Adjust R32 so that it never exceeds 21.5 volts. If it does, let the tip cool down again and repeat this step.

- Once the tip reached temperature, adjust an idle voltage of about 13.5 volts using R19. Let the tip cool down and repeat the previous step. If required repeat these two steps as often as required to rech these values. Should be very easily done, however.

- Let the tip sit idle at normal power, that is, no limit or boost enabled, for about 10 minutes. Re-adjust R19 to give an idle voltage of around 13.3 volts. Let it sit that way for 10 more minutes, and if needed make slight adjustments to R19 to bring it back to 13.3 volts.

- Enable the power-limited mode. This is done by pulling the controlling microcontroller-pin to GND. That pin goes though an 1N4148 diode, then the 1k adjustable resistor, into the VLIM adjustment pin on the RF board, where it ends up at R11. The diode is connected with the cathode to the microcontroller pin and the anode to the adjustable resistor. Now adjust that 1k trimpot to give a supply voltage reading of between 10.0 and 10.2 volts.

- Now enable the power-boosted mode. This uses the same microcontroller pin, but this time pulled high to +5 volts. This signal now goes through another 1N4148 diode, then through the 10k trimpot, and again ends up at the VLIM pin of the RF board. This diode is connected with the anode at the microcontroller pin and the cathode at the adjustable resistor. Now set that 10k trimpot so that you get a supply voltage reading of roundabout 18 volts. When done switch back to normal mode...

This concludes the adjustments required to the circuit, and it should now be fully operational. The unit is now adjusted such that in normal mode the tip is kept hot and that load changes are quickly detectable. In normal mode the control loop will nicely adjust the supply voltage to keep the tip at the temperature. During limit-mode, which is very usefull to implement auto-sleep, any slight load change will cause a huge change in the available readings (forward-voltage, reflected-voltage, and subsequently the calculated SWR and power levels). Even pulling the handle out of the stand causes enough load change to give a huge delta-reading of the above values combined. Also, when waking up, the boost-mode now allows for a quicker recovery if needed.

I will explain how to use those values to detect changes, etc., in the next post later today explaining the firmware that i am working on.

Greetings,

Chris

Report to moderator Logged

mamalala
Supporter

Posts: 777
Country:

Firmware-Preview
« **Reply #185 on:** March 22, 2013, 01:13:08 pm »

Say Thanks Reply Quote

Hello all,

here is a somewhat functional preview-version of the firmware that i am working on. It generally works already, but a few things are still missing, most importantly the menu/UI handling and structure. While i already have a menu system ready from other PIC projects, i still have to add it to this one.

Note that this is purely a preview thingy, meant to let you see in what general direction i am going with this. This also means that virtually none of the code is documented yet. Of cpurse it also means that certain things are rather messed up right now (for example the main() loop), and that other

things will undergo quite some changes. One example of that is the state-machine logic of the power-manager. As explained in my previous post, i had too high supply voltages in use. That resulted in having to do some things in a rather messy way since i got only very small changes in the readouts (no surprise, since the tip was way too hot). Now that these issues are fixed, some parts of the power-manager stuff will get reworked.

That said, here are some of the main features of the firmware:

- Multi-language support (currently only English and German)

- Extensive logging output through the RS232 port

- Manual control or automatic (power-managed) control

- Up to 8 different setups can be defined and stored in the internal EEPROM. Each setting can be given it's own name up to 16 characters long

- Virtually every aspect of the firmware is configurable with these setups

The used micro is a PIC18F2620 running off the internal oscillator. The project is done using MPLAB-X, the used compiler is microchips C18. The IDE and compiler can be downloaded from the Microchip website free of charge.

The power-management is freely configurable and allows for a variety of power handling. For example, during initial startup the power output can be set to limited, normal or boosted. Exiting the startup phase can be done either by time, actual SWR reading or by monitoring the changes in the readouts and use a threshold for them. After startup it enters a heating/heated phase that monitors changes in the readouts. If those changes are below a given threshold after a given time, it will enter an idle state. It exits that idle state if a given threshold in changes in the readouts is reached and re-enters the heating/heated state.

After some time in the idle state, and with changes in the readouts below the threshold, it can enter a sleep state. In that state the output power is limited. It will wakeup once a defined change in the readouts is reached. If it wakes up, it can wakeup in normal mode or in boost mode, the latter speeding up thermal recovery. The boost-mode wakeup can be either timed, SWR dependant or again depending on a threshold in the readouts. If it stays in sleep, it can enter power-down mode after a given time. In that mode the RF output is turned off completely. In that state, using the rotary encoder/button will restart the power-manager by enetring the initial startup-phase.

Normal operation, sleep and powerdown can be indicated by the LCD's backlight. Indication can be either a fixed backlight level, a contnous fade-in/fade-out cycling of the backling, or by flashing it. The levels and times of these modes are, of course, configurable as well.

Besides these config-sets, there is a single main config that defines in which mode to startup, which language to use and which config-set to use.

One might ask why so many parameters, some of them with little relevance to the overall operation like the backlight stuff, are configurable. Well, because we can, that's why I mean, it's always the same. Not making them runtime-configurable makes some people complain that they need to recompile the code to make changes to them. Making them configurable in turn makes other people complain that there are so many parameters...

In any case, there will be a nice menu-system that allows for easy configuration. Only a rotary encoder with pushbutton-function is then needed to control everything. The UI interaction can be either through the LCD or through the RS232. The latter will then allow for configuration as well. This way the configuration will be portable between units: export them by dumping it through the RS232, import them by feeding back that dumped data into the RS232.

Alright, that's all for now. Back to working on the code...

Greetings,

Chris

Preview_RFSupply.zip (46.11 kB - downloaded 453 times.)

Report to moderator Logged

mamalala
Supporter

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #186 on:** March 23, 2013, 02:48:18 pm »

Say Thanks Reply Quote

Just a quick note to those who may want to use a laptop power-supply brick to power this circuit. You can use one of these universal supplies that go up to 24 volts, and then modify it slightly. I have such

Posts: 777
Country:

a supply that is switchable between 12/15/16/18/19/20 and 24 volts, the latter two up to 4 amperes. There is a standard voltage divider made of resistors in it for the feedback that, if left alone, produces 12 volts. The additional voltages are selected by simply switching an additional resistor in parallel to an existing one of that divider. Just swapping the resistor for 24 volts to have it produce 26.5 did the trick.

It works just fine with such a supply.

Greetings,

Chris

Report to moderator Logged

mamalala

Supporter

Posts: 777
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #187 on:** March 24, 2013, 01:13:06 am »

Say Thanks Reply Quote

Hi all,

while working on some magic-8-ball type of addition to the code (hey, i try to predict the actual tip....), i noticed some quite dramatic differencies between original Metcal cartridges and their Thermaltronics equivalnt. While i have only 3 types of equivalent Thermaltronic tips, the trend is quite visible!

For example the STTC-025 Metcal tip compared to the allegedly equivalent/compatible M6CH178 tip from Thermaltronics. During power up from a cold tip, my firmware reoprts > 99% consumed RF energy (relative to the provded energy) for the Metcal tio, but only around 71% for the Thermaltronics.

NOTE: My power calc algo is somehwat bogus, but still relies on the forwarded RF energy vs. the reflected energy. In any case, hte supply voltage to the RF stage is the same in both cases.

Once the tip reached temp, i get an an idle supply voltage of 13.44 volts for the Metcal, and 14.58 for the Thermaltronics. The reported power consumption is 14.1% for the Metcal vs. 33.4 for the Thermaltronics.

More interresting is the reported change to thermal responses. Wiping the idling tip over a damp spnge gives me a delta of 23 for the Metcal, vs. a delta of 15 for the Thermaltronics. Similarily, wiping the tip over one of these dry brass-wool. thingies for one second gives me a delta of 13 for the Metcal tip, and 7 for the Thermaltronics equivalent.

It might also be noted that the previously "dark red glowing" cartridges were always the Thermaltronics ones (of course not the tip glowing, but around the internal coil assembly....)

Something strange is going on there, considering that the electronics (which includes the controling feedback loop) is always the same. In general, the Metcal tips idle at a lower voltage (even such things as the SMTC-147 which have a huge surface area) compared to the few Thermaltronics tips that i have available...

Greetings,

Chris

Report to moderator Logged

mamalala

Supporter

Posts: 777
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #188 on:** March 24, 2013, 01:36:26 am »

Say Thanks Reply Quote

Quote from: mikeselectricstuff on December 08, 2012, 11:46:13 pm

> Cool! I've always wanted a small lightweight Metcal supply for on-site use - SMPSU for light weight and fan cooled to minimise heatsink. Maybe even a battery option...
> Do you really need the MCU?

Comming back to this post, i have to say that no cooling fan is needed.

I use a SK92/100 heatsink from Fischer. During normal operation it feels "cold" to the toch. Onyl after using a big tip for quite while (to solder a 2 cent coint to a copper.clad PCB, for so long that i can freely move the coin in the solder blob molten around it), it gets hotter.

So, i would say that for nomral operation no extra colling besides a heastsing is needed. I think that even a SK508 or SK505 should be well enouhg. (the 505 is 15mm in height, 508 is 25mm and the 92 that i use is 40mm, all of them with 100mm * 100mm length/width)

Greetings,

Chris

Report to moderator Logged

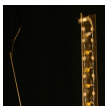
Tioleco
Contributor
Posts: 18

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #189 on:** April 15, 2013, 06:00:23 pm »
Say Thanks Reply Quote

This circuit work with Thermaltronics handle and cartridges of this ebay seller?
http://search.ebay.com/?sass=denbo32&ht=-1

Report to moderator Logged

mikeselectricstuff
Super Contributor



Posts: 11971
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #190 on:** April 16, 2013, 09:58:26 pm »
Say Thanks Reply Quote

Quote from: Tioleco on April 15, 2013, 06:00:23 pm

> This circuit work with Thermaltronics handle and cartridges of this ebay seller?
> http://search.ebay.com/?sass=denbo32&ht=-1

Yes - but only the handles with the F connector (MX series) and STTC or SMTC tips.
The ones with the DIN connectors are for the 470KHz systems.

Report to moderator Logged

Youtube channel:Taking wierd stuff apart. Very apart.
Mike's Electric Stuff: High voltage, vintage electronics etc.
Day Job: Mostly LEDs

mamalala
Supporter

Posts: 777
Country:

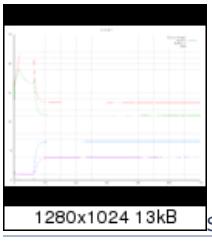
Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #191 on:** May 08, 2013, 01:29:23 pm »
Say Thanks Reply Quote

Hi all,

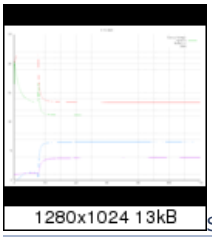
just a little time to continue working on the firmware, and added some logging functionality that allows me to plot certain paramaters using Gnuplot.

So, i sat down and logged all the tips that i have, each one for 2 minutes. These plots show the heatup phases for them, after heatup they just idle in the stand. The first 6 are Metcal tips, the last three are Thermaltronics tips. I uploaded the images to an external image hoster, since one of them is really large. Just click on the thumbnails...

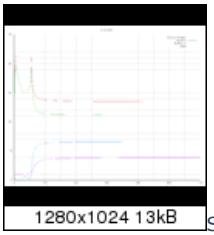
The Y scale is in volts for the supply voltage and the VSWR, the X scale is in seconds. The values for forward, reflected are the raw voltage readings from the SWR circuit multiplied by 10.



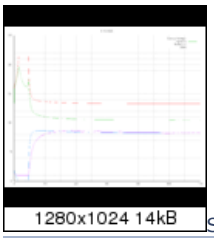
STTC-147



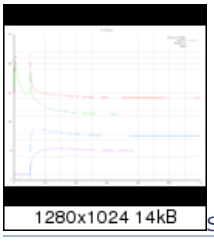
STTC-126



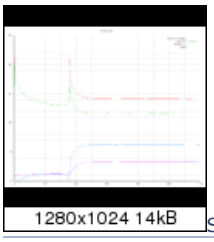
STTC-037



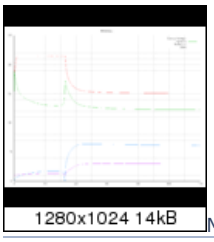
STTC-025



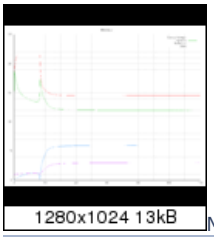
STTC-011



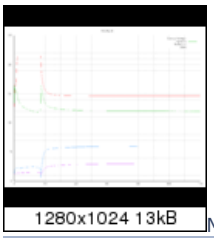
SMTC-147



M7DS525



M6CS155



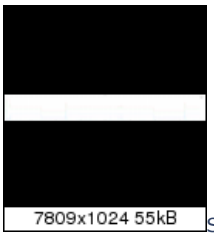
M6CH178

I also made a longer plot while using the STTC-126 tip. Be aware, this one is about 7k pixels wide. It shows the following events at roundabout the times given:

(Edit: The sleep mode reduces the supply voltage, and when waking up, it goes into boost mode for a few seconds and then switches back to normal mode)

16 seconds - heated up
142 seconds - entering sleep mode
239 seconds - wakeup by quick swipe on damp sponge
300 seconds - quick swipe on damp sponge, soldering pads for DIP package
420 seconds - quick push into brass sponge
450 seconds - soldering copper clad pcb, bare and unetched (=massive copper plane)
594 seconds - entering sleep
719 seconds - wakeup, quick push into brass sponge

There is an additional trace in this plot in cyan. This one shows the total delta of the monitored parameters, this determines the idle state, sleep state, wakeup, etc.



STTC-126 while in use

Greetings,

Chris

« *Last Edit: May 08, 2013, 01:46:41 pm by mamalala* »

Report to moderator Logged

zoltan
Contributor
Posts: 35
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #192 on:** May 13, 2013, 03:46:47 pm »
Say Thanks Reply Quote

Hi,

First, I have to thank Chris for his work. It's a great contribution to electronic hobbyst community.

~~Now, here is my question. Farnell doesn't have the smps chip anymore. But I've already sent the gerbers to Itead and boards are in production right now.~~
~~Can I use the lm2673 version instead of lm22676? I suppose that pin 5 should be lifted and connected trough resistor to the ground, but I'm not sure that's enough.~~
Update: Found that LM22670 is available. Canceled the boards production and sent them the new design. Thank everyone for help.

« *Last Edit: May 18, 2013, 11:32:35 am by zoltan* »

Report to moderator Logged

Paulinho19
Contributor
Posts: 42
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #193 on:** May 13, 2013, 10:01:55 pm »
Say Thanks Reply Quote

Hi Zoltan,

you can register at Texas Instruments an order up to 3 samples of the lm22676 for free and it is delivered in less than 48h.

Or you can buy them at RS or DIGIKEY, they still have them.

Paulo

Report to moderator Logged

mamalala
Supporter

Posts: 777
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #194 on:** May 14, 2013, 01:48:20 am »
Say Thanks Reply Quote

Quote from: zoltan on May 13, 2013, 03:46:47 pm

> Hi,
>
> First, I have to thank Chris for his work. It's a great contribution to electronic hobbyst community.

Thanks!

Quote from: zoltan on May 13, 2013, 03:46:47 pm

> Now, here is my question. Farnell doesn't have the smps chip anymore. But I've already sent the gerbers to Itead and boards are in production right now.

Hmm, for me, Farnell does list it as 1009 pcs. available. The correct part number is LM22676TJ-ADJ instead of the LM22676TJ7A that i placed in the schematic. That issue was mentioned by Mike quite a while ago (that is, that the labelling was wrong in the schematic).

Quote from: zoltan on May 13, 2013, 03:46:47 pm

> Can I use the lm2673 version instead of lm22676? I suppose that pin 5 should be lifted and connected trough resistor to the ground, but I'm not sure that's enough.

Not really, it's too different. The LM2673 needs parts for a softstart and current limiting, which are not there, and it lacks the EN pin to enable/disable the chip by the µC.

Greetings,

Chris

Report to moderator Logged

zoltan
Contributor
Posts: 35
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #195 on:** May 14, 2013, 06:14:48 am »
Say Thanks Reply Quote

Hi all,

Paulo, no chance I'll order samples any more - it cost me to much - minimum 50eur customs even for free sample. Because it's sent by FedEx only, and local FedEx is forcing everything trough customs. RS is expensive as hell here, almost 10eur/pc (i need 3) but if i cant get it any other way that would be the solution.

Chris, part number is 1657733. That exact number I put in my order list to local Farnell distributor and they say delivery time >4 months. Now, I've checked on german Farnel and it's there, 1009 pcs of 1657733. Strange. I'll call my distributor and tell them this.

The LM2673 current sensing part is actually not so problematic. You just need to lift the pin 5 and solder a small 0805 resistor between pin and GND. I'm not sure about cap on the softstart pin. Does it allow shutdown or not.

Report to moderator Logged

zoltan
Contributor
Posts: 35
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #196 on:** May 14, 2013, 07:12:48 am »
Say Thanks Reply Quote

I've just received a response from my local distributor. They say that "our" warehouse is in Leeds and their stock is the only relevant for us. Sad.
Anyone is willing to order from germany and resend to Croatia? I'll pay in advance (paypal).

Report to moderator Logged

mamalala
Supporter

Posts: 777
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #197 on:** May 14, 2013, 12:05:21 pm »
Say Thanks Reply Quote

Quote from: zoltan on May 14, 2013, 07:12:48 am

> I've just received a response from my local distributor. They say that "our" warehouse is in Leeds and their stock is the only relevant for us. Sad.
> Anyone is willing to order from germany and resend to Croatia? I'll pay in advance (paypal).

That's strange, since the UK Farnell site also lists it as 1009 available as EU stock, so i'm not really sure what the problem is. Guess your local distributor is just messing around with you. Who knows, maybe he's not interrested in small orders...

Just sent you a PM regarding the chips. But i'm wondering how you come up with a50 Euros for customs on free samples. After all, they are declared with no commercial value, usually. Plus, how is sending you stuff going to work then? If they want customs in one case (free samples), do they not want customs in the other case (if i would send them to you) as well?

And heck, even if they want customs for free samples, i still wonder how it comes to be 50 Euros. That is a multiple of what, lets say, 3 of these chips even cost.

Greetings,

Chris

Report to moderator Logged

zoltan
Contributor
Posts: 35
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #198 on:** May 14, 2013, 12:51:32 pm »
Say Thanks Reply Quote

Offtopic

I'm supposed to check availability on Export site, and there is zero of them available (but it's not restricted item). This distributor will sell you anything, you can order a single 0805 resistor and they will deliver it, except they will add 15 € fee for orders below 50 €. It's even cheaper than the deutsche site, eg. the 1657733 costs 4.92€+VAT and here costs 4.27€+VAT. But it's not available.

Re the 50€ for customs charge. The problem is only with courier post (FedEx, DHL, UPS). The have they own customs warehouses with they own customs officers employed inside so they force every single parcel trough customs. Even if customs end with zero amount to pay, you are charged with "handling and storage" fees (payable to courier) that differ from one tho another (FedEx ~50€, DHL ~30€, UPS ~30€). Ordinary post (registered, EMS) is something different. Sometimes the package get caught by customs (most often not) and I have to pay that. But much less and more transparent (10% for most things, 0% for electronics, +25% VAT for everything). In Croatia most people use couriers only once for international. After a hard lesson they use EMS

I hope things will change fast after we enter EU.

Back to the topic:

I'm right now checking for replacement parts that are available on export and it seems that the best candidate is LM22670-ADJ. It has Sync functionality on pin5, but it can be left floating. Other than that, other functionality is the same. I'll check it one more time when I get home from work, but I'm almost sure it would work.

Btw, thanks for your offer, Chris.

Report to moderator Logged

mamalala
Supporter

Posts: 777
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #199 on:** May 14, 2013, 01:48:27 pm »
Say Thanks Reply Quote

Quote from: zoltan on May 14, 2013, 12:51:32 pm

> **Offtopic**
> Re the 50€ for customs charge. The problem is only with courier post (FedEx, DHL, UPS). The have they own customs warehouses with they own customs officers employed inside so they force every single parcel trough customs. Even if customs end with zero amount to pay, you are charged with "handling and storage" fees (payable to courier) that differ from one tho another (FedEx ~50€, DHL ~30€, UPS ~30€). Ordinary post (registered, EMS) is something different. Sometimes the package get caught by customs (most often not) and I have to pay that. But much less and more transparent (10% for most things, 0% for electronics, +25% VAT for everything). In Croatia most people use couriers only once for international. After a hard lesson they use EMS

Funny, here in Germany it is the exact opposite. DHL charges no handling or whatever fees (OK, they are a Germany company and have special privileges regarding customs: They are the only ones allowed to do it themselves). Never had to pay anthing to FedEx either. Only UPS tried that once with me, and i simply refused to pay it but got the package anyways. All that for handling/storage fees, of course regular customs and VAT still applies (but never for samples either).

However, EMS is really bad here. They don't deliver themsleves, but use a subcontractor here in Germany, and they are the worst you can have. While they theoretically allow you to do the customs clearance stuff etc. yourself, they delay the notifications until it is almost too late, basically forcing you to pay them hefty sums of money. In Germany, you better avoid anything that uses EMS for packages.

Greetings,

Chris

Report to moderator Logged

mamalala
Supporter

Posts: 777

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #200 on:** May 20, 2013, 08:05:59 pm »
Say Thanks Reply Quote

Hi all,

just a quick update. Attached is the current firmware used for the PIC 18F2620 microcontroller. It is an MPLAB-X project, and it uses Microchips C18 compiler. In the src/Docu folder you will find a small, rough docu of the main points if the user interface.

Country:

Not much in terms of source code docu yet, some cleanup needs to be done, etc. But at least it is the first usable version that works.

Some main features:

- Nifty status display
- Extensible menu handling/structure
- All power manager options are editable
- Settings can be saved/loaded to/from internal EEPROM
- One main system setting and 8 power-manager settings saveable
- Multi-Language support, lang selectable during runtime
- Uses only one rotary encoder with pushbutton-function
- Verbose status output over RS232
- Alternatively extensive realtime parameter logging over RS232

The logging can be used to characterize the tips used, so that one can do proper power-manager settings. The format used also allows to just dump the log into an ASCII file and have a plot done with GnuPlot (this is how i did the plots previously shown).

So far it works rather well. It allows to enter a sleep mode with reduced power output when idling for a while. It has configurable thresholds that will automatically wake up the unit when a load change on the tip is detected. It can also go into auto-powerdown after a given time of sleeping.

Greetings,

Chris

RFSupply-00.01.zip (145.14 kB - downloaded 541 times.)

Report to moderator Logged

mamalala

Supporter

Posts: 777
Country:

Re: DIY Metcal 13.56 MHz RF Supply

« **Reply #201 on:** May 28, 2013, 04:18:48 pm »

Say Thanks Reply Quote

On a slightly related issue:

Does someone here have a handpiece for me for an affordable price? Right now i have only one, that i use for my regular work as well as for testing/developing this unit. Would be great to have a secnd one just for testing/development, so that i can avoid plugging them back and forth all the time, as well as to lower the risk of killing it due to some mistake/mishap. The old MX-RM3E would be fine, but any other that can take the STTC cartridges would be OK as well.

If so, send me a PM or let me know here in the thread.

Thanks and greetings,

Chris

Report to moderator Logged

zoltan

Contributor

Posts: 35
Country:

Re: DIY Metcal 13.56 MHz RF Supply

« **Reply #202 on:** June 02, 2013, 01:41:07 pm »

Say Thanks Reply Quote

Hi,

My RF boards arrived this Friday. If anyone need a board send me a pm. Btw, I'm open for parts-for-boards exchange ;-)

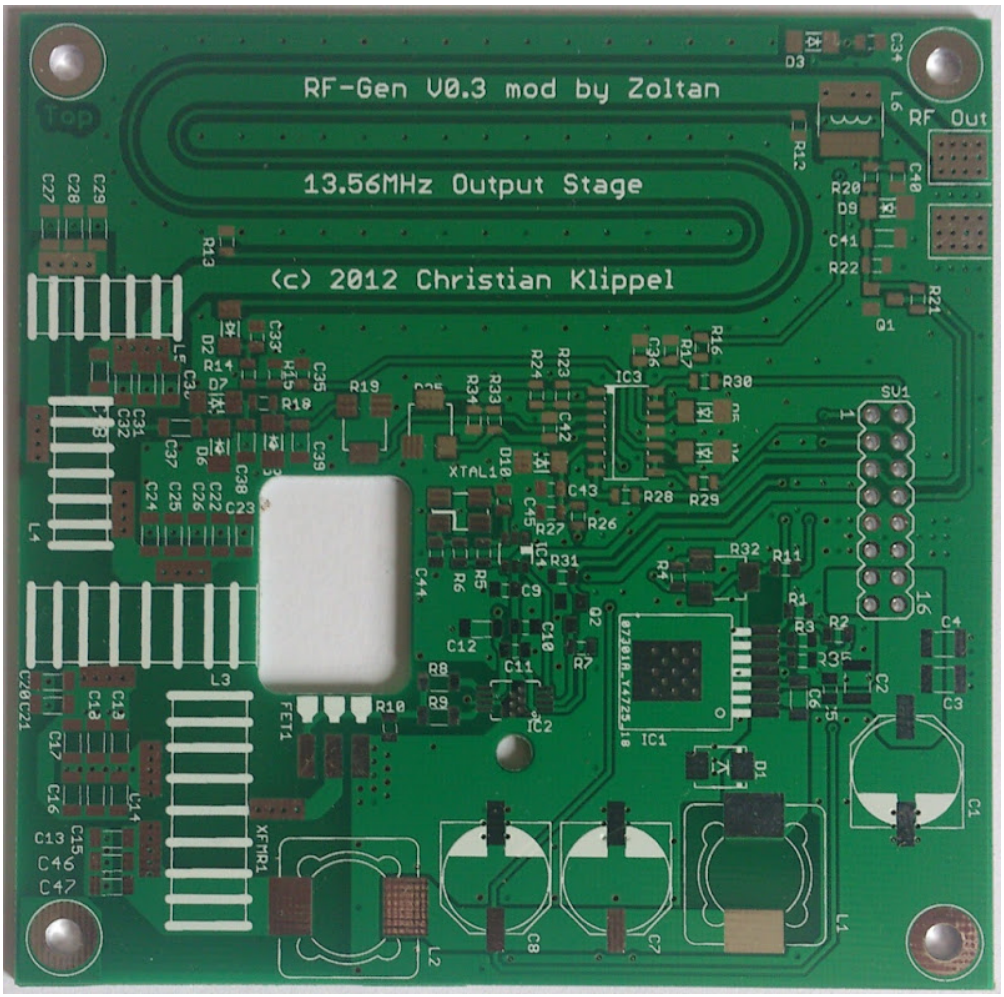
The board is a slightly modified version v0.3.
Changes:

- IC1 modified to accept LM22670, added R35 0R resistor on pin 5 of IC1. Leave it unpopulated for LM22670 or solder 0R resistor if using LM22676.
- R19,R25 changed to SMD footprint, same as R32
- SV1 changed to thru-hole
- Added extra vias on many solder-pads to strengthen them, eg. XFMR1, L3-L5, output pads.
- SV1 pin description on back side

At the moment I've finished one board assembly, but had to stop due I don't have a proper dummy load yet (It' on the way from Greece). The SMPS part is alive and working properly, the signal generation is also working (I think), but the output level looks way lower than needed (see image) and that overheats the mosfet.

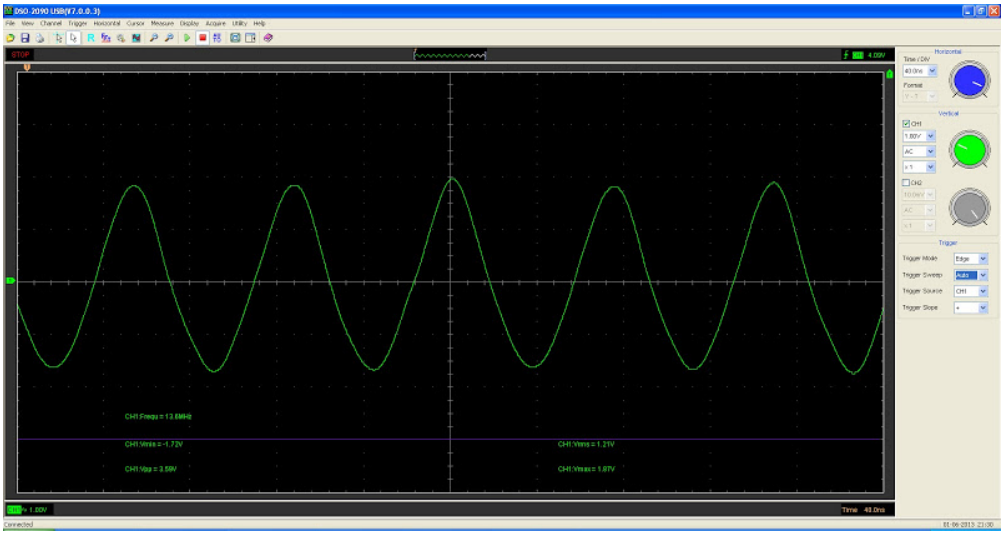
By now I managed to kill one LM22670 by accidentally shorting the output pin with multimeter probe

and cooked one gate driver (forget to put thermal paste below it).

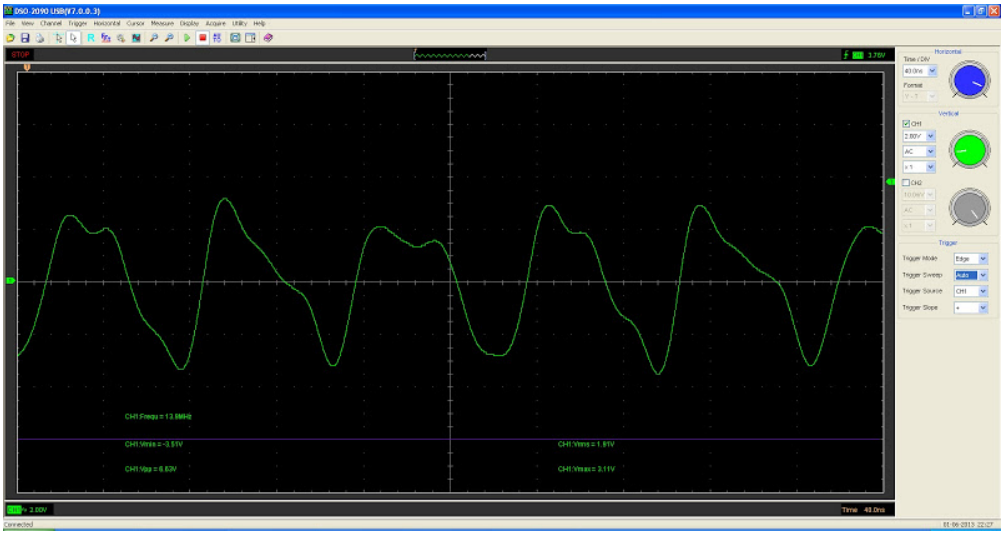


RF board

EDIT: The scope readings are false - the signal is over the range of the scope - sorry guys.



Driver output, 3.59 Vpp



Drain voltage, 6.63 Vpp @ 22V

Z

« *Last Edit: June 02, 2013, 10:58:53 pm by zoltan* »

Report to moderator Logged

mamalala

Supporter

Posts: 777

Country:

Re: DIY Metcal 13.56 MHz RF Supply

« **Reply #203 on:** June 02, 2013, 05:33:30 pm »

Say Thanks Reply Quote

Uh, the driver should not get hot at all, at least not if you use the IRF510 as output FET.

What the heck are all these holes in the pads for the coils, RF-Output and one side of L6 (near the output). Who placed them there and why? And please tell me that they are not through-plated to the other side, maybe even to the GND plane at the back?

What toroid cores did you use? There has been a problem with them in the past, meaning that what seems to be an equivalent to the Amidon core did not work out well. Also, did you wind XFMR1 properly?

And in any case, how did you use the RF board if you have no dummy load? With nothing connected at all? That sure will cause havoc if the tip-detection is somehow bypassed. Or did you use a tip? Not really usablee, since it changes characteristics when it heats up (although there is a way to do the adjustments with a tip instead of a dummy).

Greetings,

Chris

Edit: Driver output of 3.59V is dead wrong, so is the sine-wave there. It should be square-ish with about 12V p-p.

Edit 2: I also see that you have changed R19 to a single-turn pot. Good luck getting a stable and precise adjustment with that one!

« *Last Edit: June 02, 2013, 05:40:31 pm by mamalala* »

Report to moderator Logged

Paulinho19

Contributor

Posts: 42

Country:

Re: DIY Metcal 13.56 MHz RF Supply

« **Reply #204 on:** June 02, 2013, 08:16:40 pm »

Say Thanks Reply Quote

Sine-wave Driver output....🤔 What happened there, that does not look good. Also most of your changes make it almost impossible to mount the board flat on a head sink. For example "SV1 changed to thru-hole".
If you want a set of boards (Chris's RF-Gen Board + Chris's Controller Board or my Arduino Controller board) just send me a PM, I still have a few, 10 Euros plus shipping.

Greetings,

Paulo

Report to moderator Logged

zoltan

Re: DIY Metcal 13.56 MHz RF Supply

« **Reply #205 on:** June 02, 2013, 10:55:58 pm »

Say Thanks Reply Quote

Contributor

Posts: 35
Country:

Hi,

First I have to say, our friend Nyquist was making some fun with me (and the Chinese to). I'm using a cheap USB scope that's good for maybe 4MHz (never used it over 1-2MHz before) sqare wave and it's "just rounded the edges". Plus the probe is on the cheap side. Sorry guys.

The holes are vias I put there to give it a bit more strength, they are not connected to anything but the solder pad on top layer. Please don't tell me this have any effect on the RF circuitry.

The cores are from kitsandparts, exact same as you ant Paulo used. The windings are as in your manual, carefully put together and checked for short. If the cores are not good for a given F, they would most probably overheat - is this correct?

Yes, I tried with the tip only. Hopefully next week my dummy load will arrive so I can start again - or not, if the vias are affecting the circuit. Until then ill try to source a better scope.

Paulo, I have some extruded profiles that make it perfect fit that way. If you mount the board on the heatsink, you have 1.5mm to compensate by bending legs upward.
With my profiles I need to bent them to, but 1.5mm down. That gives me 3mm between board and heatsink, what is more than enough for pins. The reason I've changed it to th is that I have lot of them in every shape except SMD.

Chris, the driver is overheating if no thermal paste is put between driver and the board even with no fet connected. With little thermal paste everything is under control.

Report to moderator Logged

mamalala

Supporter

Posts: 777
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #206 on:** June 03, 2013, 09:05:43 am »

Say Thanks Reply Quote

Quote from: zoltan on June 02, 2013, 10:55:58 pm

> Hi,
>
> First I have to say, our friend Nyquist was making some fun with me (and the Chinese to). I'm using a cheap USB scope that's good for maybe 4MHz (never used it over 1-2MHz before) sqare wave and it's "just rounded the edges". Plus the probe is on the cheap side. Sorry guys.

Hmm, OK. Not Nyquist, but bandwidth limitation. I would suggest that you use a "real" scop instead, with at least 20MHz bandwidth. Who knows if the voltage levels it shows are correct, when it already messes up the waveform so badly.

In any case, the output of the driver shoud reach roundabout 12V p-p. What you have there is much too low (if that reading is correct), meaning that the FET can not turn fully on.

Quote from: zoltan on June 02, 2013, 10:55:58 pm

> The holes are vias I put there to give it a bit more strength, they are not connected to anything but the solder pad on top layer. Please don't tell me this have any effect on the RF circuitry.

Alright. As long as they don't touch anything at the bottom that should be no problem.

Quote from: zoltan on June 02, 2013, 10:55:58 pm

> The cores are from kitsandparts, exact same as you ant Paulo used. The windings are as in your manual, carefully put together and checked for short. If the cores are not good for a given F, they would most probably overheat - is this correct?

Well, that's the thing. The ones that Paulo got first turned out to not work that well, while it was claimed that they are equivalent. Once i sent them a set of cores from the exact types i use here, it worked for him as well.

The cores are good for a rather wide frequency range. However, small differencies in material composition can have big effects. RF is a nasty thing when it comes to such things...

Also note that later i updated the docu, so the number of turns for each core changed. If you used the very first one i wrote, it will be slightly off.

[quote author=zoltan link=topic=12578.msg240931#msg240931 Chris, the driver is overheating if no thermal paste is put between driver and the board even with no fet connected. With little thermal paste everything is under control.
[/quote]

That does not sound right at all. Without load (i.e. no FET connected) it should not get hot, not even really warm, no matter if there is thermal paste or not. That, in combination with the awkwardly low output level you get from the driver, tells me that there is something wrong. Either with the supply voltages or with the solderwork on the circuit itself. Maybe soldered in a wrong (too low) value for R10, the pulldown connected to the FET's gate? Is the supply voltage to the driver a clean 12V DC?

You need to check and verify the RF board step by step. First make sure that all supply voltages are OK and that the +5V DC and +12V DC are clean. Then check (with a suitable scope!) that the output of the oscillator is good. If it is, next check the output of the driver (roundabout same waveform as input, just with 12V p-p).

Unless you know what you are doing, using a tip to setup the circuit is a bad idea. If it drives the output stage too hard (improperly adjusted R19), it will almost instantly kill the FET when the SWR goes up (tip is hot).

You should also limit the output voltage from the dc/dc converter to a lower value using R32 first during testing. That will help to protect the FET bit in case something goes wrong.

Can you upload an image of the bottom of the PCB you have?

Greetings,

Chris

Report to moderator Logged

zoltan
Contributor
Posts: 35
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #207 on:** June 03, 2013, 09:57:49 am »
Say Thanks Reply Quote

Hi Chris,

Quote

> Hmm, OK. Not Nyquist, but bandwidth limitation. I would suggest that you use a "real" scop instead, with at least 20MHz bandwidth. Who knows if the voltage levels it shows are correct, when it already messes up the waveform so badly.

I'm using a Hantek DSO-2090 40MHz, 100MS/s. Last night I've made made a test - I've set up a 50MHz ARM microcontroller clock output to one of it's pins. Started with 50MHz all I got was a nice 50MHz sine wave. By decreasing a clock little by little the usable shape showed up at 4MHz. It's time to buy a new scope I think

Quote

> In any case, the output of the driver shoud reach roundabout 12V p-p. What you have there is much too low (if that reading is correct), meaning that the FET can not turn fully on.

By now I can say that the reading IS incorrect for sure. I'll try to get access to something better this week.

Quote

> Alright. As long as they don't touch anything at the bottom that should be no problem.

They are not touching anything. Maybe the via stubs add up a little bit of capacitance, but not much.

Quote

> Well, that's the thing. The ones that Paulo got first turned out to not work that well, while it was claimed that they are equivalent. Once i sent them a set of cores from the exact types i use here, it worked for him as well.
>
> The cores are good for a rather wide frequency range. However, small differencies in material composition can have big effects. RF is a nasty thing when it comes to such things...

I have this from kitsandparts:
T50-6 powdered iron toroid
T80-6 powdered iron toroid
FT82-61 ferrite toroid

While searching for cores I've found many good reviews from HAM people regarding kitsandparts. Are they correct then or not? How can I test them?

Quote

> Also note that later i updated the docu, so the number of turns for each core changed. If you used the very first one i wrote, it will be slightly off.

Used the docu from post #68.

> **Quote**
>
> That does not sound right at all. Without load (i.e. no FET connected) it should not get hot, not even really warm, no matter if there is thermal paste or not. That, in combination with the awkwardly low output level you get from the driver, tells me that there is something wrong. Either with the supply voltages or with the solderwork on the circuit itself. Maybe soldered in a wrong (too low) value for R10, the pulldown connected to the FET's gate? Is the supply voltage to the driver a clean 12V DC?

Tonight I'll put together a new board and see how it behaves. Maybe there is some residue left from soldering - any kind of mess can behave badly in RF world. When I say'd no load I meant without R8 and R9 populated - R10 should have no effect at all.
The supply voltage looks OK, I've checked with scope and it is not showing any variations in voltage level. Even with BW problems, the scope should show if there is significant level change, but it's clean line.

> **Quote**
>
> Unless you know what you are doing, using a tip to setup the circuit is a bad idea. If it drives the output stage too hard (improperly adjusted R19), it will almost instantly kill the FET when the SWR goes up (tip is hot).

It does not heat the tip, only the FET  But it clearly does something RF, because my hot-air station switch on when RF power is enabled. At least I can use it as remote control for hot-air.
I will not do any testing until my dummy load arrives. I'm getting short on parts.

> **Quote**
>
> You should also limit the output voltage from the dc/dc converter to a lower value using R32 first during testing. That will help to protect the FET bit in case something goes wrong.

What level you suggest? 12V or more?

> **Quote**
>
> Can you upload an image of the bottom of the PCB you have?

Tonight. I can send you the gerbers if you wish, but I will not upload them to public until the board is working.

Thanks for help,

Z

Report to moderator Logged

mamalala
Supporter

Posts: 777
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #208 on:** June 03, 2013, 06:33:22 pm »

Say Thanks Reply Quote

Ho zoltan,

the cores i use are from here:

FT82-61:
http://www.reichelt.de/index.html?ACTION=3;ARTICLE=7937;SEARCH=FT%2082-61

T80-6:
http://www.reichelt.de/index.html?ACTION=3;ARTICLE=20024;SEARCH=T%2080-6

T50-6:
http://www.reichelt.de/index.html?ACTION=3;ARTICLE=20012;SEARCH=T%2050-6

I have no way of knowing if the kitsandparts cores are the same or not. The name would suggest that they are....

Regarding the docu, in post #82 i already made some corrections, and in later posts are even more changes. So it's a good idea to check them all. When i have some time i will upload an updated doc.

With the 2k2/18k combination for the feedback resistors onthe dc/dc converter, it should output a little less than 12 volts. You can simply remove R4 (that disconnects the OpAmp from the feedback loop) and make sure that the limit/boost pin is left open (or remove R11).

Please double check the driver chip. As said, it should not get hot at all without any load attached. It's easy to short two pins with solder, as well as not properly soldering the GND pin (due to thermal mass attached through the PCB's copper). Also double-check the orientation.

The output pins are the two outmost ones. Between them are the +12V and GND pins. Accidently

shorting two pins there will very likely show the symptoms you see.

Greetings,

Chris

Report to moderator Logged

mamalala
Supporter

Posts: 777
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #209 on:** June 03, 2013, 06:54:16 pm »
Say Thanks Reply Quote

Attached is a ZIP with the latest Eagle files for the RF stage. R23/R24 is now 22k/200R. Added some text for the toroids/windings in the schema as well.

Greetings,

Chris

RF-Stage-latest.zip (56.59 kB - downloaded 614 times.)

Report to moderator Logged

mamalala
Supporter

Posts: 777
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #210 on:** June 03, 2013, 08:45:11 pm »
Say Thanks Reply Quote

BTW,

i'm in the process of assembling two more units. That means that soon i have again a unit to play with.

So, if anyone wants to send me a set of torroids to try out, i can then test them against the "original" ones, one by one, and check what the difference is so as to add some extra hints how to wind/use the alternative ones.

Anyone interrested just send me a PM here in the forum, and i will give you my contact details.

Might be useful to know what is going on with them.

Greetings,

Chris

Report to moderator Logged

zoltan
Contributor

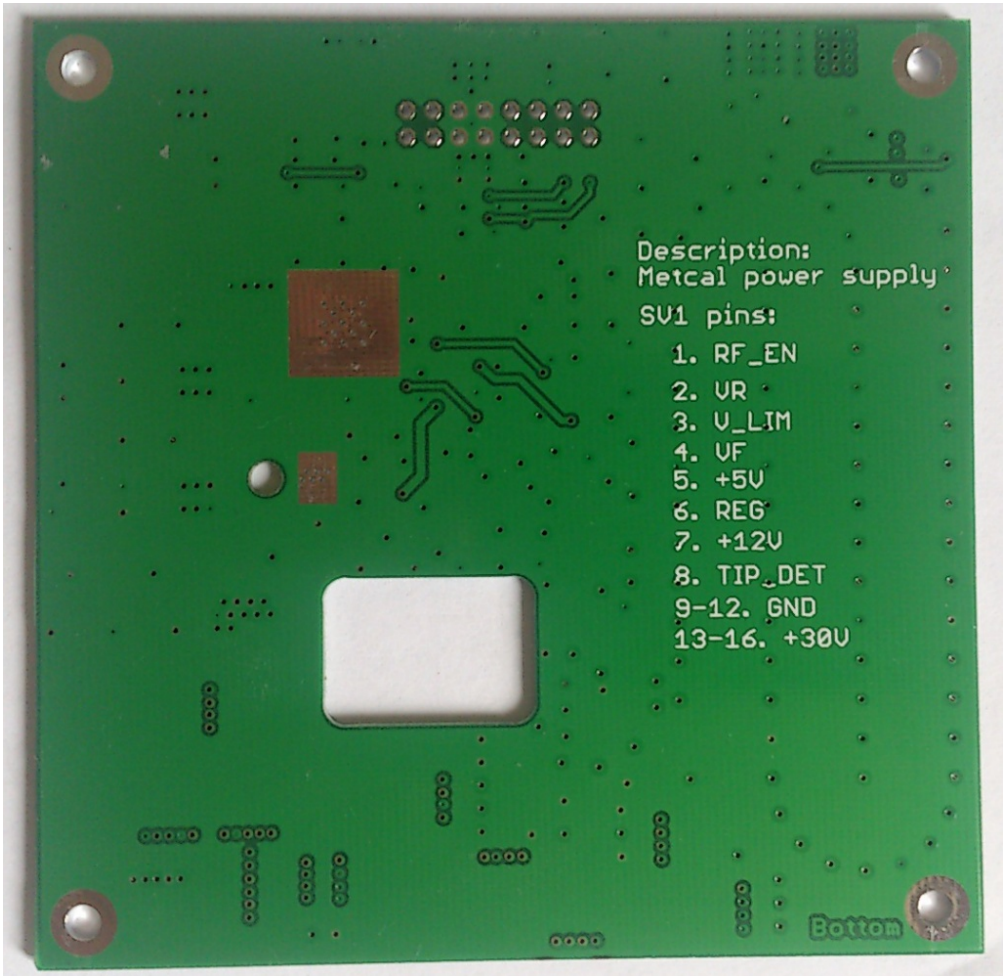
Posts: 35
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #211 on:** June 04, 2013, 06:31:45 am »
Say Thanks Reply Quote

Hi Chris,

Attached is the bottom side of the board, as you asked.

I will send you sample cores. Just give me your mailing address in pm.



IMG_20130604_080919.jpg (238.61 kB, 1024x995 - viewed 1076 times.)

Report to moderator Logged

mamalala
Supporter

Posts: 777
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #212 on:** June 04, 2013, 04:03:32 pm »

Say Thanks Reply Quote

Quote from: zoltan on June 04, 2013, 06:31:45 am

> Hi Chris,
>
> Attached is the bottom side of the board, as you asked.
>
> I will send you sample cores. Just give me your mailing address in pm.

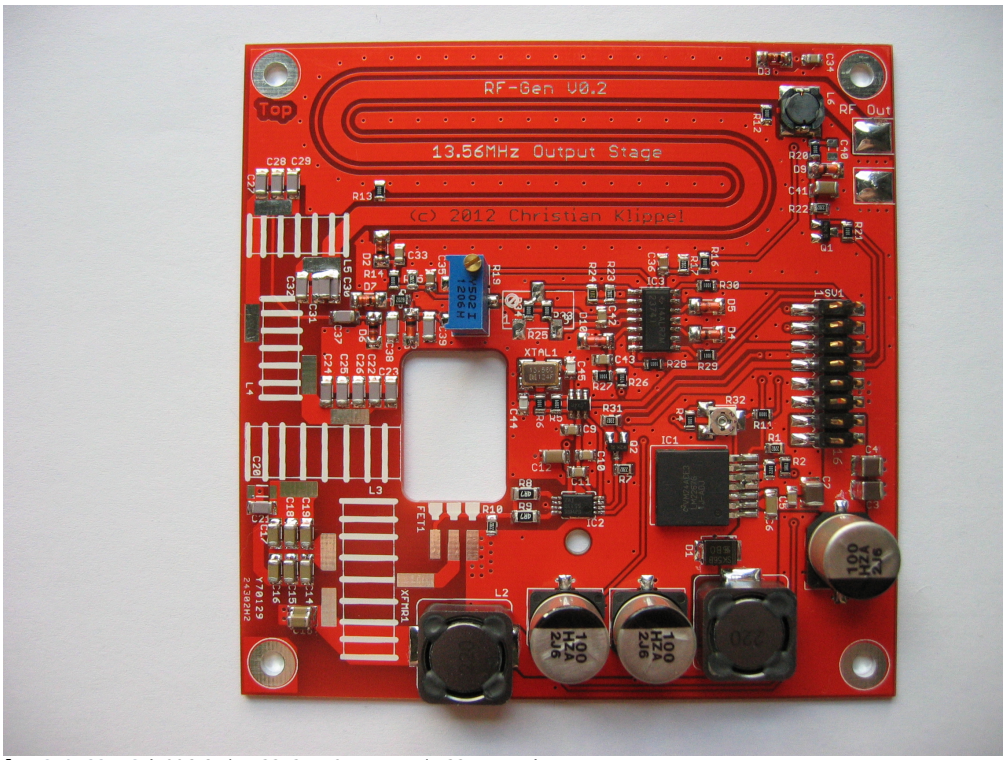
Looks OK then, nothing suspicious.

That said, you should really check out what is wrong with the driver there. The p-p voltage is way too low, indicating a short somewhere (or a broken driver chip). Instead of just visually checking, you might also want to actually meassure for resistance/conductivity there. While rare, it can always happen that something went wrong during PCB fabrication. I had the occasinal PCB's where a hair-thin short was present between two adjacent traces/signals.

In any case, for reference i attach a hi-res image of one of the latest RF boards (sans the toroids) i'm assembling. Part values should be quite readable there. Keep in mind that i mostly use 1% resistors, so most of them have 4 digits on them.

Greetings,

Chris



IMG_9466.JPG (1996.64 kB, 2272x1704 - viewed 1327 times.)

Report to moderator Logged

zoltan
Contributor
Posts: 35
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #213 on:** June 05, 2013, 04:52:44 pm »
Say Thanks Reply Quote

Hi,

I had no time to build another board these days but I managed to find some data to compare.

Here are the A_L values for different cores and vendors:

Vendor: reichelt.de (data source: www.amidoncorp.com)
FT 82-61: 75 (turn number not defined, may be 10)
T 80-6: 45 µH/100 turns
T 50-6: 40 µH/100 turns

Vendor: kitsandparts.com (data source: toroids.info)
FT 82-61: 79 (Actual measured AL using 10 turns #28 wire - comment from toroids.info)
T 80-6: 4.5 (It is not defined, but I believe the number is for 10 turns, that is 45/100)
T 50-6: 4 (It is not defined, but I believe the number is for 10 turns, that is 40/100)

Chris, what are the values of your inductors? Cannot find them in schematic and the values from older files are not accurate (L3=1u, L4=1u, L5=400n) based on Paulo's measurement (0.6, 07 and 0.3uH).

Edit:
Tonight I rebuilt the signal stage on a new board, and the signal is much better - 4.69 Vpp after oscillator output and 11.6 Vpp on driver output. It still heats up without thermal paste, but it's not critical. Re-checked every component before soldering and inspected every solder with microscope. Paranoia kickin'
Z

« Last Edit: June 05, 2013, 09:24:43 pm by zoltan »

Report to moderator Logged

mamalala
Supporter

Posts: 777

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #214 on:** June 06, 2013, 08:34:10 am »
Say Thanks Reply Quote

Hi zoltan,

sorry, but my crap LC meter simply does not register the inductors. The values i had in the schematic were derieved from the original circuit. I then tweaked the inductors and number of capacitors in the filter section to give a decently high output voltage on a dummy load. But i really can't say what the actual value of them is, since i am unable to meassure them, sorry.

Country:

Greetings,

Chris

Report to moderator Logged

richard.cs
Frequent Contributor
Posts: 662
Country:
Electronics engineer from Southampton, UK.

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #215 on:** June 07, 2013, 05:57:56 pm »
Say Thanks Reply Quote

Hi All,

I've been planning to build a 13 Meg Metcal power supply for some time now and I've been following this thread with interest. I'm not intending to make a clone of either the circuit posted here or of the Metcal power supply, simply something that works well and fits with my own style of building stuff.

I've a few questions that people who are building this might be able to answer:

1) This PSU and the Metcal one both regulate based on Peak voltage at a certain point in the filter, It seems to me it should also work regulating for constant RF current or perhaps for constant reflected power. Does anyone see a problem with either of those?

2) Power requirements - I've seen 100V Peak mentioned during heating, so 100 Watts for a few seconds assuming the tip looks vaguely 50 Ohms below its Curie temperature. The SWR vs time graphs are very nice but would it be possible to plot some Power vs time for typical usage, or perhaps post the raw data so I could have a go at estimating it.

3) What does the tip really look like in impedance? My understanding is that when below the Curie temperature it will look like a very lossy inductor, but I don't have a feel for the real and reactive impedances (or do the tips have a small capacitor to resonate out the L?). Above the Curie temperature the ferrite "disappears" and you should just see the copper core as a shorted turn and therefore the tip presumably approximates a short. Some odd behaviour must then happen in between over a very narrow temperature range. It'd be nice to be able to build an accurate dummy load for testing and setup.

I have the ability to measure the tip impedance, but I haven't yet got around to buying a handset. The only ones I have around here are for the 450 kHz system - if anyone wants one of those measured give me a shout and I'll put it on the network analyser, I *think* we've got one that goes that low.

My current thinking is to full wave rectify the mains supply to get a 350V dc bus and run a small non-isolated switcher off of that to power the control circuitry. I plan to generate the RF directly from the high voltage dc and provide the output isolation and much of the matching via a suitable RF transformer. I'm currently toying with the idea of using a pair of line output valves for the high voltage RF source - designed for switching, suitable for the peak voltages expected, tolerant of overloads on timescales of ten seconds or so (tip heatup time), generally bombproof. What's holding me back at the moment is not really knowing what the load is like, and being a little unsure of the best parameter to regulate for.

I don't intend to include the LCD, etc, although I'll probably put a bit more status information on it than the standard Metcal source. I'm currently thinking a few LEDs for "ready, standby, fault" and an analogue meter showing forward minus reverse power.

Report to moderator Logged

mamalala
Supporter

Posts: 777
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #216 on:** June 07, 2013, 11:25:12 pm »
Say Thanks Reply Quote

Hi Richard,

Quote from: richard.cs on June 07, 2013, 05:57:56 pm

> 1) This PSU and the Metcal one both regulate based on Peak voltage at a certain point in the filter, It seems to me it should also work regulating for constant RF current or perhaps for constant reflected power. Does anyone see a problem with either of those?

According to the original patent (which is now expired), it is indeed a regulation for a constant RF current. The original patent:

http://www.google.com/patents/US4626767

In my circuit i use the same point in the RF path for the feedback loop, however, i end up at the dc/dc converter at a different point compared to the schematics of the MX-500P you can find here:

http://www.eserviceinfo.com/downloadsm/33981/Metcal_MX-500P-11.html

In that circuit they use a zener + trimmer, on the input side of the regulator, which goes to the feedback pin together with the signal picked up before L7 (which in my circuit would be L5, the last coil before the output). In my circuit i feed that signal through an op-amp and series resistor into the feedback pin of the regulator.

Quote from: richard.cs on June 07, 2013, 05:57:56 pm

> 2) Power requirements - I've seen 100V Peak mentioned during heating, so 100 Watts for a few seconds assuming the tip looks vaguely 50 Ohms below its Curie temperature. The SWR vs time graphs are very nice but would it be possible to plot some Power vs time for typical usage, or perhaps post the raw data so I could have a go at estimating it.

I think you got the numbers a bit wrong. At 100V pp into a 50 ohms load, it should be around 25 watts. In reality i get a bit higher even, up to 120V pp, but that also depends on the maximum voltage that the dc/dc converter can supply, of course, and thus can be adjusted.

Quote from: richard.cs on June 07, 2013, 05:57:56 pm

> 3) What does the tip really look like in impedance? [...snip...] (or do the tips have a small capacitor to resonate out the L?).

Good question, and i simply don't know what the real tip cartridge characteristics are. I dont have the equipment to test that.

However, you can take a look at the relevant patents to get an idea of their workings. For the tip cartridges themselves, specifically the heater method, check these:

http://www.google.com/patents/US4745264
http://www.google.com/patents/US4769519
http://www.google.com/patents/US4877944

As for the handpiece, the patent is

http://www.google.com/patents/US4839501

According to that patent there seems to be a capacitor in series to the tip cartridge.

In any case, continuing to pump lots of power into the tip even after the temp is reached will cause it to heat up more, up to a point the cartridge starts glowing where the coil assembly is inside. So it really is important to regulate the RF power into the cartridge once it is heated up and the mismatch happens.

Quote from: richard.cs on June 07, 2013, 05:57:56 pm

> My current thinking is to full wave rectify the mains supply to get a 350V dc bus and run a small non-isolated switcher off of that to power the control circuitry. I plan to generate the RF directly from the high voltage dc and provide the output isolation and much of the matching via a suitable RF transformer. I'm currently toying with the idea of using a pair of line output valves for the high voltage RF source - designed for switching, suitable for the peak voltages expected, tolerant of overloads on timescales of ten seconds or so (tip heatup time), generally bombproof. What's holding me back at the moment is not really knowing what the load is like, and being a little unsure of the best parameter to regulate for.

While it would probably look nice with tubes, i'm not sure that it is really practical. Tubes need heaters, which by themselves consume quite some power. You might end up using more energy there compared to the actual soldering cartridge. Also keep in mind that other countries have different line voltages. If you intend that others may build your circuit as well, i think that directly using the line voltage is a rather risky thing to do. But then, this is of course completely up to you

About usage data, attached is a zip file with the raw data log i made a while ago, using a STTC-126 tip. The .gpd contains the data, one sample every 100 miliseconds, the .plt is the gnuplot commands i used to create an actual plot. Vsup is the voltage out of the dc/dc converter, in volts. Vfwd and Vref are more or less raw ADC readings. SWR is what i calculated as SWR out of the Vf/Vr, and DELTA is just what i internally use in the firmware to detect load changes, it is a combination of various parameters.

The file start with a normal heatup with a cold tip. It starts out with a VSWR of 1.00, then slowly rises. When it reaches temp it makes a dip to almost 1.00 again and then quickly rises, which is also the point where the regulation kicks is and reduces the supply voltage. The next event is when the unit goes to sleep mode with reduced power output. it then wakes up with boosted output for a while, then switching back to normal power output. Then follow a few quick solder joints, a pause, another set of quick solder joints, then again sleep, wakeup, and that's it. Hope it is helpful for you.

Greetings,

Chris

STTC-126_use.zip (34.76 kB - downloaded 418 times.)

Report to moderator Logged

richard.cs
Frequent Contributor
Posts: 662
Country:
Electronics engineer from Southampton, UK.

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #217 on:** June 08, 2013, 08:17:14 am »
Say Thanks Reply Quote

Chris,

Thanks for the reply, the patents look very useful. I'll need to think about the voltage to current conversion, it's not really clear to me yet how that works. I've not yet decided between that approach and regulating the current directly - probably with a current transformer based measurement.

Quote

> I think you got the numbers a bit wrong...

Oops, somewhere along the way I'd read that as peak rather than p-p. That makes things a bit easier.

Quote

> Good question, and i simply don't know what the real tip cartridge characteristics are. I dont have the equipment to test that.

I have the equipment to measure it (I can do it at work), cold characteristics are easy anyway. Hot measurements might end up being a bit crude. Looks like the first thing I should be doing is buying the handpiece and tip .

Quote

> While it would probably look nice with tubes, i'm not sure that it is really practical. [snip] Also keep in mind that other countries have different line voltages.

I'm well aware of the disadvantages with a tube based output stage but I do like the idea of using the RF transformer for isolation. Given there are only really two line voltages in common use worldwide I would imagine a switchable doubler similar to older computer PSUs would be fine, smaller variations would then be ironed out by the feedback loop. Of course a modern design with a power factor correction switcher at its input inherently produces a stable dc bus from a wide range of supply voltages.

I haven't really settled on a design yet and may well end up with something closer to a standard Metcal supply. Or given the lower output power than I thought I wanted a single PL504 across the rectified mains and live with the 9 Watts of heater. Or maybe a reasonably priced MOSFET exists that can handle transients of a kilovolt and can switch at 14 MHz, I'll admit I haven't looked yet.

Thanks for the data files, I'll see if I can make sense of them later.

Regards
Richard

Report to moderator Logged

mamalala
Supporter

Posts: 777
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #218 on:** June 08, 2013, 11:05:30 am »
Say Thanks Reply Quote

Quote from: richard.cs on June 08, 2013, 08:17:14 am

> Chris,
>
> Thanks for the reply, the patents look very useful. I'll need to think about the voltage to current conversion, it's not really clear to me yet how that works. I've not yet decided between that approach and regulating the current directly - probably with a current transformer based measurement.

From what i gather, that last coil (L7 in the original, L5 in my circuit) is the actual CV-CC converter. At least in my circuit, once the regulation kicks in, the voltage at that node is kept constant, which should result in a constant current through the load.

What is different compared to the original is just that i use an opamp and different way of building the feedback loop. In the original, in case of some failure, the dc/dc converter can generate a rather high voltage. In my circuit i still have the regular voltage divider there (R2=18k, R3=2k2) which causes the converter to drop to roundabout 12 volts if no external feedback is coming in. Since the opamp output goes through a series resistor (fixed R4 and variable R32), i can limit the maximum output voltage it

can generate (unless boost mode is activated), which is about 21.5 volts.

The opamp is configured so that it references to 2.5 volts instead of GND. That means that any input below that will have 0 volts as output, thus causing the dc/dcv converter to generate the maximum voltage as adjusted with R32. Only if the output of the peak detector goes above 2.5 volts, something comes out of the opamp.

Greetings,

Chris

Edit: as to the Vpp readings i gave, please be aware that those are just what my old scope tells me. But it is half broken, and i have a really cheap, shitty probe. So those values might be off somewhat...

« *Last Edit: June 08, 2013, 11:08:35 am by mamalala* »

Report to moderator Logged

mamalala

Supporter

Posts: 777

Country:

Re: DIY Metcal 13.56 MHz RF Supply

« **Reply #219 on:** June 12, 2013, 05:17:01 pm »

Say Thanks Reply Quote

Just in case:

http://dangerousprototypes.com/2013/05/28/diy-metcal-13-56-mhz-rf-supply/

A few things... For a few days i'm thinking where to go next with this project. There are several, not mutually exclusive, options:

- Single board design that has everything on one PCB
- A version that uses a boos or SEPIC converter, so it could work, for example, with a 12V supply
- One that has "no frills", that is, basically just the RF board designed to work on its own from a single 26V minimum supply

What do you folks think would be usable? In case of the boost/SEPIC option, i would rather prefer the SEPIC variant: This would allow to use a wide range of input voltages, below, equal and above to what the RF stage would need. However, i'm still looking for a suitable converter chip. Since the buck version already eats up to 3 amperes at 30V input, i think that a suitable boost/SEPIC would have to be able to at least handle 5 or 6 amps.

A "no frills" version would result in something like the old RFG3/STSS styles of supplies, that is, no sleep/boost mode stuff, no auto-off, etc. Only the tip-detection would still be there (and of course, still would not require a power-cycling as with these old original units).

What do you folks think about the placement of the output FET? Right now the whole thing is made so that it has to sit flat on a heatsink. Of course it can be made so that a heatsink has to be mounted vertically to the board.

Let me know what you guys think/want/prefer, and i see forward to it that the next step will include that as much as possible

Greetings,

Chris

Report to moderator Logged

Paulinho19

Contributor

Posts: 42

Country:

Re: DIY Metcal 13.56 MHz RF Supply

« **Reply #220 on:** June 12, 2013, 11:56:01 pm »

Say Thanks Reply Quote

Hi Chris,

for me it's the single board (10 x 15 cm) SEPIC, bases for example on this chip:

http://www.linear.com/product/LTC3805-5

The FET position is good, but the IRF510 is too close to his limits and it’s easy to kill them. I think a bigger (TO-247 for example for better heat transfer) and better (200V 10A) FET would be great, but I don't know if there exists one. Overkill is always appropriated.

My unit is 99% done, next week I will post some pics, videos and scopes.

Paulo

Report to moderator Logged

richard.cs

Re: DIY Metcal 13.56 MHz RF Supply

« **Reply #221 on:** June 13, 2013, 10:47:32 am »

Say Thanks Reply Quote

Frequent Contributor

Posts: 662
Country:

Electronics engineer from Southampton, UK.

My metcal handpiece just arrived and I was somewhat surprised by the connector. I *think* it mates with a normal F-type but it's not threaded, it grips with some kind of collet. Is this normal?

If it does fit the F to N type adaptor I have then I should have some impedance mesurements by the end of today.

Report to moderator Logged

mamalala

Supporter

Posts: 777
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #222 on:** June 13, 2013, 12:57:27 pm »

Say Thanks Reply Quote

Quote from: richard.cs on June 13, 2013, 10:47:32 am

> My metcal handpiece just arrived and I was somewhat surprised by the connector. I *think* it mates with a normal F-type but it's not threaded, it grips with some kind of collet. Is this normal?
>
> If it does fit the F to N type adaptor I have then I should have some impedance mesurements by the end of today.

Yes, it fits on a standard F connector. Untighten the collet, plug it in, then fasten with the collet.

Greetings,

Chris

Report to moderator Logged

richard.cs

Frequent Contributor

Posts: 662
Country:

Electronics engineer from Southampton, UK.

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #223 on:** June 13, 2013, 01:40:31 pm »

Say Thanks Reply Quote

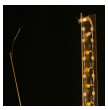
First measurements are in. At 13.56 MHz the handpiece with tip (STTC-147) looks like 42.3 + 13 j Ohms. So a 16 dB return loss / SWR of 1.4 in a 50 ohm system. Not too bad a match I suppose. I'll try and get some hot measurements done later and if I can maybe some of the tip alone. The handset alone looks like 280 pF.

Bear in mind that I haven't taken out the handpiece cable so the reactive components are what is measured looking into the F connector, not what actually exists at the tip end.

Report to moderator Logged

mikeselectricstuff

Super Contributor



Posts: 11971
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #224 on:** June 13, 2013, 02:06:39 pm »

Say Thanks Reply Quote

Quote from: mamalala on June 12, 2013, 05:17:01 pm

> Just in case:
>
> http://dangerousprototypes.com/2013/05/28/diy-metcal-13-56-mhz-rf-supply/
>
> A few things... For a few days i'm thinking where to go next with this project. There are several, not mutually exclusive, options:
>
> - Single board design that has everything on one PCB
> - A version that uses a boos or SEPIC converter, so it could work, for example, with a 12V supply
> - One that has "no frills", that is, basically just the RF board designed to work on its own from a single 26V minimum supply
>
> What do you folks think would be usable? In case of the boost/SEPIC option, i would rather prefer the SEPIC variant: This would allow to use a wide range of input voltages, below, equal and above to what the RF stage would need. However, i'm still looking for a suitable converter chip. Since the buck version already eats up to 3 amperes at 30V input, i think that a suitable boost/SEPIC would have to be able to at least handle 5 or 6 amps.
>
> A "no frills" version would result in something like the old RFG3/STSS styles of supplies, that is, no sleep/boost mode stuff, no auto-off, etc. Only the tip-detection would still be there (and of course, still would not require a power-cycling as with these old original units).
>
> What do you folks think about the placement of the output FET? Right now the whole thing is made so that it has to sit flat on a heatsink. Of course it can be made so that a heatsink has to be mounted vertically to the board.
>
> Let me know what you guys think/want/prefer, and i see forward to it that the next step will include that as much as possible
>
> Greetings,
>
> Chris

My thinking was to integrate the PSU, user interface, oscillator etc. using a MCU, promarily to minimise the part count - Microchip have recently brought out a PIC with built-in building-blocks for switchmode PSUs - I've not looked at it hard enough to see how useful it would be for this.
It would also be nice to have something that fits an off-the-shelf shielded/heatsink case - maybe

something like this:
http://www.evatron.com/index-pag-products-cid-13-sid-91-l-2.html
using PCB as front & rear panels.

Report to moderator Logged

Youtube channel:Taking wierd stuff apart. Very apart.
Mike's Electric Stuff: High voltage, vintage electronics etc.
Day Job: Mostly LEDs

richard.cs
Frequent Contributor
Posts: 662
Country:
Electronics engineer from Southampton, UK.

Re: DIY Metcal 13.56 MHz RF Supply - More impedance measurements
« **Reply #225 on:** June 13, 2013, 07:16:00 pm »
Say Thanks Reply Quote

I took some more measurements, including over temperature (using my recently calibrated British standard cigarette lighter)

Firstly, so far as I can tell there are no matching components in the handpiece, it it looks a bit capacitive when unterminated and measures about an ohm end-to end. It's possible there might be a series L and/or shunt C but I suspect there isn't and I'm just seeing the cable. At d.c. the tip itself looks like a dead short as expected.

Measurements at 13.56 MHz

	R	X	Equiv X	SWR	S11
Cold:	42.3	+13j	153 nH	1.4	-16dB
Warm (but below Curie temp):	55	-16j	730pF	1.1	-23 dB
Hot (above Curie temp):	12	+24j	280 nH	5.1	-3.4 dB

There's a gradual sweep from cold to warm that passes through a near perfect 50 Ohms, then there's a quick transition at the Curie temperature to a low impedance with a lot of inductance. Notice that even at this point return loss is still better than -3dB - more than half the power is absorbed, this is the reason for the current source drive - constant voltage drive from 50 Ohms would only give a 50% reduction in power when hot, not enough.

A design is forming involving generating the RF from a high voltage variable bus, I could phase-angle control the rectifier but has anyone got any experience using the PFC chips for this?

Report to moderator Logged

mamalala
Supporter

Posts: 777
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #226 on:** June 17, 2013, 10:50:34 am »
Say Thanks Reply Quote

Hi Richard,

thanks, that's quite interresting information.

I'm wondering if any of the many available coax sockets can fit on the cartridge. Then use a 3D-printer to make handpieces....

Greetings,

Chris

Report to moderator Logged

zoltan
Contributor
Posts: 35
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #227 on:** June 23, 2013, 08:09:55 am »
Say Thanks Reply Quote

Quote from: mamalala on June 17, 2013, 10:50:34 am

> I'm wondering if any of the many available coax sockets can fit on the cartridge. Then use a 3D-printer to make handpieces....

Recently, I've got a "solar charger" from ebay (don't ask why). It came with a lot of different connectors, one of the barrel shaped fits nicely to the cartridge.

Report to moderator Logged

laumingis
Newbie
Posts: 3

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #228 on:** June 27, 2013, 06:35:49 pm »
Say Thanks Reply Quote

Hi,

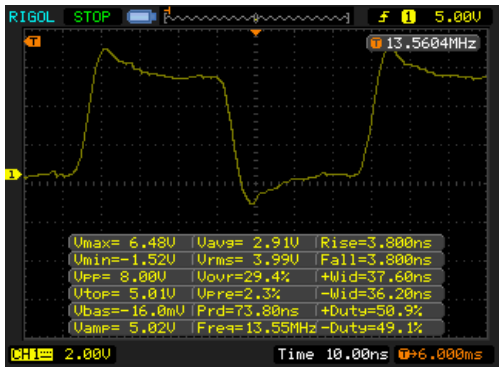
Finally I soldered everything up to oscillator and FET driver, but I get ISL55110IVZ heating up also,

even with no load at all (R8/R9 desoldered). After ~30 second with 12V on, it is getting too hot to keep the finger on the chip. As one chip is dead already, I would like to ask if generated vaweforms look ok at all (oscillator output and FEt driver output).

For 12/5V supply I use TSR 1-24120 and TSR 1-2450 converters.
Soldering seems to be ok, with no shorts.

P.S.: this very nice project!

--
Laumingis



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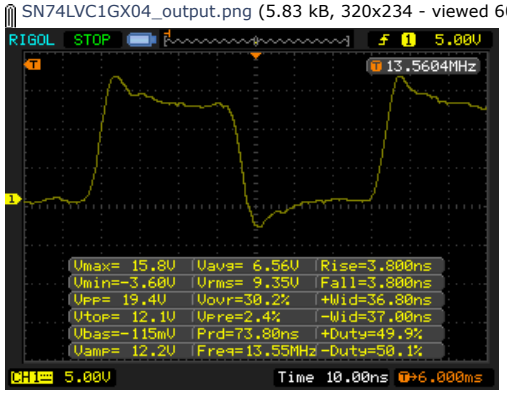


ISL55110IVZ_output.png (5.88 kB, 320x234 - viewed 494 times.)

Report to moderator Logged

mamalala
Supporter

Posts: 777
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #229 on:** June 29, 2013, 03:00:48 pm »
Say Thanks Reply Quote

Hmm, strange thing about the driver getting hot.

The waveforms look OK, however. I will check with my unit in the next days as i have time. So far i never noticed that it gets hot without any load.

Could check the two output channels simultanously? There are the 4.7 Ohms resistors R8 and R9. Desolder them and scope the two outputs to see if both are OK and in-phase (however, i doubt a problem there, otherwise you would not get that high of an output signal there anyways).

After all, that chip is not designed with a thermal pad and thus should be able to run "cool" without any load. But then, who knows...

Greetings,

Chris

P.S.: Zoltan, i have not forgotten about the toroids. I just had no time yet to look at it...

Report to moderator Logged

zoltan
Contributor
Posts: 35
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #230 on:** July 01, 2013, 03:13:24 pm »
Say Thanks Reply Quote

Re driver chip:

I managed to kill three (3) pcs, but I have some clues that may (or not) help troubleshooting.

(1) +5V connected, +12V not, no input signal - no heat
(2) +5V connected, +12V connected, no input signal - no heat
(3) +5v connected, +12V not connected, input signal connected - no heat
(4) +5v connected, +12V connected, input signal connected - very fast heat buildup, in circa 15 seconds ready for barbeque

All (1-4) tests done with R8, R9 not populated, eg. driver output hanging in thin air.

Chris, do you have a part number for the capacitors used on the supply lines of the driver chip? I suspect mine (and laumingis's) are not of adequate quality for this application.

--
Don't worry about toriods, I've run out of other parts to so I have to order new ones, but have to wait for salary. My biggest problem is the driver/heater now.

Report to moderator Logged

laumingis
Newbie
Posts: 3

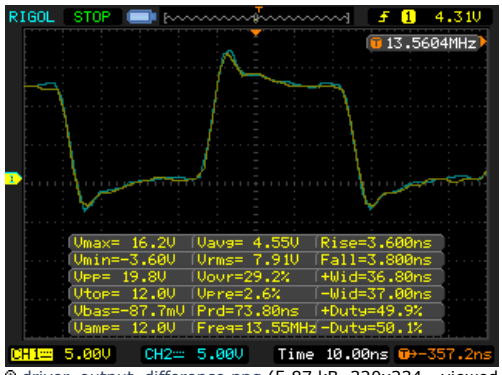
Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #231 on:** July 01, 2013, 06:00:25 pm »

Say Thanks Reply Quote

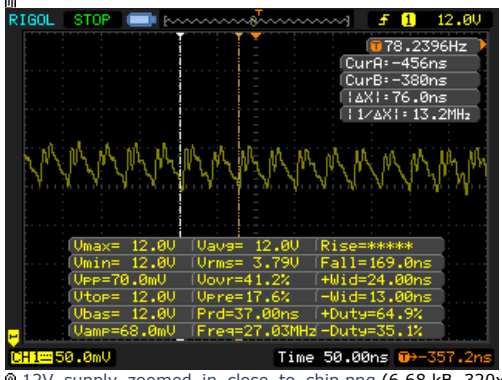
Hi,

Done some measurement with osciloscope, without R8, R9 (they were not soldered in my first post also).
Power supply measurements are with only one driver input connected: then chip gets only slightly warm. I guess I'll proceed from here and try to connect FET to one output only.

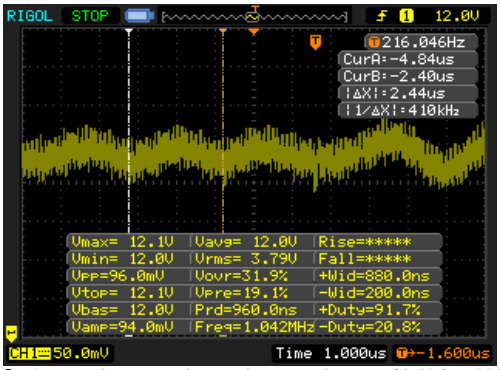
--
Laumingis



driver_output_difference.png (5.87 kB, 320x234 - viewed 404 times.)



12V_supply_zoomed_in_close_to_chip.png (6.68 kB, 320x234 - viewed 383 times.)



12V_supply_zoomed_out_close_to_chip.png (6.69 kB, 320x234 - viewed 422 times.)

Report to moderator Logged

zoltan
Contributor
Posts: 35
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #232 on:** July 01, 2013, 07:42:55 pm »
Say Thanks Reply Quote

Quote from: laumingis on July 01, 2013, 06:00:25 pm

> Hi,
>
> Done some measurement with osciloscope, without R8, R9 (they were not soldered in my first post also).
> Power supply measurements are with only one driver input connected: then chip gets only slightly warm. I guess I'll proceed from here and try to connect FET to one output only.

Hi Laumingis,

Try to add one more cap in parallel to C11 and one to C12. Then check the 12V line again (between the chip and the cap). That should smooth the supply and maybe resolve the heating problem. I suspect that the heating is due to "dirty" 12V.

br, Z

Report to moderator Logged

mamalala
Supporter

Posts: 777
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #233 on:** July 01, 2013, 09:59:55 pm »
Say Thanks Reply Quote

Hi,

as for the caps, the parts that i use are from RS-Online:

100n, 50V, X7R, 0805 264-4416
4µ7, 25V, 1206 723-6679

Besides those, in the power supply section i have:

100µ, 50V, Electrolytic 758-1272
10µ, 50V, X7R, 1210 723-6824
150µ, 16V, 716-7100

I did a quick check on my unit today. The driver does not get hot, and that is in normal operation with HF output enabled. It gets mildly warm, that's all. I have a small dab of thermal paste between the chip and the PCB. But even on my initial prototype, where i had no such paste applied, it never got really hot. I will ask a friend of mine, who got one from me as well, how his unit behaves. I'm sorry that i can't give absolute temperatures, i simply don't have a suitable thermometer at hand...

Greetings,

Chris

Edit: please also keep in mind that all the units i built use the design with the switchmode regulators for the 5/12 volt rails.

Report to moderator Logged

mamalala
Supporter

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #234 on:** July 01, 2013, 10:18:45 pm »
Say Thanks Reply Quote

Quote from: laumingis on July 01, 2013, 06:00:25 pm

Posts: 777
Country:

Hi,

Done some measurement with osciloscope, without R8, R9 (they were not soldered in my first post also).
Power supply measurements are with only one driver input connected: then chip gets only slightly warm. I guess I'll proceed from here and try to connect FET to one output only.

--
Laumingis

Hi Laumingis,

that there is some ripple should be expected. The roundabout 70mV are also what is expected from the specs given by the converter that you use. However, that you have ripple with twice the frequency that the unit operates is rather strange, i think.

Do you have a lab supply? If so, can you try and supply the unit with 5 and 12 volts from that? Right now i guess that something about the supply generation is somehow wrong. But then, it's only a wild guess...

I'm wondering what Paulo's experience is with the driver chip. He had trouble with blowing the FET, which was then solved after i sent him a set of torroids from my source here. But IIRC he never said anything about the driver chip.

Greetings,

Chris

Report to moderator Logged

laumingis

Newbie

Posts: 3

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #235 on:** July 20, 2013, 06:27:58 am »

Say Thanks Reply Quote

Hi,

Finally I've got some time to work on this, and finally everything is working properly now!

I am not sure what helped with driver heating:
a) I added parallel capacitors to C10, C11, C12. It did smooth out power supply a little, but heating was still here
b) I added low esr electrolytic caps on 5 and 12 V rails, still heating
c) Used separate power supply, as 30V power supply was oscilating a little under load
d) Shortened wires from dc-dc converters to rf board
e) Did not use any thermal paste under the chip
f) Stopped measuring driver temperature with my fingers, which was probably the main issue. I have a feeling that it was the main problem, maybe driver picks some noise from my body and starts heating.

After I've "implemented" part f), i now use both channels on the driver again, it is ok. Also I went back to single power supply, just use one additional LC filter before dc-dc converters, just in case. Now if i still touch driver with my fingertip, it feels like it is warm at best, and it is heating up instantly. I even bought a IR temperature thermometer for this, but, unfortunately, it has too wide measurement area to accurately measure this tiny chip (this laser diode in small distance is useless and misleading). Anyway, it does show some temperature increase, but nothing serious.

When I solved driver issue, I fried some FETs, of course. I was a little scarred at first, because I use the same XFMR core from RS as Paulinho had problems with. But it looks like FET was just overheating: after I added thermal paste under it, everything became ok.

So in the end I am very happy: finally I have a decent solder iron. To solder this board I used cheap unregulated one with 6 mm tip. It was my first smd work as well, and now I prefer it to through the hole type.

Thank you, Chris, a lot for this project, it is really great. Also thanks to Paulinho, who supplied PCB to me. And everyone else, who contributed to this.

--
Happy and proud
Laumingis

Report to moderator Logged

mamalala

Supporter

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #236 on:** August 30, 2013, 03:12:54 pm »

Say Thanks Reply Quote

Posts: 777
Country:

Hi all,

just to let you know, i got a metcal Talon tweezer a few days ago, and it works just fine with this supply. Now if i could just find a Metcal desolder gun for cheap to test ....

Greetings,

Chris

Report to moderator Logged

ee.jmlp
Contributor
Posts: 39
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #237 on:** September 26, 2013, 12:18:42 pm
»

Say Thanks Reply Quote

Hello,
Thank you very much mamalala (and others who participated) for freely sharing your work.
I'm going to embed the whole system in a single psoc and I'll use a full bridge rf inverter with filtered output to avoid "from no load to load" changes in the output.
A shunt resistor or a hall sensor to measure the current the output uses will tell me the power output. (If current is constant, then a voltage divider)

What do you think? Did you try anything similar?

« Last Edit: September 26, 2013, 10:58:08 pm by ee.jmlp »

Report to moderator Logged

-->

Yeah buddy!

ee.jmlp
Contributor
Posts: 39
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #238 on:** September 26, 2013, 12:41:24 pm
»

Say Thanks Reply Quote

What do you think about this minimonster for the full bridge?

IRFB4212PBF
Look at the switching characteristics, rated for 15A and 10Vp in the gate
Less current and higher gate voltage (15v) would make it even faster.

When you talk about constant current, how much is that constant current? As Metcal talks about its constan current I need to know if it's fixed.
And Peak-to-Peak voltage at max load (heating up)? I hope the max power output depends on max voltage in the current regulator.

Thank you very much.

« Last Edit: September 26, 2013, 11:03:00 pm by ee.jmlp »

Report to moderator Logged

-->

Yeah buddy!

ee.jmlp
Contributor
Posts: 39
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #239 on:** September 28, 2013, 11:48:01 am
»

Say Thanks Reply Quote

I have another question,
why didn't you use for L3 L4 and L5, 560nH 780nH and 250nH rf power inductors?
These are standard values. I used the Al constant * turns^2 in each core to calculate the equivalent inductance.

The RS code for the transformer is 467-4267

Thank you.

Report to moderator Logged

-->

Yeah buddy!

ee.jmlp
Contributor
Posts: 39

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #240 on:** September 29, 2013, 12:50:03 am
»

Say Thanks Reply Quote

Country:

I've been Reading problems about power losses in the switcher. Why dont you use a good TVS?
A RC snubber could have resonation related problems (if it's not well calculated as in the 99% of the times).
On the other hand a good TVS will continue to dissipate the exceeding power in the other case the resistor, the transistor and the esr of the capacitor would dissipate.

For example SMAJ110A, the parasitic capcitance of the diode is nearly null for the application.

And the same goes to the output of the mosfet driver, a good tvs rated at 5V would help to cool down the driver in 0ohm resistor condition.
Basically I use TVS's to avoid reflections.

I saw another thing, in the toroids I saw no litz wire, the wire diameter you use is a waste for 13.56MHz due skin effect in the conductor and so the DC resistance is really higher tan you expected, lowering the overall efficiency.

But all is theory, sometimes real life is like science fiction

Report to moderator Logged

-->

Yeah buddy!

mamalala

Supporter

Posts: 777
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #241 on:** September 29, 2013, 08:26:41 am

Say Thanks Reply Quote

»

> **Quote from: ee.jmlp on September 26, 2013, 12:18:42 pm**
>
> I'm going to embed the whole system in a single psoc and I'll use a full bridge rf inverter with filtered output to avoid "from no load to load" changes in the output.

What "from no load to load" changes are you talking about?

> **Quote from: ee.jmlp on September 26, 2013, 12:18:42 pm**
>
> A shunt resistor or a hall sensor to measure the current the output uses will tell me the power output. (If current is constant, then a voltage divider)
>
> What do you think? Did you try anything similar?

I'm not convinced that it is necessary to use a full bridge in this application. Not only does it introduce more parts in the output driver stage that can fail, it also would require more power in the driver to drive the FET's (assuming you want FET's in the full bridge).

> **Quote from: ee.jmlp on September 26, 2013, 12:41:24 pm**
>
> What do you think about this minimonster for the full bridge?
>
> IRFB4212PBF

You did notice that this FET ist for digital audio amplifier applications, right? And you also notcied what they show in the datasheet for the gate charge and input/output capacitances? Also, during heatup the RF voltage is way over 100 volts, i doubt that a 100 volt FET is the best choice in such a bridge, if you want it to drive the tip cartridge more or less directly.

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> When you talk about constant current, how much is that constant current? As Metcal talks about its constan current I need to know if it's fixed.
> And Peak-to-Peak voltage at max load (heating up)? I hope the max power output depends on max voltage in the current regulator.

I lack the tools to do any RF meassurements that go beyond looking at the output waveform on a scope. But generally i assume that "constant" somehow means "fixed", because otherwise it would be variable, right? But then i think that there is more to it than just constant current. This is RF, were we have to deal with stuff like impedance mismatch and thus reflections when the tip changes temperature, the latter being able to easily kill the RF final FET. But then, i'm not a RF wiz, so it is quite probable that i misunderstand a few things.

> **Quote from: ee.jmlp on September 28, 2013, 11:48:01 am**

> I have another question,
> why didn't you use for L3 L4 and L5, 560nH 780nH and 250nH rf power inductors?

I thought about using ready made inductors. But they are much harder to get than standard toroids that are on the market for decades already, and thus have a really good availability. Plus, during development of the circuit it is much more useful and cheaper to simply rewind a toroid instead of buying lots of different fixed value inductors. Keep the DIY aspect of this in mind. It is important to use parts that have a rather good availability. Generic standard toroids and a bunch of magnet wire is far easier to get than some specific type and brand of fixed RF inductors. And most likely much cheaper too.

> **Quote from: ee.jmlp on September 28, 2013, 11:48:01 am**
>
> The RS code for the transformer is 467-4267

Thanks for proving my point about standard stuff. That part is no longer available at RS in Germany, for example. It says that they no longer have it in their product line. So it's just a matter of time until it is no longer available at other RS outlets as well, i guess. OTOH, the T-* and FT-* toroids are supposedly more standard (although there have been problems), and are on the market for a really long time by now.

> **Quote from: ee.jmlp on September 29, 2013, 12:50:03 am**
>
> I've been Reading problems about power losses in the switcher. Why dont you use a good TVS?

What power losses in the switcher? You mean the DC/DC converter? Or the RF final? The DC/DC is just fine, and normally so is the RF final once the right parts are used in the output filter stage.

> **Quote from: ee.jmlp on September 29, 2013, 12:50:03 am**
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Too bad that there is no RC snubber to be found anywhere in this circuit.

> **Quote from: ee.jmlp on September 29, 2013, 12:50:03 am**
>
> On the other hand a good TVS will continue to dissipate the exceeding power in the other case the resistor, the transistor and the esr of the capacitor would dissipate.
>
> For example SMAJ110A, the parasitic capcitance of the diode is nearly null for the application.

So, in a constantly running RF circuit you propose to use a TVS that has a 0.01% duty cycle specified? The whole point of the circuit is to have a control loop that avoids generating excess RF power in the first place.

> **Quote from: ee.jmlp on September 29, 2013, 12:50:03 am**
>
> I saw another thing, in the toroids I saw no litz wire, the wire diameter you use is a waste for 13.56MHz due skin effect in the conductor and so the DC resistance is really higher tan you expected, lowering the overall efficiency.

You did read the thread, did you? You had a look inside an original Metcal unit, right? You looked at, lets say, 50 watts HAM radio's output stages, right? Are you saying they all do it wrong by using solid magnet wire? We are not talking about hundreds of watts or even kilowatts here. Plus, the inductors don't get that hot, so there seems to be no issue there at all.

Keep in mind that one goal of my circuit was to simplify things and to use parts that are relatively cheap, trying to avoid speciality stuff as much as possible. But of course you are welcome to design your own circuit in any way you like. After all, that's the whole point of DIY.

Greetings,

Chris

Report to moderator Logged

ee.jmlp
Contributor
Posts: 39
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #242 on:** September 29, 2013, 12:27:43 pm »

Say Thanks Reply Quote

> **Quote from: mamalala on September 29, 2013, 08:26:41 am**

What "from no load to load" changes are you talking about?

I'm not convinced that it is necessary to use a full bridge in this application. Not only does it introduce more parts in the output driver stage that can fail, it also would require more power in the driver to drive the FET's (assuming you want FET's in the full bridge).

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Greetings,

Chris

Thank you for your time, first of all "from load to no load" I meant when you take out the tip, in a constant current regulator the sudden change in an open circuit tends to overshoot the voltaje too much.

A H-bridge in rf is really complicated but once done it allows you control the current directly from the bridge, the shunt resistor with an integrator would show the current. Think the integrator must not to be so fast because of the thermal inertia of the tip but fast enough to not to burn the TVS is in antiparallel with the + and the - of the bridge.

Forgive that mosfet, other talked about another much better, the IRFB4019. Note that is a "digital" audio amplifier, that means it controls the current in the speakers by varying the dutty cycle in a switching frequency much higher tan the audio frequency. Faster times, better efficiency. The mosfet I talked about was for the same purpose but its worse talking about speed and gate charge. They are designed for hard switching and that means a TVS is necessary(or a rc snubber).

I agree with you about the toroids.

Power losses at the switcher I meant the IRF510. Someone talked about an rc snubber that's all. I've seen lots of rf stages dying because of a lack of a TVS.

The control loop controls the excess of the power but it has a time constant orders of magnitude higher than the response time of a TVS. TVSs only acts when the voltage goes over a value, see it as a hyperfast zener.

Yeah they are wrong by using solid magnet wire but it's not a significant problem, the current is not high. Litz wire can be made with thin enameled copper wire.
The heatup time would decrease with litz wire, and the efficiency would increase. If you have the time

try it! enameled AWG40 is enough. I would like to compare theory with reality although skin effect is reality too.

Pleased.

Report to moderator Logged

-->

Yeah buddy!

ee.jmlp
Contributor
Posts: 39
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #243 on:** September 29, 2013, 12:40:45 pm
Say Thanks Reply Quote
»

I did the worng way, I bought the fixed inductors instead of buying the toroids I can't find..... hope I not to have much problems.
(sorry for the spelling)

Report to moderator Logged

-->

Yeah buddy!

mamalala
Supporter

Posts: 777
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #244 on:** September 29, 2013, 01:14:39 pm
Say Thanks Reply Quote
»

Quote from: ee.jmlp on September 29, 2013, 12:27:43 pm

> Thank you for your time, first of all "from load to no load" I meant when you take out the tip, in a constant current regulator the sudden change in an open circuit tends to overshoot the voltaje too much.

That's a non-issue here, since there is circuitry to detect a faulty/missing tip which turns off the RF stage then. This is true for the original as well as my circuit, just that mine automatically restarts once the fault condition is gone. Plus, the maximum possible output voltage from the DC/DC to the output stage is limited in this circuitry.

Also, as i said i'm not that convinced that the basic principle for the regulation here is only about constant current. The peak detector picks up the RF voltage right before the last inductor. But the voltage at that point also varies depending on the reflected RF energy. You can see that if you drive the RF stage with, lets say, only 9 volts or so (to avoid blowing up the FET) without the control loop, then enable it and connect/disconnect a 50 ohm dummy load. If my half-broken digital scope didn't play silly tricks on me, then the voltage at that point rises when no dummy load is connected. This must be reflected RF, since in an open circuit very little current could flow...

Quote from: ee.jmlp on September 29, 2013, 12:27:43 pm

> A H-bridge in rf is really complicated but once done it allows you control the current directly from the bridge, the shunt resistor with an integrator would show the current. Think the integrator must not to be so fast because of the thermal inertia of the tip but fast enough to not to burn the TVS is in antiparallel with the + and the - of the bridge.

Well, it still is far more compicated compared to the simple method that is used now, namely a very simply RF generator plus filter stage, where the output power is controlled by the supply voltage to it. If i would redo the circuit, i would keep the basic principle the same, but then use a beefier output FET, like the IXYS IXFH12N50F (or comparable) tthat is used in the newer Metcal supplies. Question is just if the currently used driver chip has enough juice to drive it, or if a different driver would be needed.

Quote from: ee.jmlp on September 29, 2013, 12:27:43 pm

> Forgive that mosfet, other talked about another much better, the IRFB4019. Note that is a "digital" audio amplifier, that means it controls the current in the speakers by varying the dutty cycle in a switching frequency much higher tan the audio frequency. Faster times, better efficiency. The mosfet I talked about was for the same purpose but its worse talking about speed and gate charge. They are designed for hard switching and that means a TVS is necessary(or a rc snubber).

I know how digital amplifier stages work. But they don't use such a high frequency. Usually they operate in the upper 100s of kHz to very low MHz regions. Plus, they usually also need LC filtering to restore the actual AC waveform. Very crude ones use the inductance of the actual speaker as part of that filtering, though.

In the end you would still need good filtering after the full bridge, the only difference then would be the use of said bridge instead of a single FET and transformer.

Quote from: ee.jmlp on September 29, 2013, 12:27:43 pm

> I agree with you about the toroids.
>
> Power losses at the switcher I meant the IRF510. Someone talked about an rc snubber that's all. I've seen lots of rf stages dying because of a lack of a TVS.

Well, RF power stages usually die because of too much reflected power due to a impedance mismatch. (EDIT: That is assuming that the finals are not driven beyond their rating even with a correct load impedance.) There are only two sensible ways, IMHO, to remedy that: either match the load impedance, thus reducing the amount of reflected RF (not possible in this application), or reduce the output power accordingly to protect the RF final (which is what is done here). Slapping some TVS diodes into the circuit just covers the symptoms but does nothing to correct the actual problem.

> **Quote from: ee.jmlp on September 29, 2013, 12:27:43 pm**
>
> The control loop controls the excess of the power but it has a time constant orders of magnitude higher than the response time of a TVS. TVSs only acts when the voltage goes over a value, see it as a hyperfast zener.

Yes, TVS's are fast. But the actual regulation is not that slow either. It is definitely fast enough to protect the output stage quite well. Keep in mind that the transition is not infinitely quick. As the tip heats up there is a more or less gradual change over time, as you can see in the graphs that i posted in this thread.

Heck, the only instance where there would be a real sudden change is when the tip is removed during opertaion, due to the time constant in the tip-detection circuitry. But even that is short enough to protect the RF stage well enough.

> **Quote from: ee.jmlp on September 29, 2013, 12:27:43 pm**
>
> Yeah they are wrong by using solid magnet wire but it's not a significant problem, the current is not high. Litz wire can be made with thin enameled copper wire.
> The heatup time would decrease with litz wire, and the efficiency would increase. If you have the time try it! enameled AWG40 is enough. I would like to compare theory with reality although skin effect is reality too.

While i did not try litz wire in this circuit, i did play around with different supply voltages to the RF stage, which in turn also effectively pumps more or less power into the tip. There is a point after which it makes very little to no difference in the heatup/heat-recovery time. Again, the fact that the inductors don't produce excessive heat shows that the losses in them are not that big. And even then an argument can be made that the core losses contribute the majority to the heat production. Initally i used a smaller ferrite toroid for the transformer, which then got rather warm. Using a bigger one helped with that, while the wire was the same. So, again, these losses are definitely bigger in the core than the wire.

Maybe you want to contact the manufacturers of such HAM transmitters, as well as Metcal, and tell them they are wrong, or ask them why they used solid wire instead litz wire? Would be interresting to hear their take on the issue

Greetings,

Chris

« *Last Edit: September 29, 2013, 01:18:22 pm by mamalala* »

Report to moderator Logged

ee.jmlp
Contributor
Posts: 39
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #245 on:** September 29, 2013, 02:01:59 pm »

Say Thanks Reply Quote

They're simply wrong in terms of efficiency and performance, the only significant reason is money.

Litz wire is a must in todays high frequency, high power converters and switching devices, IEEE archives are flooded with that: theory, experiments, re-produced experiments, raw data and whatever you want. You only need to have privileges to access all of its content.

In the end, a constant current regulator would automatically adjust the output voltage in any load scenario and so regulating the reflected power. A TVS works beyond the regulator limits, only for hard switching spikes, not for the overall reflected power.

The response time of your regulator is greater than 4.5us, that means the mosfet eats more than 62 cycles of overvoltage conditions in the transition of the curie point.
A TVS here not only eats the switching spikes (**you can't see them without a differential probe**), it will absorbs more than 4.5us of overvoltage conditions.

The response time of the TVS are few ps, no more than 100ps, enough. The control loop is necessary,

tvs only improves security at the mosfet where the control loop does not respond.
Pleased.

« *Last Edit: September 29, 2013, 07:34:33 pm by ee.jmlp* »

Report to moderator Logged

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Yeah buddy!

megajocke
Regular Contributor

Posts: 185
Country: 00

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #246 on:** October 03, 2013, 10:12:34 pm »

Say Thanks Reply Quote

The individual strand diameter of litz wire needs to be small compared to the skin depth or else the proximity effect losses will be high. At 13 MHz the skin depth in copper is about 20 µm. AWG40 has an 80 µm diameter.

For example, a 100 strand AWG40 litz wire has a copper cross section of 0.5 mm^2. If you use that you'll have a winding with effectively 10 layers and proximity effect losses will give you an Rac/Rdc of more than 100! (see the Dowell plot at http://en.wikipedia.org/wiki/Proximity_effect_%28electromagnetism%29 for example) So your 100 strand litz wire will actually have higher resistance than even a single (40 AWG) strand of the same!

A single layer winding made out of thick solid wire is more practical than litz wire at such frequencies.

Report to moderator Logged

zoltan
Contributor

Posts: 35
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #247 on:** October 04, 2013, 05:43:16 am »

Say Thanks Reply Quote

Well, I don't know much about RF so I can comment what I've been told.
I've been told by a engineer who has built couple of high power (hundreds kilowatt range) transmitters for his former company (http://www.riz.hr/en/transmitters.html) that building coils for that level of power is a heavy plumber work. The coils are built from large diameter copper pipes.
I think that confirm megajoke's post about loses in litz wire.

Report to moderator Logged

ee.jmlp
Contributor

Posts: 39
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #248 on:** October 06, 2013, 09:04:40 pm »

Say Thanks Reply Quote

Quote from: megajocke on October 03, 2013, 10:12:34 pm

> The individual strand diameter of litz wire needs to be small compared to the skin depth or else the proximity effect losses will be high. At 13 MHz the skin depth in copper is about 20 µm. AWG40 has an 80 µm diameter.
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>
> A single layer winding made out of thick solid wire is more practical than litz wire at such frequencies.

Nobody talked about a 100 strand of foolish nolitz wire. AWG40 was just a starting point because is easy to find, better if you find a litz one.

You can not add as many wires as you want, it's a compromise.
Read at the end of the paragraph "effects":

http://en.wikipedia.org/wiki/Proximity_effect_%28electromagnetism%29

Large diameter copper pipes are far cheaper than litz and much better for cooling where the space is not a limiting factor...

As I said, it's a compromise, let's raise the bar a notch:
http://thayer.dartmouth.edu/inductor/papers/litzj.pdf

http://ieeexplore.ieee.org/xpl/login.jsp?tp=&arnumber=1407989&url=http%3A%2F%2Fieeexplore.ieee.org%2Fiel5%2F63%2F30533%2F01407988

Well, that's all I'm going to talk about this matter

Pleased.

« *Last Edit: October 06, 2013, 09:08:12 pm by ee.jmlp* »

Report to moderator Logged

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Yeah buddy!

megajocke
Regular Contributor

Posts: 185
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #249 on:** October 06, 2013, 09:57:41 pm »

Say Thanks Reply Quote

> **Quote from: ee.jmlp on October 06, 2013, 09:04:40 pm**
>
> Nobody talked about a 100 strand of foolish nolitz wire. AWG40 was just a starting point because is easy to find, better if you find a litz one.

Huh? *You* suggested using litz wire made out of AWG40 strands, and this was the configuration I was talking about.

According to the Dartmouth reference "Many manufacturers cannot provide litz wire using strands finer than 48 or 50 AWG.". Even such thin strands (0.025 mm) will not be very effective at 10 MHz+ because you will need so many of them for any reasonable cross section and the proximity effect losses will be large.

Report to moderator Logged

ee.jmlp
Contributor

Posts: 39
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #250 on:** October 06, 2013, 10:09:50 pm »

Say Thanks Reply Quote

> **Quote from: megajocke on October 06, 2013, 09:57:41 pm**
>
> > **Quote from: ee.jmlp on October 06, 2013, 09:04:40 pm**
> >
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So you didn't read the pdf I posted. Read it carefully because it has all the answers you need.

« Last Edit: October 06, 2013, 10:11:30 pm by ee.jmlp »

Report to moderator Logged

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Yeah buddy!

megajocke
Regular Contributor

Posts: 185
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #251 on:** October 06, 2013, 10:34:40 pm »

Say Thanks Reply Quote

So what configuration do you suggest?

Report to moderator Logged

ee.jmlp
Contributor

Posts: 39
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #252 on:** October 07, 2013, 09:10:08 am »

Say Thanks Reply Quote

A copper pipe...

Let's stop spamming mamalala's work

Report to moderator Logged

-->

Yeah buddy!

mamalala
Supporter

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #253 on:** October 10, 2013, 01:39:45 am »

Say Thanks Reply Quote

Don't worry about spamming "my" work. First of all, i am not the original designer of the system used. Standing of the shoulders of others, as they say. Secondly, i very much welcome discussion of what improvements could be done to the little, simple circuit i made. And finally, since i am not an RF

Posts: 777
Country:

guy myself, i very much welcome any discussion about that stuff.

Personally? Yes, i am pretty sure that in (at least) this instance there is not much (if any) gain in using litz wire, compared to solid core wire. As said, any heatup that i could note was pretty much only in the cores themselves. This is most obvious with the transformer on the ferrite core. Simply using a bigger core got rid of most of the heat, while still using solid core wire. This is proof positive that the core itself has much more influence than the type of wire used.

Plus, most of the manufacturers of radios out there use solid core wire as well. Yea, some might say they are all wrong, but i highly doubt it. Theory is one thing, practice is another. Sure, you may get rid of a small amount of losses by using litz wire, but the cost of doing so is probably much higher than the cost of the actual losses. After all, companies are not charities. If they could make something that gives them an advantage over their competitiors, they will do it. But since rarely anyone uses litz wire in such applications, i have to assume that the cost/benefit ratio is heavily tilted towards simple solid core wire here.

But hey, that is just what i think. Build it using litz wire, and let's see how it compares. I'm always open to that kind of stuff. But you have to show me substantial data to change my mind. So, unless someone builds the circuit as is, plus another one using litz wire, and then compares them and finds substantial benefits for litz wire, i will stick to my preliminary conclusion that the type of wire simply does not matter that much, if at all.

Greetings,

Chris

Edit: To make it clear: I really mean same circuit. That is, same parts, same layout, everything the same, except for the inductors and transformer in the RF path. Then show what the actual differences are. Does it heat up half a second faster due to less losses? Does it consume a few miliamperes less current to achive the same output on the same tip cartridge? If so, what is the price difference between that litz wire and solid core? Solid core is bog standard and cheap. Litz wire, not so much. At least for RF applications. There is no gain in saving one buck in electricity during the lifetime of the thing, when using litz wire costs 2 bucks more... Heck, even if i save one buck and the litz wire costs me one buck extra, i have saved nothing at all.

Keep in mind that this project is meant to be built by others without resorting to too many exotic parts. The FET driver is already quite exotic, but still readily available. Some specific litz wire is (in my experience) much harder to come by, compared to regular magnet wire....

« Last Edit: October 10, 2013, 01:49:52 am by mamalala »

Report to moderator Logged

AndersAnd

Frequent Contributor

Posts: 568
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #254 on:** October 11, 2013, 05:35:14 pm »

Say Thanks Reply Quote

Quote from: mamalala on March 24, 2013, 01:13:06 am

> while working on some magic-8-ball type of addition to the code (hey, i try to predict the actual tip....), i noticed some quite dramatic differencies between original Metcal cartridges and their Thermaltronics equivalnt. While i have only 3 types of equivalent Thermaltronic tips, the trend is quite visible!...

Hi mamalala and everyone else,

This is a great DIY-project which I have been following for a long time. I just haven't signed up until today.

I'm a great fan of the Metcal soldering system after having tested several high end systems at work before we decided to buy Metcal MX500 soldering stations for everyone to replace outdated Weller stations. Everyone agreed MX500 was by far the best system tested compared to Pace, Weller and a few other brands I can't recall. Only problem after some time was that a lot of Metcal tips died prematurely, so they couldn't heat up at all. This is however a big issue since the Metcal tips are quite expensive, but we did get all the dead tips replaced under warranty by our distributor. Not sure if Metcal has since fixed this issue, as I don't work there anymore and it was about 15 years ago.

Anyway enough about that, the reason for this post was I wanted to inform you guys that Thermaltronics is also sold rebranded as EasyBraid:
http://www.easybraidco.com/hand-soldering-c-3-l-en.html
http://www.thermaltronics.com/products.php

As you can see the EasyBraid rebranded soldering stations are still named 9000S, 5000S and 2000S series respectively, just like their Thermaltronics equivalents.

I found out about the rebranded Easy Braid systems while browsing the DigiKey website. DigiKey sell both Metcal and EasyBraid but not Thermaltronics.

EasyBraid at DigiKey: http://www.digikey.com/suppliers/us/easy-braid.page (you might have to

disbale AdBlockers at DigiKey.com for this page to show up)

EasyBraid is also sold at Amazon.com: http://www.amazon.com/s/ref=sr_st?lo=tools&keywords=EasyBraid&rh=n%3A228013%2Ck%3AEasyBraid&sort=-price

And at eBay
From USA (by http://gokimco.com): http://stores.ebay.com/Kimco-Distributing/?nkw=Easy%20Braid
From Germany: http://stores.ebay.com/ukpartsdeal/Sound-Vision-/?_nkw=EasyBraid

Thermaltronics doesn't seem to have a lot of resellers (yet?), so it's nice there's other sources like Amazon and a huge distributor like DigiKey for (rebranded) Thermaltronics tips, hand pieces etc.

EasyBraid Tips <-> Metcal Tips Cross References: http://www.easybraidco.com/cross-references.php?competitor=4
Thermaltronics Tips <-> Metcal Tips Cross References:
http://www.thermaltronics.com/references.php

EasyBraid EB9000S

Exact same picture as the below except for the brand sticker, looks like they have just photoshopped another name on:
Thermaltronics TMT-9000S

Newer picture, looks like they have changed the design of the handpiece holder:

Thermaltronics TMT-9000S

« *Last Edit: October 12, 2013, 06:07:52 am by AndersAnd* »

Report to moderator Logged

ee.jmlp
Contributor

Posts: 39
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #255 on:** October 14, 2013, 03:32:07 am »

Say Thanks Reply Quote

Quote from: mamalala on October 10, 2013, 01:39:45 am

Don't worry about spamming "my" work. First of all, i am not the original designer of the system used. Standing of the shoulders of others, as they say. Secondly, i very much welcome discussion of what improvements could be done to the little, simple circuit i made. And finally, since i am not an RF guy myself, i very much welcome any discussion about that stuff.

Personally? Yes, i am pretty sure that in (at least) this instance there is not much (if any) gain in using litz wire, compared to solid core wire. As said, any heatup that i could note was pretty much only in the cores themselves. This is most obvious with the transformer on the ferrite core. Simply using a bigger core got rid of most of the heat, while still using solid core wire. This is proof positive that the core itself has much more influence than the type of wire used.

Plus, most of the manufacturers of radios out there use solid core wire as well. Yea, some might say they are all wrong, but i highly doubt it. Theory is one thing, practice is another. Sure, you may get rid of a small amount of losses by using litz wire, but the cost of doing so is probably much higher than the cost of the actual losses. After all, companies are not charities. If they could make something that gives them an advantage over their competitiors, they will do it. But since rarely anyone uses litz wire in such applications, i have to assume that the cost/benefit ratio is heavily tilted towards simple solid core wire here.

But hey, that is just what i think. Build it using litz wire, and let's see how it compares. I'm always open to that kind of stuff. But you have to show me substantial data to change my mind. So, unless someone builds the circuit as is, plus another one using litz wire, and then compares them and finds substantial benefits for litz wire, i will stick to my preliminary conclusion that the type of wire simply does not matter that much, if at all.

Greetings,

Chris

Edit: To make it clear: I really mean same circuit. That is, same parts, same layout, everything the same, except for the inductors and transformer in the RF path. Then show what the actual differences are. Does it heat up half a second faster due to less losses? Does it consume a few miliamperes less current to achive the same output on the same tip cartridge? If so, what is the price difference between that litz wire and solid core? Solid core is bog standard and cheap. Litz wire, not so much. At least for RF applications. There is no gain in saving one buck in electricity during the lifetime of the thing, when using litz wire costs 2 bucks more... Heck, even if i save one buck and the litz wire costs me one buck extra, i have saved nothing at all.

Keep in mind that this project is meant to be built by others without resorting to too many exotic parts. The FET driver is already quite exotic, but still readily available. Some specific litz wire is (in my experience) much harder to come by, compared to regular magnet wire....

Heyyyy, I'm back I have good news!!
This last week I made the unit you uploaded in Eagle files with few custom mods, and taraaa, It Works!! (thank you this time mamalala to save me the design stage) I wanted to make something different but I have lots of work and no time. Own etching with in single side board and strong ground plane (0.4mm thick) on the other side pressed with epoxy.

I used fixed commertial inductors for the output filter and 3 custom made switched power sources with different adjustable voltages fixed in 5.1V, 12.6V, 27.5V outputs.
I get 21V (or more if I allow it) output in full power and 8.1V in idle.

8.1V in idle, I saw you get more than 13V in idle, mine heats up in 7s or less. It melts 40/60 and 99.3/0.7 like a champ. I'm amazed with this soldering iron and still cannot believe its awesomeness power

Maybe the difference is the tip and the room temperature. I wired the transformer with 4wires of 0.5mm dia each. I mean, you used two twisted wires, I used two twisted two twisted wires xD (2line litz wire <- thats litz, cheap enough).

NO heat in any component. Buck regulator warms but thats all. (The following days I'll connect the lcd w psoc controller).

Thank you very much again. I'll upload a photo tomorrow.

Report to moderator Logged

-->

Yeah buddy!

mamalala
Supporter

Posts: 777
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #256 on:** October 14, 2013, 01:57:08 pm »

Say Thanks Reply Quote

Hi ee.jmlp,

sounds great! Looking forward to see some pics, as well as some details about the used inductors and stuff.

Yes, the heatup times, idle-voltages, etc. depend on the type of tip used. Also, the length of the cable from the RF generator to the connector plays a role as well, as i have found out. Quite likely the type of cable used as well (i.e. RG58 vs. RG59, for example). As said, i lack the proper tools to do good RF meassurements, so i went with stuff that worked well. Theree sure is room for improvement. Also, you can adjust what voltages it idles or heats up at through the trimpots. As a rule of thumb, the lower the idle voltage, the longer it will take to recover from idle to full temp. I chose to have a rather quick response, and in addition put that sleep/boost stuff in the firmware to get some extra control over that.

Since so much depends on the circuitry/cabling, just looking at the supply voltage makes sense only if the comparison is done between more or less identical layouts and setups. For example, i'm pretty sure that the SWR "bridge" i added to the PCB is far from optimal, so it likely matters a lot how (or if at all) one implements such a thing. And as said, cables, etc. influence it as well. For example, if i simply increase the length of the cable between my PCB and the F-Connector to, lets say, twice the length, i get a higher idle voltage. Stands to reason that reducing the length would result in a alower idle voltage (but never tried it). The only "definite" thing that could be compared is what actually gets out at the F-Connector, while the used tip type and handle stays the same.

Greetings,

Chris

Report to moderator Logged

ee.jmlp
Contributor
Posts: 39
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #257 on:** October 14, 2013, 06:51:39 pm »
Say Thanks Reply Quote

Maybe I'm wrong with the term "idle".

I call idle when the tip reaches Curie point, power output goes down and tip stays hot. I need some time to fine adjust the feedback but I cannot see a moment with frozen tin. If I touch a 0.4mm thick copper plane it takes 2s to adsorb the tin in the copper.

I'll give you all of the details.

Report to moderator Logged

-->

Yeah buddy!

mamalala
Supporter

Posts: 777
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #258 on:** October 14, 2013, 07:45:21 pm »
Say Thanks Reply Quote

Quote from: ee.jmlp on October 14, 2013, 06:51:39 pm

> Maybe I'm wrong with the term "idle".
>
> I call idle when the tip reaches Curie point, power output goes down and tip stays hot. I need some time to fine adjust the feedback but I cannot see a moment with frozen tin. If I touch a 0.4mm thick copper plane it takes 2s to adsorb the tin in the copper.
>
> I'll give you all of the details.

Yes, that's what i refer to as idle as well I just found that if i set that voltage too low, it takes a little bit longer to recover if you hit a big copper area. After all, the tip does not act in a binary on/off fashion. There is still heat produced, due to losses in the coil and the metal/copper, so it regulates the output power down once it reached a bit above that curie point. At least that is how i understand what i can see and meassure here. But then again, my circuit is not perfect and i never really analyzed the original one to the level i did with my circuit. So there may well be some kinks in the finer details. But in the end it works, and that is all that matters, to me at least

Greetings,

Chris

Edit: And as mentioned in my previous post: There are other factors than just the tip that contribute to what the idle supply voltage is.

« *Last Edit: October 14, 2013, 07:47:27 pm by mamalala* »

Report to moderator Logged

AndersAnd
Frequent Contributor
Posts: 568
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #259 on:** October 15, 2013, 11:31:54 am »
Say Thanks Reply Quote

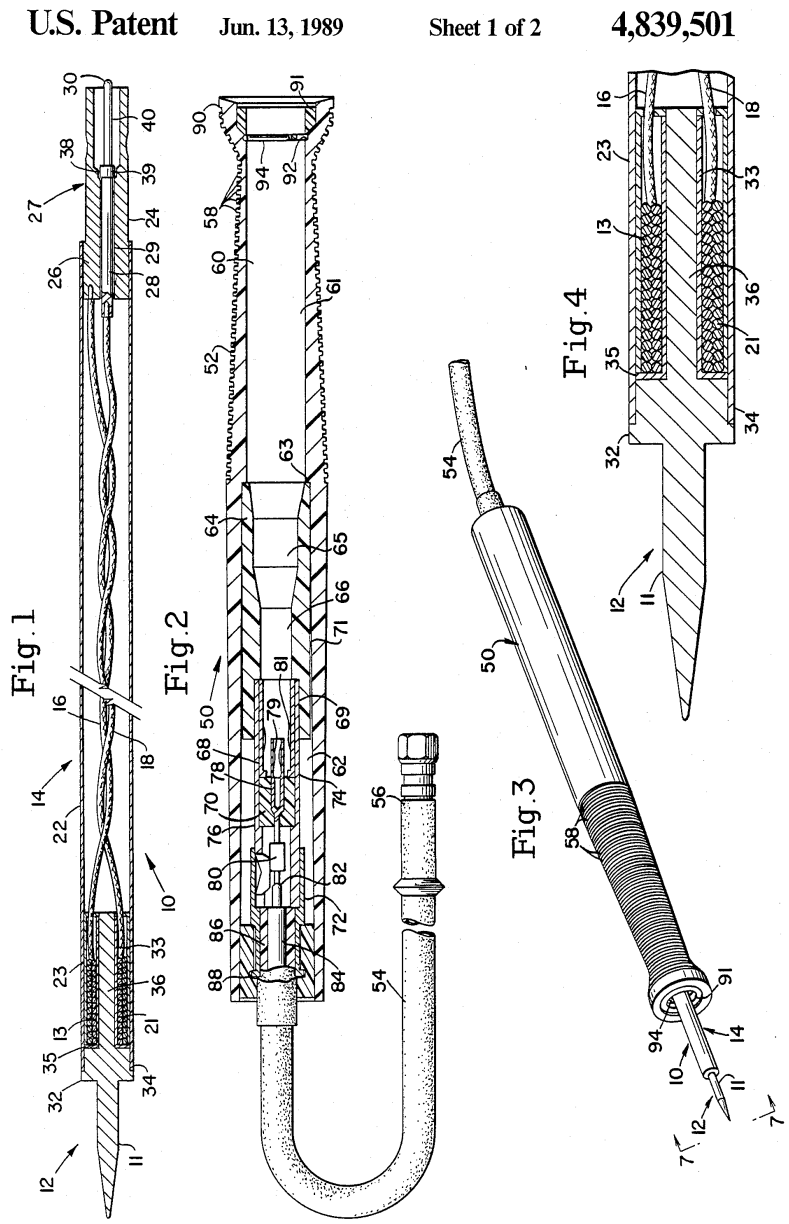
Quote from: mamalala on June 07, 2013, 11:25:12 pm

> As for the handpiece, the patent is
>
> http://www.google.com/patents/US4839501
>
> According to that patent there seems to be a capacitor in series to the tip cartridge.

Looks more like "position 80" is a feed-through capacitor with the capacitance in parallel with the tip cartridge.
Of course then the proximal lead of the feed-through capacitor is then in series with the inner wire (maybe that's what you meant by capacitor in series), but the capacitance is between the proximal lead and the housing of the feed-through capacitor, and the housing must be connected to the coax socket shield. You can see the feed-through capacitor housing touching the shield at one side in the patent drawing. So this means the capacitance is in parallel with the tip cartridge [or in other words between the inner wire and shield of the coax socket].

Quote

> Moving to the distal portion of socket assembly 68, inner socket 78 is electrically connected by solder to a lead of capacitor 80, which in turn has its proximal lead soldered to inner wire 82 of coaxial cable of coaxial cable 54.



The feed-through capacitor (80) inside socket assembly (68).

Metcal handpeice taken apart, where you can see the socket assembly (68):
http://electronics.stackexchange.com/questions/9071/fixing-a-broken-metcal-handpiece

« *Last Edit: October 15, 2013, 11:40:08 am by AndersAnd* »

Report to moderator Logged

AndersAnd

Frequent Contributor

Posts: 568

Country:

Re: DIY Metcal 13.56 MHz RF Supply

« **Reply #260 on:** October 15, 2013, 12:01:01 pm »

Say Thanks Reply Quote

Quote from: mamalala on June 17, 2013, 10:50:34 am

> I'm wondering if any of the many available coax sockets can fit on the cartridge.

Does the tips fit an SMB or SMC female connector?

SMB and SMC has similar outer and inner dimensions for the male plug, so if it fits one female, it might fit both.

http://www.rf-microwave.com/eng/catalog_view_category/95-smb-series-connectors.html

Quote

> **SMB series connectors**
>
> The miniature SMB connectors are used for internal connections in RF equipments with good performances up to microwave frequencies. SMB and SMC are similar and can be easily confused, SMB type has a snap-on coupling while SMC type is provided with a coupling nut like SMA. The SMB connector can be used up to 6 GHz.

http://www.rf-microwave.com/eng/catalog_view_category/98-smb-series-connectors.html

Quote

> **SMC series connectors**
>
> The miniature SMC connectors are used for internal connections in RF equipments with good performances up to microwave frequencies. SMB and SMC are similar and can be easily confused, SMB type has a snap-on coupling while SMC type is provided with a coupling nut like SMA. The SMC connector can be used up to 6 - 8 GHz and it is a good compromise between the SMA, from which has copied the screw coupling, and the SMB, from which has copied the small size.

I don't have a Metcal / Thermaltroincs tip at hand, what's the outer and inner diameter at the socket end? For SMB and SMC OD is 3.7 mm.

The socket end of the tips kind of looks like a male SMB connector without the groove or a male SMC connector without the threads:

All dimensions for SMB at the bottom: http://www.rfconnector.com/smb-connectors.php
All dimensions for SMC at the bottom: http://www.rfconnector.com/smc-connectors.php
« *Last Edit: October 15, 2013, 02:18:02 pm by AndersAnd* »

Report to moderator Logged

mamalala
Supporter

Posts: 777
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #261 on:** October 15, 2013, 02:11:20 pm »

Say Thanks Reply Quote

Hi AndersAnd,

quite possible that it is a feed-through cap. If any is there, it must be: there is basically a DC short when you meassure between shield and center pin of the F connector.

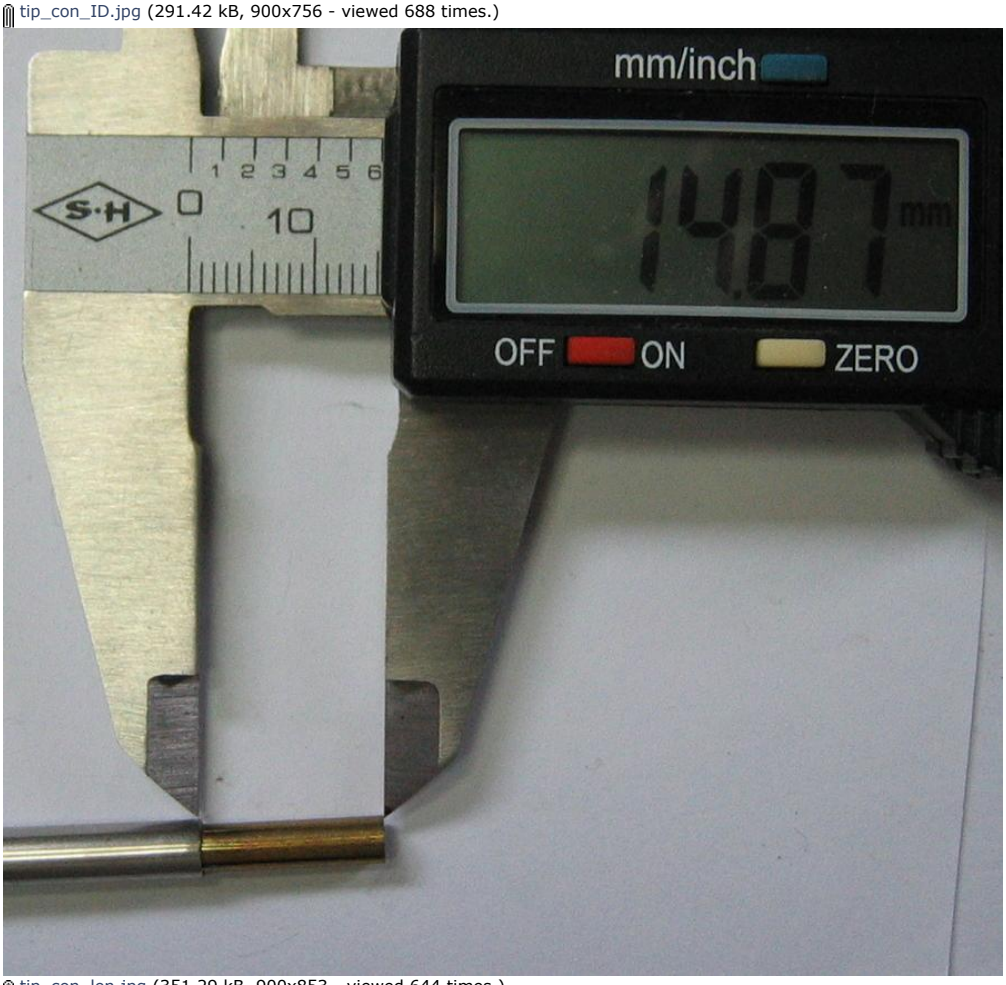
Attached are some images about the tip connector side with caliper meassurements (not 100% accurate, had to hold the stuff in one hand, and the cam in the other...)

Greetings,

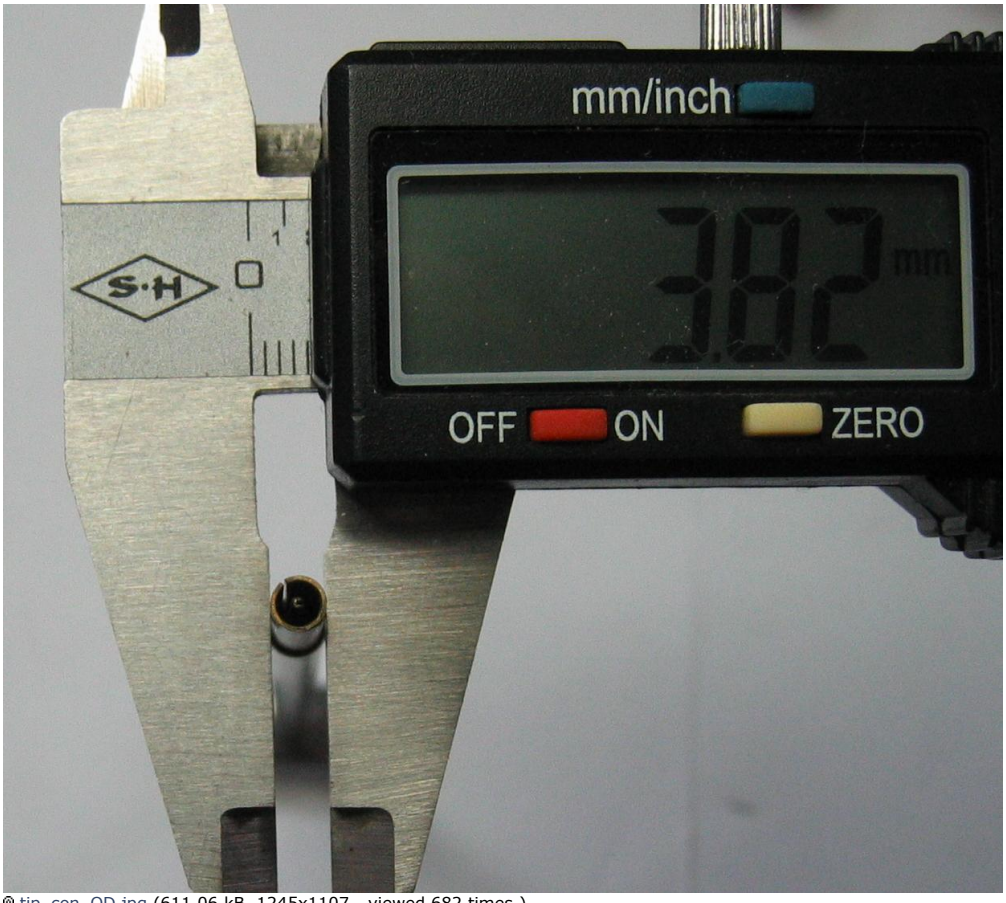
Chris

tip_con.jpg (238.19 kB, 678x885 - viewed 837 times.)

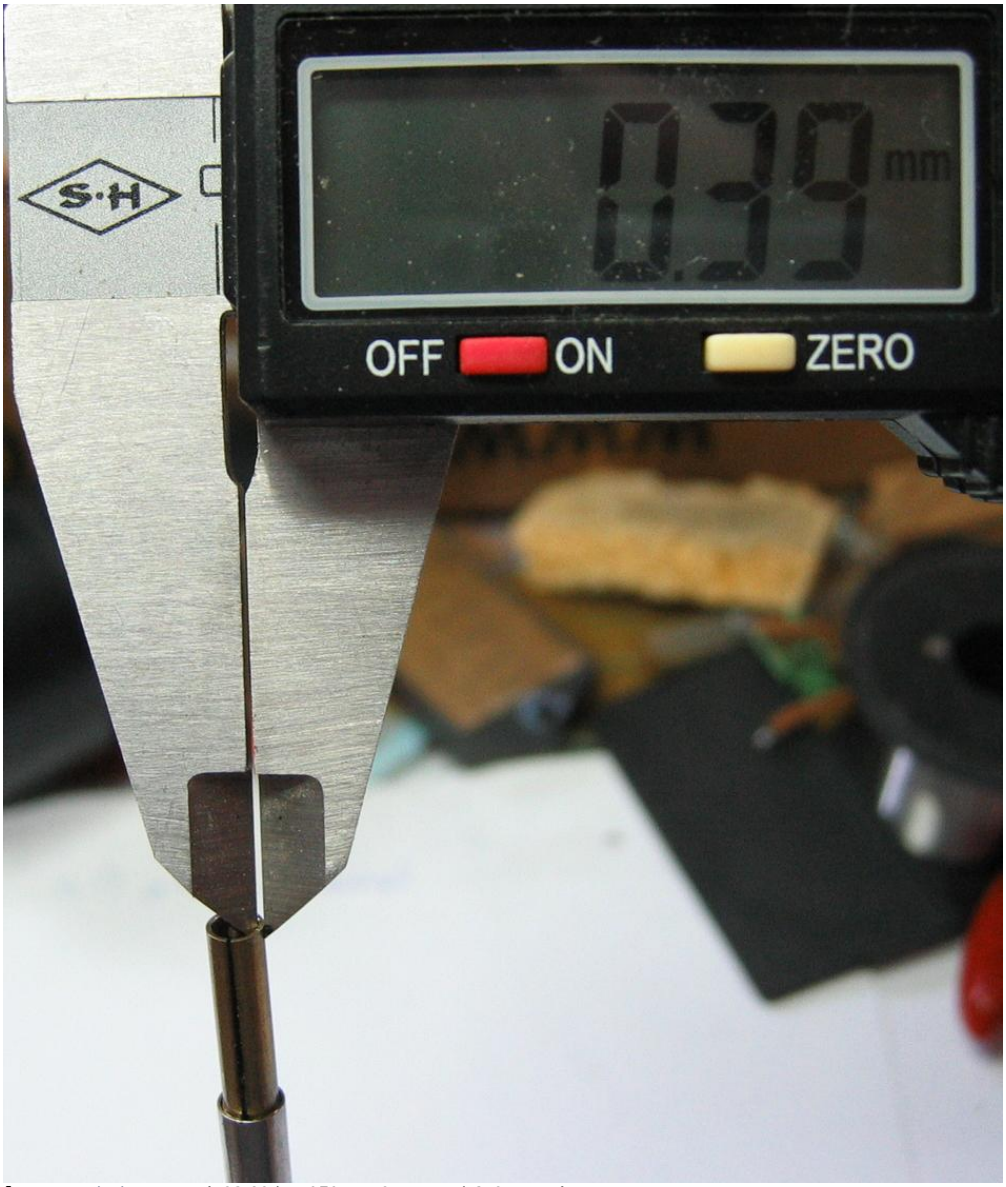
tip_con_ID.jpg (291.42 kB, 900x756 - viewed 688 times.)



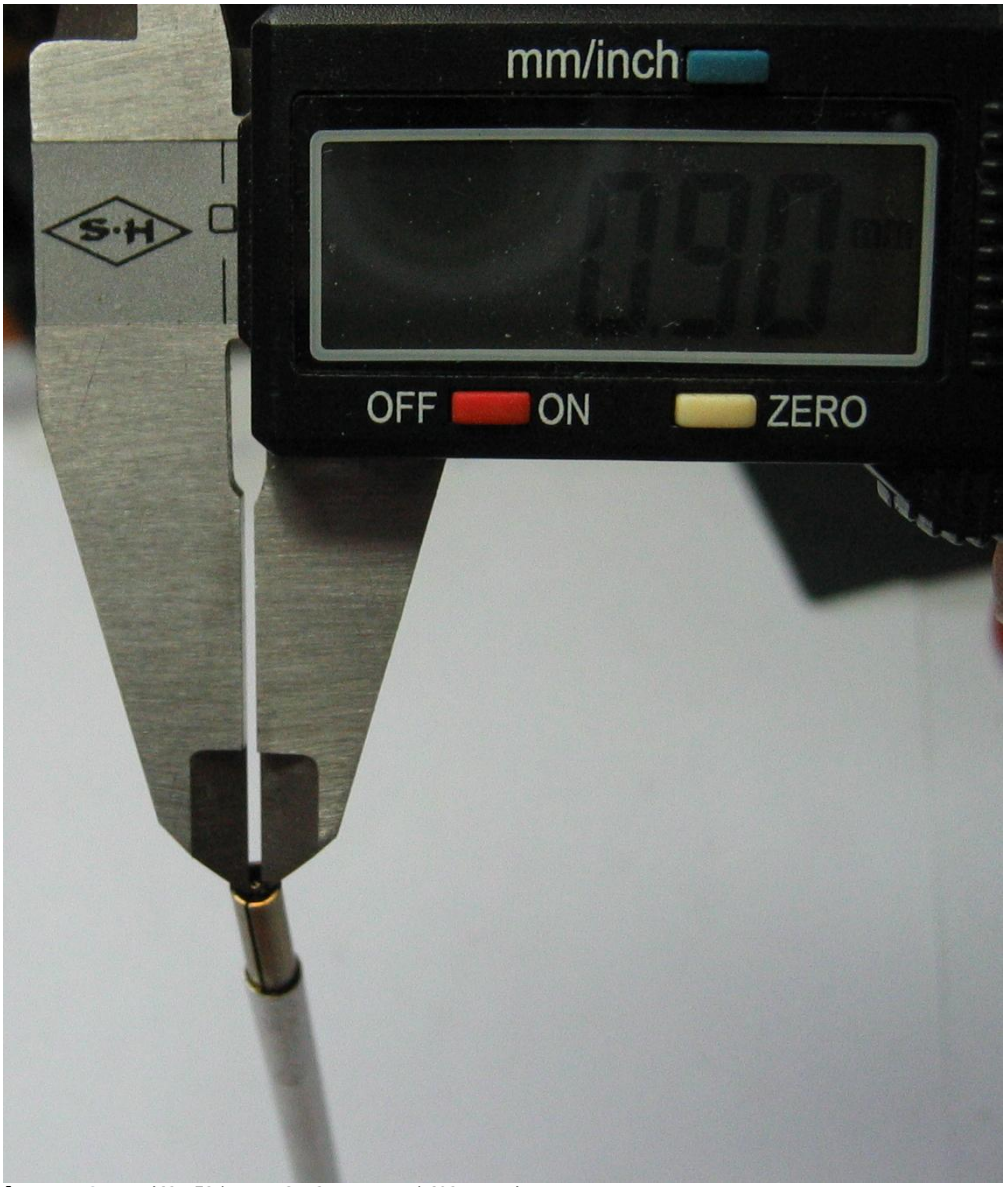
tip_con_len.jpg (351.29 kB, 900x853 - viewed 644 times.)



tip_con_OD.jpg (611.06 kB, 1245x1107 - viewed 682 times.)



tip_con_thickness.jpg (493.89 kB, 950x1119 - viewed 640 times.)



tip_pin_OD.jpg (621.52 kB, 1143x1347 - viewed 692 times.)

Report to moderator Logged

AndersAnd
Frequent Contributor
Posts: 568
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #262 on:** October 15, 2013, 02:26:28 pm »
Say Thanks Reply Quote

Quote from: mamalala on October 15, 2013, 02:11:20 pm

Hi AndersAnd,

quite possible that it is a feed-through cap. If any is there, it must be: there is basically a DC short when you meassure between shield and center pin of the F connector.

A DC short between shield and center pin of the F connector? Is this also true with no tip mounted? This wouldn't be explained by any capacitor as those are open circuit at DC, so is there also an inductor in parallel, to make the DC short?

« *Last Edit: October 15, 2013, 02:55:17 pm by AndersAnd* »

Report to moderator Logged

mamalala
Supporter

Posts: 777

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #263 on:** October 15, 2013, 02:37:31 pm »
Say Thanks Reply Quote

Quote from: AndersAnd on October 15, 2013, 02:26:28 pm

Quote from: mamalala on October 15, 2013, 02:11:20 pm

Hi AndersAnd,

quite possible that it is a feed-through cap. If any is there, it must be: there is basically a DC short when you meassure between shield and center pin of the F connector.

Country:

> A DC short between shield and center pin of the F connector? Is this also true with no tip mounted?
> This wouldn't be explained by any capacitor as those are open circuit at DC, so is there also an inductor in parallel, to make the DC short?

Only with the tip inserted. Without it is open circuit. This is also what the type of tip-detection i implemented detects. Same is true for the Metcal Talon tweezers, just that the two cartridges there are in series. So, if there is any cap, it must be a feedthrough type, that is, the capacitance is only between center and shield. (Called "Durchführungskondensator" in German).

I was just assuming that the cap shown in the patent would be a regular one. But as you said (and as i noted very early on), that just can't be, otherwise there wouldn't be a DC short with an inserted tip, and an open without a tip.

Greetings,

Chris

Report to moderator Logged

AndersAnd
Frequent Contributor
Posts: 568
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #264 on:** October 15, 2013, 02:51:13 pm »
Say Thanks Reply Quote

> **Quote from: mamalala on October 15, 2013, 02:37:31 pm**
>
> > **Quote from: AndersAnd on October 15, 2013, 02:26:28 pm**
> >
> > > **Quote from: mamalala on October 15, 2013, 02:11:20 pm**
> > >
> > > Hi AndersAnd,
> > >
> > > quite possible that it is a feed-through cap. If any is there, it must be: there is basically a DC short when you meassure between shield and center pin of the F connector.
> >
> > A DC short between shield and center pin of the F connector? Is this also true with no tip mounted?
> > This wouldn't be explained by any capacitor as those are open circuit at DC, so is there also an inductor in parallel, to make the DC short?
>
> Only with the tip inserted. Without it is open circuit. This is also what the type of tip-detection i implemented detects. Same is true for the Metcal Talon tweezers, just that the two cartridges there are in series. So, if there is any cap, it must be a feedthrough type, that is, the capacitance is only between center and shield. (Called "Durchführungskondensator" in German).
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> I was just assuming that the cap shown in the patent would be a regular one. But as you said (and as i noted very early on), that just can't be, otherwise there wouldn't be a DC short with an inserted tip, and an open without a tip.
>
> Greetings,
>
> Chris

Oh now I see what you mean. With a capacitor in series there would have been no DC short when you insert a tip, which is the case.
But based on the patent drawing it looks like a feed-through capacitor with the capacitance being between the inner wire and shield. And this wouldn't prevent the DC short you measure between inner lead and shield with a tip inserted, so it's very likely there's some small feed-through capacitor hidden inside the socket.
Maybe someone would be able to measure it, but the coax cable will have some capacitance itself, so if it's a small value feed-through capacitor it would be hard to measure or tell if it's just cable capacitance you measure.
Edit: a regular RG58 coax cable has a capacitance of approx 25 pF/ft (82 pF/m) according to Wikipedia, so if someone measures the capacitance of the handpiece you could try to compare it to this and see if the capacitance is any higher than this.

« Last Edit: October 15, 2013, 03:01:40 pm by AndersAnd »

Report to moderator Logged

AndersAnd
Frequent Contributor
Posts: 568
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #265 on:** October 15, 2013, 03:10:30 pm »
Say Thanks Reply Quote

> **Quote from: mamalala on October 15, 2013, 02:11:20 pm**
>
> Attached are some images about the tip connector side with caliper meassurements (not 100% accurate, had to hold the stuff in one hand, and the cam in the other...)
>
> Greetings,
>
> Chris

Danke schön

Your measured outer diameter is quite close to the 3.7 mm of male SMB / SMC connectors.

But the 0.9 mm inner pin diameter you measured is much bigger than the 0.5 mm of the SMB / SMC inner pins, so it probably won't fit those.
Anyone know of a coax connector that would fit the dimensions of the Metcal tips?

Report to moderator Logged

ee.jmlp
Contributor
Posts: 39
Country:

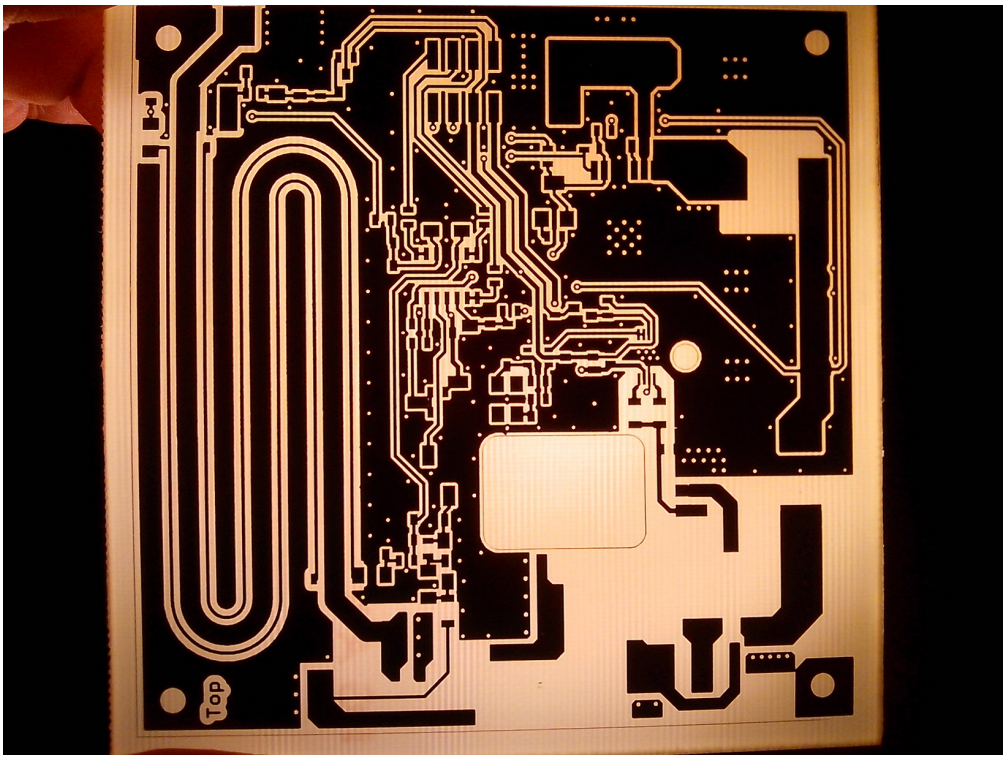
Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #266 on:** October 15, 2013, 07:35:11 pm »

Say Thanks Reply Quote

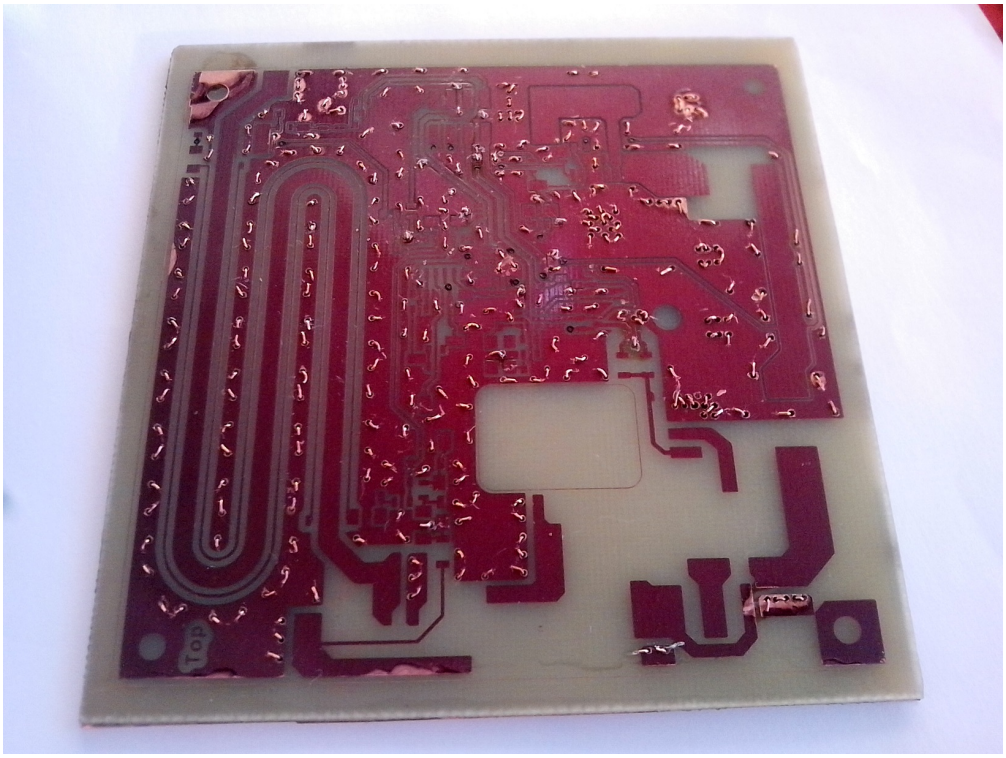
Hey, I got cheap handpiece from RS for 60€.

Here are the pics.

I modified the bypass capacitors before transformer, I put 4x100nF + 4x10nF (stacked in 2 files), 8 capacitors in total.
With 3x100nF capacitors X7R there wasn't enough. I saw it in the oscilloscope. Just between the transformer input and ground.



IMG_20130928_004308.jpg (588.01 kB, 1632x1224 - viewed 1894 times.)



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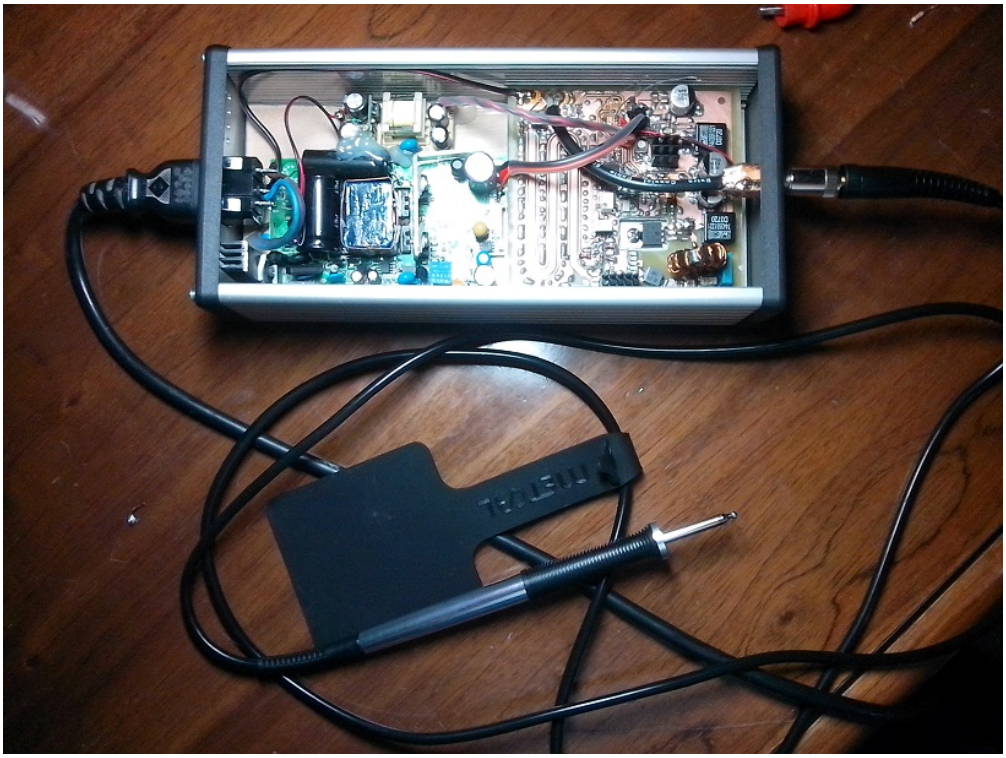
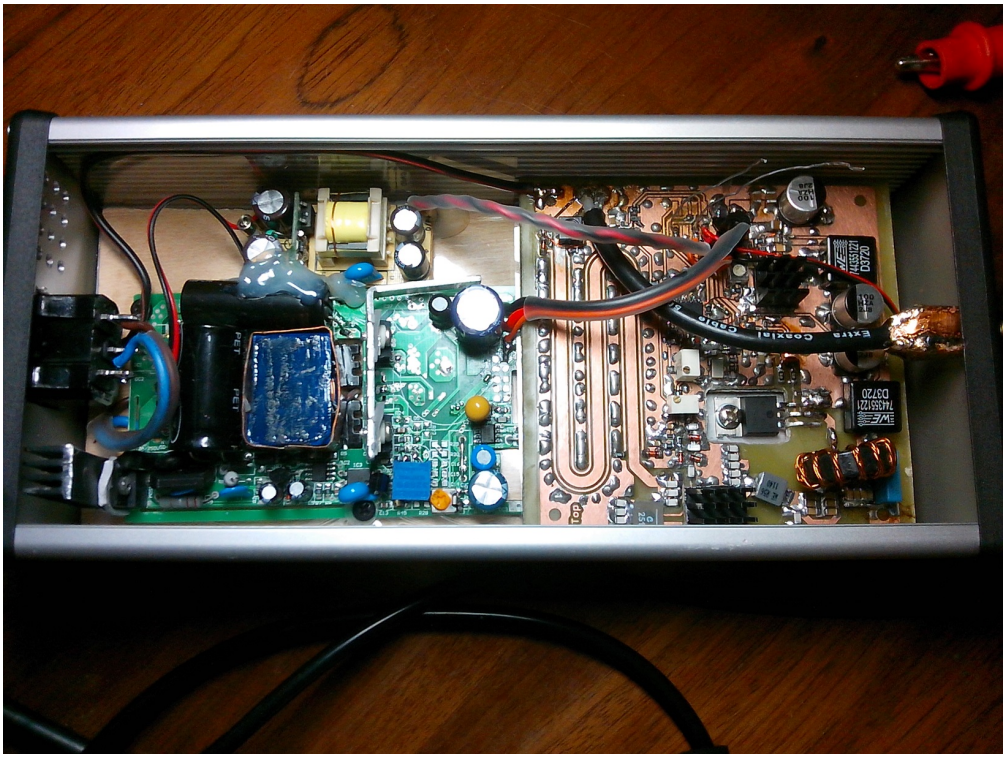
IMG_20131001_224408.jpg (244.68 kB, 816x612 - viewed 1262 times.)



IMG_20131015_210239.jpg (227.22 kB, 816x612 - viewed 1728 times.)

IMG_20131015_210343.jpg (203.48 kB, 816x612 - viewed 1891 times.)



IMG_20131015_210256.jpg (696.45 kB, 1632x1224 - viewed 1858 times.)

« *Last Edit: October 15, 2013, 07:41:36 pm by ee.jmlp* »

Report to moderator Logged

-->

Yeah buddy!

mamalala

Supporter

Posts: 777

Country:

Re: DIY Metcal 13.56 MHz RF Supply

« **Reply #267 on:** October 15, 2013, 07:47:59 pm »

Say Thanks Reply Quote

Quote from: ee.jmlp on October 15, 2013, 07:35:11 pm

> Hey, I got cheap handpiece from RS for 60€.
>
> Here are the pics.
>
> I modified the bypass capacitors before transformer, I put 4x100nF + 4x10nF (stacked in 2 files), 8 capacitors in total. With 3x100nF capacitors X7R there wasn't enough. I saw it in the oscilloscope. Just between the transformer input and ground.

Nice! Your poor sidecutter, what with all the wire stubs for the GND connection to the bottom

Yea, the three caps there are not optimal. In my first prototype i had even less (but bigger capacitance), and one of them sometimes blew into a short when switching off...

What inductors did you use? And what did you use for L4? In the pics it looks like there is a heatsink on that one? They should not get warm/hot. That is why i chose to use standard cores plus do-it-yourself windings on them. The "ready to use" ones i testes with initially got terribly hot, although their datasheet said something about 10 MHz test frequency...

Anyways, nice to see that this project is of help for you. And i _always_ like when people do their own interpretations of the thing!

Greetings,

Chris

Report to moderator Logged

mamalala

Supporter

Re: DIY Metcal 13.56 MHz RF Supply

« **Reply #268 on:** October 15, 2013, 08:01:35 pm »

Say Thanks Reply Quote

Oh,

and "cheap" is relative. Sure, that Metcal stuff is really high quality, but still, it's basically just a simple

Posts: 777
Country:

handle with a bit of coax and a F connector... But hey, what i am complaining. Just look at what a simple stand for that handle costs.

In any case, look around on eBay for tip cartridges. There are lots of cheap ones there, new and used. My favourite one is the STTC-126. Somewhat combines a fine point tip with the benefits of a chisel tip (due to it's bend). Here are cheap new ones:

http://www.ebay.de/itm/290990293484

There is also a seller who sells sets of used tips for a good price, if you want a nice variety of tips:

http://www.ebay.de/itm/20-Metcal-soldering-tips-various-types-sizes-used-tips-but-cheap-/190931325260

Greetings,

Chris

Greetings,

Chris

Edit: And if you (or someone else) needs a SMTC-007 (this is for SOIC-28 packages), let me know. Have three new ones in original packaging left. 15 Euros for one, plus shipping...

« Last Edit: October 15, 2013, 08:04:29 pm by mamalala »

Report to moderator Logged

ee.jmlp

Contributor

Posts: 39
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #269 on:** October 15, 2013, 10:07:12 pm »

Say Thanks Reply Quote

Before cutting the wires the board was completely sewn with non-enameled copper wire.

The inductors (search for SMD power inductors in newark or farnell) must have SRF at least at 60MHz or higher, the core material must be low permeability iron powder or composite (not ferrite), the saturation current must be at least 3 times the max rms alternating current of the inductor and the DCR shuldn't be more than 3mOhm. Shielded always better. Look at the datasheet the inductance is stable enough in the current range you'll use.

The inductor with a heatsink has a low saturating current, that is a weak point I didn't see when I bought it. Think a small component (low volume and low dissipating area) that spends 1W can reach the temperature of the sun.

Btw the rest of components aren't hot.

If you use a toroid for the main supply, connect in parallel an X2 rated capacitor at the 220Vac input (330nF even 100nF should be enough), that would eat the switching off transient in other case will be dissipated in the rest of the circuit blowing any component. I put them always I use a conventional transformer. Big filtering capacitors also helps a slow decay in the supply voltage and so a slow half-controlled turn off.

« Last Edit: October 15, 2013, 10:10:30 pm by ee.jmlp »

Report to moderator Logged

-->

Yeah buddy!

Parak

Contributor

Posts: 15
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #270 on:** October 18, 2013, 03:07:54 pm »

Say Thanks Reply Quote

Curious if something similar might be done for the cheaper metcal/oki MFR units, especially as I have a full set of them (handpieces/tweezers/desoldering) . They do use a different (8 pin din) connector, but if the frequency/power can be boosted up to regular metcal levels via diy, that'd be quite amazing.

Report to moderator Logged

mamalala

Supporter

Posts: 777
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #271 on:** October 18, 2013, 03:15:17 pm »

Say Thanks Reply Quote

Quote from: Parak on October 18, 2013, 03:07:54 pm

> Curious if something similar might be done for the cheaper metcal/oki MFR units, especially as I have a full set of them (handpieces/tweezers/desoldering) . They do use a different (8 pin din) connector, but if the frequency/power can be boosted up to regular metcal levels via diy, that'd be quite amazing.

The supply circuit for those 470 kHz systems is pretty simple. Gerhard over at the µC.net forum has

drawn out the schematics for the SP200 supply unit: http://www.mikrocontroller.net/topic/311671#3363592. This one is the predescessor to the MFR1100 unit.

As you can see, a really simple thing.

Greetings,

Chris

« *Last Edit: October 18, 2013, 08:37:17 pm by mamalala* »

Report to moderator Logged

Parak
Contributor
Posts: 15
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #272 on:** October 18, 2013, 03:27:36 pm »

Say Thanks Reply Quote

Quote from: mamalala on October 18, 2013, 03:15:17 pm

> The supply circuit for those 470 kHz systems is pretty simple. Gerhard over at the µC.net forum has drawn out the schematics for the SP200 supply unit:http://www.mikrocontroller.net/topic/311671#3363592. This one is the predescessor to the MFR1100 unit.
>
> As you can see, a really simple thing.

Neat, but I have little interest myself in just making new power supplies, having a station myself already. I was more interested in getting the power up to the MX series 13.56 mhz levels while keeping all the existing handpiece and vacuum bits that I already have

Of course, if this is somehow possible, then it makes the cheaper MFR handpieces an alternative to MX ones for anyone looking to do a diy power supply as well.

Report to moderator Logged

mamalala
Supporter

Posts: 777
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #273 on:** October 18, 2013, 03:33:50 pm »

Say Thanks Reply Quote

Quote from: Parak on October 18, 2013, 03:27:36 pm

> Neat, but I have little interest myself in just making new power supplies, having a station myself already. I was more interested in getting the power up to the MX series 13.56 mhz levels while keeping all the existing handpiece and vacuum bits that I already have
>
> Of course, if this is somehow possible, then it makes the cheaper MFR handpieces an alternative to MX ones for anyone looking to do a diy power supply as well.

Ah, sorry, i misunderstood you then.

No, the two systems are not compatible, it is a completely different frequency range, and thus the parameters that the 470 kHz hanpieces, cartridges, etc. present do not match to what would be required. Well, to be clear, it's probably possible to somehow match those two together, but this will very likely involve massive losses and thus make no real sense.

Greetings,

Chris

Report to moderator Logged

Parak
Contributor
Posts: 15
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #274 on:** October 18, 2013, 04:03:24 pm »

Say Thanks Reply Quote

Quote from: mamalala on October 18, 2013, 03:33:50 pm

> No, the two systems are not compatible, it is a completely different frequency range, and thus the parameters that the 470 kHz hanpieces, cartridges, etc. present do not match to what would be required. Well, to be clear, it's probably possible to somehow match those two together, but this will very likely involve massive losses and thus make no real sense.

Hmm, are the tip heater elements (or materials used perhaps) so different between those in MFR and MX tips that a frequency increase would result in a different curie point? Pardon my ignorance when it comes to these things, but I guess I was hoping that the tips are not really that different, and all that the higher frequency does is allow for more power, faster.

Report to moderator Logged

Re: DIY Metcal 13.56 MHz RF Supply

mamalala
Supporter

Posts: 777
Country:

« **Reply #275 on:** October 18, 2013, 08:13:01 pm » Say Thanks Reply Quote

Quote from: Parak on October 18, 2013, 04:03:24 pm

Quote from: mamalala on October 18, 2013, 03:33:50 pm

No, the two systems are not compatible, it is a completely different frequency range, and thus the parameters that the 470 kHz hanpieces, cartridges, etc. present do not match to what would be required. Well, to be clear, it's probably possible to somehow match those two together, but this will very likely involve massive losses and thus make no real sense.

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No, the curie point of the alloy does not change, it is a fixed physical property of that alloy. The frequency itself also has little effect on the amount of power that can be transferred.

As far as the tips for the 13.56 MHz system are concerned, please look up the US patents 4,745,264 and 4,877,944. That shows you how they are constructed. You have the copper slug that makes the actual tip. On that slugs stub, inside the cartridge, is a cladding of the alloy with the curie effect. Around that you have a coil of wire, where the RF is fed into.

This means that you have an inductor there, and the RF source must match that, so that most energy is coupled into the alloy (which basically forms a short-circuited winding below the curie point). I don't know the specific construction of the 470 kHz tips. There are two different systems, one that has a handpiece with the coil, into which the tip is inserted, and another which more resembles the MX stuff, where all is in a single cartridge. In any case, assuming the construction is similar, the inductance will most likely not match to what can be used on a 13.56 MHz system.

I mean i have never tried it, i simply don't have any stuff from the 470 kHz system, so i can't try either. But consider this: Take a regular mains transformer that is designed to work on 50/60 Hz mains. Check what voltage ratio you get, and how much power it can deliver at a given input voltage. Now keep the voltage the same, but increase it to several kHz, and see how good it works. Most transformers will degrade rather quickly at higher frequencies. I would think that the same is true here. After all, the RF supply and the tip cartridge are basically a tuned circuit. Changing the parameters of the load will greatly detune it.

But as said, i never tried it. It may work, it may not work. I can's test it either, since i don't have any of the 470 kHz Metcal stuff. If anyone wants to send me a handpiece and tip, be my guest, then i will try it. But no guarantees, and the result might be a damaged tip and/or handpiece.

Plus, at least the cable running to the handpiece must be a coax, otherwise you will have big trouble when you go into the MHz range. After all we don't want the cable to act as an antenna and lose energy that way before it even reaches the tip.

Greetings,

Chris

Report to moderator Logged

AndersAnd
Frequent Contributor

Posts: 568
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #276 on:** October 18, 2013, 08:21:36 pm » Say Thanks Reply Quote

Quote from: mamalala on October 18, 2013, 03:15:17 pm

Quote from: Parak on October 18, 2013, 03:07:54 pm

Curious if something similar might be done for the cheaper metcal/oki MFR units, especially as I have a full set of them (handpieces/tweezers/desoldering) . They do use a different (8 pin din) connector, but if the frequency/power can be boosted up to regular metcal levels via diy, that'd be quite amazing.

The supply circuit for those 470 kHz systems is pretty simple. Gerhard over at the µC.net forum has drawn out the schematics for the SP200 supply unit: http://www.mikrocontroller.net/topic/311671#3363592. This one is the predescessor to the MFR1100 unit.

As you can see, a really simple thing.

Greetings,

Chris

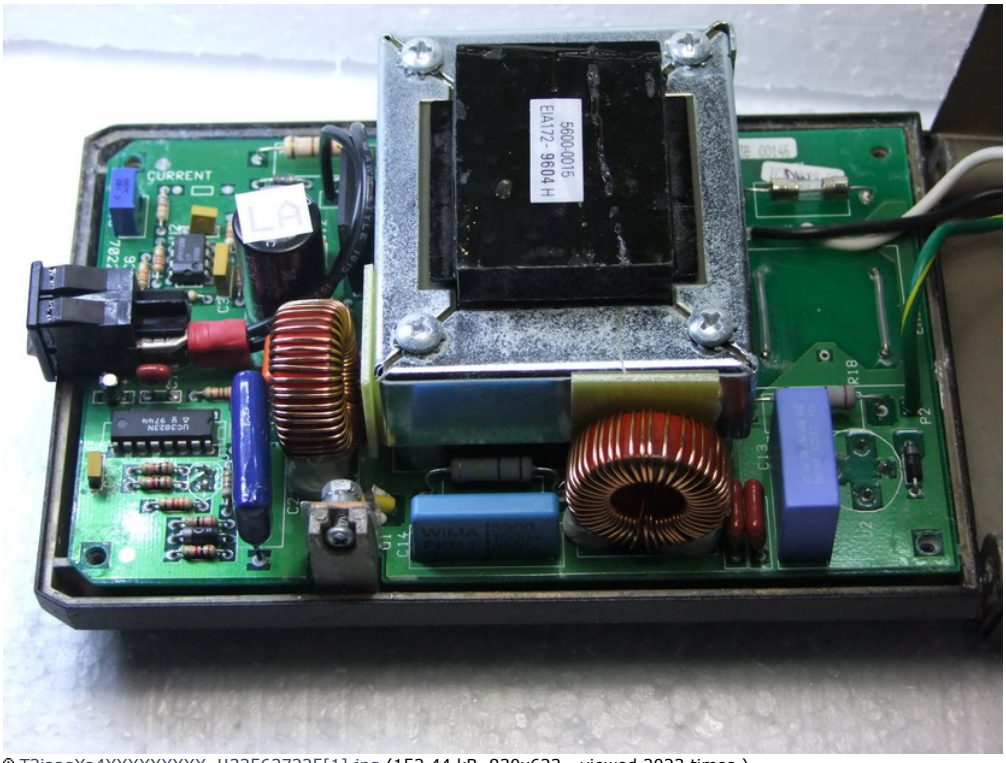
~~Your link doesn't work, so you might want to edit that~~

Anyway I understand German, so I could see you asked Gerhard for pictures of the inside of SP200 in that topic. Or SP-PW1 as the power supply for SP200 is named.

Here's some more pictures found on the net. Notice that these just have bypassing jumpers where the EMI line filter is located at the topic above. Instead these units have the EMI filter integrated into the power inlet socket, just like MX-500 has. [MX-500 uses a Delta Electronics 03SEEG3H two stage EMI line filter as mentioned in the MX500 schematic and BOM for MX-500, linked to earlier in this topic].

http://bbs.38hot.net/thread-20460-1-1.html

http://is.gd/z4jvYf



T2iaaqXa4XXXXXXXXX_!!325637225[1].jpg (152.44 kB, 830x623 - viewed 2023 times.)

T2gXOqXjhXXXXXXXXX_!!325637225[1].jpg (147.69 kB, 1030x773 - viewed 952 times.)

T2qU9pXidaXXXXXXXX_!!325637225[1].jpg (151.98 kB, 920x690 - viewed 2179 times.)

Metcal SP-200.jpg (55.81 kB, 396x600 - viewed 2258 times.)

« *Last Edit: October 18, 2013, 09:44:08 pm by AndersAnd* »

Report to moderator Logged

mamalala
Supporter

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #277 on:** October 18, 2013, 08:32:16 pm »

Say Thanks Reply Quote

Posts: 777
Country:

Hi AndersAnd,

~~hmm, strange, the link to µC.net works just fine here, but in your quote it looks rather messed up (while in my original post it looks normal). Dunno what i can do...~~

Edit: Sorry, somehow my browser crapped out and showed me garbage. You are right, the link was screwed up. Fixed it now. Thanks!

Anyways, thanks for the extra pics!

Parak:

BTW, the reason why i don't know how the 470 kHz system cartridges work is because of some other patents that Metcal has on heating technology using materials with a curie effect. Here's a list of some (including the two mentioned above):

US 4,256,945
US 4,623,401
US 4,695,713
US 4,701,587
US 4,745,264
US 4,752,673
US 4,769,519
US 4,814,587
US 4,877,944

So, unless someone opens up one of these cartridges, there is no way to know if there is even a remote chance to mix these two systems.

Greetings,

Chris

« *Last Edit: October 18, 2013, 08:38:11 pm by mamalala* »

Report to moderator Logged

AndersAnd

Frequent Contributor

Posts: 568
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #278 on:** October 18, 2013, 08:53:08 pm »

Say Thanks Reply Quote

There's a few more SP200 pictures in these albums.

https://plus.google.com/photos/114369772963211136986/albums/5726704339957072481

https://plus.google.com/photos/114369772963211136986/albums/5708625608608987905

https://picasaweb.google.com/lh/photo/KfuHpsjK8F3pIb48oPC7sfk5APBYHO-bRtJwxAbZTwc

And some kind of repair video involving a light bulb connected via a wire through a coil:
https://plus.google.com/photos/114369772963211136986/albums/5708625608608987905/57252255356banner=pwa&pid=5725225535621735938&oid=114369772963211136986

You might be able to find more pictures in some of his albums, there's even pictures of Yellow Metcal soldering stations:
https://plus.google.com/photos/114369772963211136986/albums/5708625608608987905/58568746656pid=5856874665601731314&oid=114369772963211136986

Maybe they were repainted by the owner company as anti theft protection, so they don't end up on ebay?

« *Last Edit: October 18, 2013, 08:55:54 pm by AndersAnd* »

Report to moderator Logged

Parak

Contributor

Posts: 15
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #279 on:** October 18, 2013, 09:01:17 pm »

Say Thanks Reply Quote

Quote from: mamalala on October 18, 2013, 08:13:01 pm

> No, the curie point of the alloy does not change, it is a fixed physical property of that alloy. The frequency itself also has little effect on the amount of power that can be transferred.
>
> As far as the tips for the 13.56 MHz system are concerned, please look up the US patents 4,745,264 and 4,877,944. That shows you how they are constructed. You have the copper slug that makes the actual tip. On that slugs stub, inside the cartridge, is a cladding of the alloy with the curie effect. Around that you have a coil of wire, where the RF is fed into.
>
> This means that you have an inductor there, and the RF source must match that, so that most energy is coupled into the alloy (which basically forms a short-circuited winding below the curie point). I don't know the specific construction of the 470 kHz tips. There are two different systems, one that has a handpiece with the coil, into which the tip is inserted, and

another which more resembles the MX stuff, where all is in a single cartridge. In any case, assuming the construction is similar, the inductance will most likely not match to what can be used on a 13.56 MHz system.

I mean i have never tried it, i simply don't have any stuff from the 470 kHz system, so i can't try either. But consider this: Take a regular mains transformer that is designed to work on 50/60 Hz mains. Check what voltage ratio you get, and how much power it can deliver at a given input voltage. Now keep the voltage the same, but increase it to several kHz, and see how good it works. Most transformers will degrade rather quickly at higher frequencies. I would think that the same is true here. After all, the RF supply and the tip cartridge are basically a tuned circuit. Changing the parameters of the load will greatly detune it.

Ah, I see now. That makes sense, of course.

Quote from: mamalala on October 18, 2013, 08:13:01 pm

> But as said, i never tried it. It may work, it may not work. I can's test it either, since i don't have any of the 470 kHz Metcal stuff. If anyone wants to send me a handpiece and tip, be my guest, then i will try it. But no guarantees, and the result might be a damaged tip and/or handpiece.

I might be able to arrange something, but currently it sounds like a somewhat expensive (I'm in US) proposition that is unlikely to succeed I don't suppose it's possible to non-destructively measure the inductance?

On another note, the MFR units come with two types of tips - those where the heater is inside the handpiece, and those where the heater is inside the tip. The latter is mostly used looking similar to MX types, but MFR-H2-ST handpiece and the desoldering guns use the former. I have both types..

Quote from: mamalala on October 18, 2013, 08:13:01 pm

> Plus, at least the cable running to the handpiece must be a coax, otherwise you will have big trouble when you go into the MHz range. After all we don't want the cable to act as an antenna and lose energy that way before it even reaches the tip.

..but the whole thing may be moot anyway because of this - the MFR handpieces all use what seems to be a regular multiconductor cable as opposed to a coax.

Report to moderator Logged

mamalala
Supporter

Posts: 777
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #280 on:** October 18, 2013, 09:42:36 pm »

Say Thanks Reply Quote

Quote from: Parak on October 18, 2013, 09:01:17 pm

> Ah, I see now. That makes sense, of course.

Yea, and if you look at the patents, they have a system with a coil around the slug (like the 13.56 MHz stuff uses), but also some system where the AC is basically directly connected to the alloy.

Quote from: Parak on October 18, 2013, 09:01:17 pm

> I might be able to arrange something, but currently it sounds like a somewhat expensive (I'm in US) proposition that is unlikely to succeed I don't suppose it's possible to non-destructively measure the inductance?

While i surely like to tinker around with such things, i simply don't think that it is worth the effort if the stuff has to come from the US. Especially considering that there is a chance that thing will get damaged during testing. So unless it is something to throw away, i doub't it's worth the risk.

Quote from: Parak on October 18, 2013, 09:01:17 pm

> On another note, the MFR units come with two types of tips - those where the heater is inside the handpiece, and those where the heater is inside the tip. The latter is mostly used looking similar to MX types, but MFR-H2-ST handpiece and the desoldering guns use the former. I have both types..

Yes, i know. There was the PS-800E, which uses the PS-HC2 handpiece, that has a coil assembly in the handpiece. The successor of that is the PS-900 with the PS-HC2 handpiece, from what i know.

But then there is also the SP200 stuff, that uses the SP-HC1 handpiece, which have "complete" cartridges (no coil assy in the handpiece), which are superseeded by the MFR-1110 with the MFR-H1_SC handpiece. Note the SP/PS fuzzing between those two types...

Quote from: Parak on October 18, 2013, 09:01:17 pm

> ..but the whole thing may be moot anyway because of this - the MFR handpieces all use what seems to be a regular multiconductor cable as opposed to a coax.

True. Without a proper coax, it's pretty futile to use 13.56MHz. On another note, while the 470 kHz stuff may be a bit cheaper, the 13.56 MHz stuff is far more common. Plus, there is a massive range of tips available. And i mean, really massive. STTC for "normal" stuff, SMTC for rework stuff (you get tips for chip resistor/capacitor packages, IC packages, etc.). And you can find tips rather cheaply on eBay as well, with a little patience. Patience is needed especially if you are outside the US. While the merchandise itself might be cheap, there are many sellers who have insane ideas about shipping cost. For example, i have bought a 6-pack of brand new SMTC-007 tips for 23.49 US$, plus 12.75 US$ shipping. But then you also find stuff like this: http://www.ebay.de/itm/Metcal-SMTC-103-Cartridge-Slot-Chip-1808-1812-/200965267828. 40 US$ for shipping a _single_ tip. And that's not even the worst, i have seen sellers wanting in excess of 50 or 60 bucks, for a 10 bucks soldering tip...

But generally, you can find lots tips and stuff rather cheap on eBay, just keep an eye on it.

Greetings,

Chris

Report to moderator Logged

mamalala
Supporter

Posts: 777
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #281 on:** October 18, 2013, 09:55:08 pm »

Say Thanks Reply Quote

Quote from: AndersAnd on October 18, 2013, 08:53:08 pm

And some kind of repair video involving a light bulb connected via a wire through a coil:
https://plus.google.com/photos/114369772963211136986/albums/5708625608608987905/5725225535621735938?banner=pwa&pid=5725225535621735938&oid=114369772963211136986

While the video is a pain to watch due to the autofocus going havoc all the time, what is interresting is that he clearly uses STTC tipc connected to the SP200 supply. You can see that he cobbled together the connection to the F connector of the RM3E handpiece to the cable form the SP200 supply through the inductor. So it seems that the "other way around" works. However, without knowing what the heatup and recovery times are, it's impossible to say if that makes sense. And then:

Quote from: AndersAnd on October 18, 2013, 08:53:08 pm

You might be able to find more pictures in some of his albums, there's even pictures of Yellow Metcal soldering stations:
https://plus.google.com/photos/114369772963211136986/albums/5708625608608987905/5856874665601731314?pid=5856874665601731314&oid=114369772963211136986

Maybe they were repainted by the owner company as anti theft protection, so they don't end up on ebay?

Yes, they are cleary repainted. But you can also see that he modified one and put an F connector in there, to use the MX series handpieces. So it seems that at least that way they are interchangeable. Which may mean that just maybe the SP stuff can be used on MX series supplies as well. If they would have used a proper coax cable. Which we don't really know unless someone cuts open that cable, but i doubt it.

Greetings,

Chris

Edit: Damn, fell victim to the PS/SP fuzziness... fixed it.
« Last Edit: October 18, 2013, 09:58:50 pm by mamalala »

Report to moderator Logged

AndersAnd
Frequent Contributor

Posts: 568
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #282 on:** October 18, 2013, 10:01:34 pm »

Say Thanks Reply Quote

Quote from: mamalala on October 18, 2013, 09:55:08 pm

Quote from: AndersAnd on October 18, 2013, 08:53:08 pm

You might be able to find more pictures in some of his albums, there's even pictures of Yellow Metcal soldering stations:
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I'm pretty sure it's a BNC-connector and not an F-connector fitted in the one on the right. Notice the two bayonet lugs if you zoom in.

Report to moderator Logged

mamalala
Supporter

Posts: 777
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #283 on:** October 18, 2013, 10:04:59 pm »

Say Thanks Reply Quote

> **Quote from: AndersAnd on October 18, 2013, 10:01:34 pm**
>
> I'm pretty sure it's a BNC-connector and not an F-connector fitted in the one on the right. Notice the two bayonet lugs if you zoom in.

Damn, you are right, my mistake.

Greetings,

Chris

Report to moderator Logged

AndersAnd
Frequent Contributor

Posts: 568
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #284 on:** October 18, 2013, 10:19:21 pm »

Say Thanks Reply Quote

Here's a couple of picture with a BNC cable and a coil + light bulb connected to the unit above. He also has a soldering tip connected to it with another set of windings on the coil.
Looks like he uses the coil as an impedance transformer.

https://plus.google.com/photos/114369772963211136986/albums/5708625608608987905/58568535838?pid=5856853583803528258&oid=114369772963211136986

https://plus.google.com/photos/114369772963211136986/albums/5708625608608987905/58568537235?pid=5856853723512252370&oid=114369772963211136986

https://plus.google.com/photos/114369772963211136986/albums/5708625608608987905/58568538679?pid=5856853867973491346&oid=114369772963211136986

https://plus.google.com/photos/114369772963211136986/albums/5708625608608987905/58568753291?pid=5856875329127444386&oid=114369772963211136986

« *Last Edit: October 18, 2013, 10:22:32 pm by AndersAnd* »

Report to moderator Logged

AndersAnd
Frequent Contributor

Posts: 568
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #285 on:** October 18, 2013, 10:37:43 pm »

Say Thanks Reply Quote

Googled for 'Metcal Sompong Tungmepol' (his name) and found these interesting videos on his YouTube channel.
Unfortunately he speaks Thai, so I don't understand anything he's saying:

Metcal MX 500 MX5000 Tips Operate on Metcal SP 200 http://youtu.be/DDttEAs8pZs

TORIOD FERRITE CORE 470 Khz TEST http://youtu.be/xNBsWEpcTDY

He sure has a lot of toriod's to experiment with and it looks like he has also replaced the toriod's inside the SP200. Maybe he has changed it's operating frequncy:
http://youtu.be/wY8mSnWTlUc

« *Last Edit: October 18, 2013, 10:48:41 pm by AndersAnd* »

Report to moderator Logged

mamalala
Supporter

Posts: 777
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #286 on:** October 18, 2013, 11:34:23 pm »

Say Thanks Reply Quote

> **Quote from: AndersAnd on October 18, 2013, 10:37:43 pm**
>
> Googled for 'Metcal Sompong Tungmepol' (his name) and found these interesting videos on his YouTube channel.
> Unfortunately he speaks Thai, so I don't understand anything he's saying:
>
> **Metcal MX 500 MX5000 Tips Operate on Metcal SP 200** http://youtu.be/DDttEAs8pZs
>
> **TORIOD FERRITE CORE 470 Khz TEST** http://youtu.be/xNBsWEpcTDY
>
> He sure has a lot of toriod's to experiment with and it looks like he has also replaced the toriod's inside the SP200. Maybe he has changed it's operating frequncy:
> http://youtu.be/wY8mSnWTlUc

Hmm, from seeing these videos, i get the impression that he is somewhat blindly trying to get the STTC tips to work on the SP unit, while not really understanding how it works. Looks like a complete trial & error approach. The first video seems to show that the performance of the STTC connected to the SP unit is rather poor, and while he has lots of tips, many of them don't look healthy at all. Sure, i can only guess here, but by the looks of it it seems more that the tips are heated mainly through heating the coil.

The fact that a small area above the tip, where internally the copper slug, alloy and coil sits, is heavily blackened would indicate that. Usually the darkening of that area happens rather slow and is spread out a bit larger than that. I had that effect when i had a too high idle voltage on my DIY supply. It caused the tip to glow dark red at exactly that spot, meaning that the coil itself heats up while no longer inducing (much) energy into the alloy/slug but having mostly resistive losses.

But then, i don't understand what he says either, so this is just guesswork from what i can see combined with my own experience. In any case, kudos to him for being so persistant in trying it all out

Greetings,

Chris

Report to moderator Logged

ee.jmlp
Contributor
Posts: 39
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #287 on:** October 20, 2013, 03:41:18 pm »
Say Thanks Reply Quote

mamalala I changed the inductors by iron powder toroids, no heat and no heatsinks.

I installed a 16x2 LCD controlled with a psoc and a reset button.
(The position of the HF connector and the reset button is limited by internal space of the box)

The way it works will tell it to you the source code.

Chip: CY8C29466 from Cypress.
Developed in Psoc Designer 5.4 Cypress free software.

This is the main.c

Code: [Select]

```
//-------------------------------------------------------------------------
// C main line
//-------------------------------------------------------------------------

 #include <m8c.h>        // part specific constants and macros
 #include "PSoCAPI.h"    // PSoC API definitions for all User Modules
 #include "stdlib.h"
 #include "string.h"

// you must use this lines if you used ljmp instruction at the interrupt .asm files for each module
// in this case PSoCGPIOINT.asm and IDLETIMERINT.asm
 #pragma interrupt_handler TipDetectionISR
 #pragma interrupt_handler TimeoutISR

unsigned int    vforward;
```

This is PSoCGPIOINT.asm

Code: [Select]

```
;  Generated by PSoC Designer 5.4.2946
;
;;*****************************************************************************
;;*****************************************************************************
;;  FILENAME: PSoCGPIOINT.asm
;;   Version: 2.0.0.20, Updated on 2003/07/17 at 12:10:35
;;  @PSOC_VERSION
;;
;;  DESCRIPTION: PSoC GPIO Interrupt Service Routine
;;-----------------------------------------------------------------------------
;;  Copyright (c) Cypress Semiconductor 2013. All Rights Reserved.
;;*****************************************************************************
;;*****************************************************************************

include "m8c.inc"
include "PSoCGPIOINT.inc"
```

This is IDLETIMERINT.asm

Code: [Select]

```
;;*****************************************************************************
;;*****************************************************************************
;;  FILENAME: IDLETIMERINT.asm
;;   Version: 2.6, Updated on 2013/5/19 at 10:44:39
;;  Generated by PSoC Designer 5.4.2946
;;
;;  DESCRIPTION: Timer16 Interrupt Service Routine
;;-----------------------------------------------------------------------------
;;  Copyright (c) Cypress Semiconductor 2013. All Rights Reserved.
;;*****************************************************************************
;;*****************************************************************************

include "m8c.inc"
include "memory.inc"
include "IDLETIMER.inc"
```

« *Last Edit: October 21, 2013, 12:19:55 pm by ee.jmlp* »

Report to moderator Logged

-->

Yeah buddy!

ee.jmlp
Contributor
Posts: 39
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #288 on:** October 20, 2013, 03:42:42 pm »

Say Thanks Reply Quote

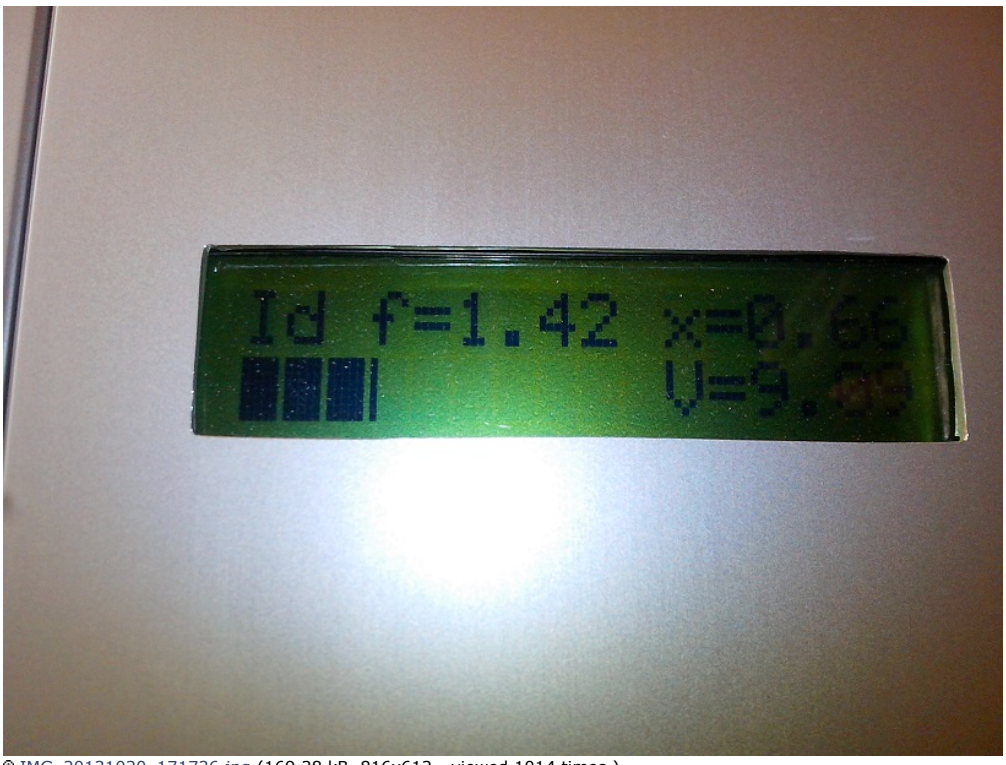
And some pics of the final unit.
This is the configuration file for the CY8C29466 config. (two formats, open XPS and XPS).

I have to say the controller, after timeup, it cuts power waiting you with "press reset" message. I don't use VLIM.

My reason for this is if I stop using the unit for a while, it stops working alone, needing my intervention. As the tip takes less than 5 sec for heating up, I don't care about the restarting.

It's like to play chess, once you move you hit the clock, but only if I don't use the tip for a while in this case.

You can add a DAC to control the power with the PSoC, it's really easy. (I know you have your software mamalala I was talking to the other readers in this line).



IMG_20131020_171736.jpg (169.28 kB, 816x612 - viewed 1014 times.)

IMG_20131020_171747.jpg (173.77 kB, 816x612 - viewed 956 times.)

IMG_20131020_171708.jpg (193.3 kB, 816x612 - viewed 1110 times.)
psocconfig.oxps.zip (1092.49 kB - downloaded 331 times.)
psocconfig.xps.zip (1092.47 kB - downloaded 307 times.)

« *Last Edit: October 20, 2013, 09:19:11 pm by ee.jmlp* »

Report to moderator Logged

-->

Yeah buddy!

ee.jmlp
Contributor
Posts: 39
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #289 on:** October 20, 2013, 04:12:16 pm »

Say Thanks Reply Quote

Quote from: mamalala on October 18, 2013, 11:34:23 pm

Quote from: AndersAnd on October 18, 2013, 10:37:43 pm

Googled for 'Metcal Sompong Tungmepol' (his name) and found these interesting videos on his YouTube channel. Unfortunately he speaks Thai, so I don't understand anything he's saying:

Metcal MX 500 MX5000 Tips Operate on Metcal SP 200 http://youtu.be/DDttEAs8pZs

TORIOD FERRITE CORE 470 Khz TEST http://youtu.be/xNBsWEpcTDY

He sure has a lot of toriod's to experiment with and it looks like he has also replaced the toriod's inside the SP200. Maybe he has changed it's operating frequncy:
http://youtu.be/wY8mSnWTlUc

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The fact that a small area above the tip, where internally the copper slug, alloy and coil sits, is heavily blackened would indicate that. Usually the darkening of that area happens rather slow and is spread out a bit larger than that. I had that effect when i had a too high idle voltage on my DIY supply. It caused the tip to glow dark red at exactly that spot, meaning that the coil itself heats up while no longer inducing (much) energy into the alloy/slug but having mostly resistive losses.

But then, i don't understand what he says either, so this is just guesswork from what i can see combined with my own experience. In any case, kudos to him for being so persistant in trying it all out

Greetings,

Chris

I think the same mamalala.

What about this?

467,5862KHz * 29 = 13.56MHz
29th harmonic. With a 467,5862KHz square wave (with ns rise fall times) and a 13.56MHz bandpass you could theoretically achieve the goal. (jaja not to mention the power output/input relationship)

LOL

Yeah buddy!

« Last Edit: October 21, 2013, 12:09:50 pm by ee.jmlp »

Report to moderator Logged

-->

Yeah buddy!

CristopherD
Contributor
Posts: 6

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #290 on:** October 22, 2013, 01:11:03 pm »

Say Thanks Reply Quote

hi there Chris;
The names Chris; From the OZ.
Been keeping an eye on this discussion for a while now,
First of all i would like to say a big thanks for the research you have done and the time you have put in.
i've recently had the chance to use a thermaltronics iron and i've fallen in love with the inductive technology; the only thing keeping our love apart is the price ($550 in AU for the 13.56mhz machine), although i am now thinking about purchasing the original metcal tips if what you referred to in a previous post is true about efficiencies of the two manufactures tips.

With that being said;
Whenever you change something in regards to the schematic/adjust a value of a component, have you been updating your zip data with the changes?
I've read all 20 pages of this thread and you've made quite a few changes since your original files but shy of printing the 20 pages out and highlighting every change is there a way to get all the current files including eagle, girber, and parts list?

also, further to that point, if there is anybody here from Australia who has had these boards produced, and have some spare, if you could drop me a PM that would be appreciated.
regards. Christopher

Report to moderator Logged

ee.jmlp
Contributor
Posts: 39

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #291 on:** October 22, 2013, 01:53:09 pm »

Say Thanks Reply Quote

Quote from: CristopherD on October 22, 2013, 01:11:03 pm

Country:

> hi there Chris;
> The names Chris; From the OZ.
> Been keeping an eye on this discussion for a while now,
> First of all i would like to say a big thanks for the research you have done and the time you have put in.
> i've recently had the chance to use a thermaltronics iron and i've fallen in love with the inductive technology; the only thing keeping our love apart is the price ($550 in AU for the 13.56mhz machine), although i am now thinking about purchasing the original metcal tips if what you referred to in a previous post is true about efficiencies of the two manufactures tips.
>
> With that being said;
> Whenever you change something in regards to the schematic/adjust a value of a component, have you been updating your zip data with the changes?
> I've read all 20 pages of this thread and you've made quite a few changes since your original files but shy of printing the 20 pages out and highlighting every change is there a way to get all the current files including eagle, girber, and parts list?
>
> also, further to that point, if there is anybody here from Australia who has had these boards produced, and have some spare, if you could drop me a PM that would be appreciated.
> regards. Christopher

The circuit works as is in the .zip with eagle files. Only increase the capacitance in the C47 zone with multiple capacitors (I put 4*100nF x7r + 4*10nF x7r + 1*100nF epcos X2 rated, stacked in two rows).

The notes in the schematic are ok. You only have to take care about the bypass capacitors named in one post (mamalala named them with it's RS code):

> **Quote from: mamalala**
>
> as for the caps, the parts that i use are from RS-Online:
>
> 100n, 50V, X7R, 0805 264-4416
> 4µ7, 25V, 1206 723-6679
>
> Besides those, in the power supply section i have:
>
> 100µ, 50V, Electrolytic 758-1272
> 10µ, 50V, X7R, 1210 723-6824
> 150µ, 16V, 716-7100

And if you can install an smd heatsink in the mosfet driver sticked with thermal bond.

For the part list, I exported one with eagle, you can do it too in a txt file.

Report to moderator Logged

-->

Yeah buddy!

mamalala

Supporter

Posts: 777

Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #292 on:** November 05, 2013, 06:56:54 pm »

Say Thanks Reply Quote

> **Quote from: CristopherD on October 22, 2013, 01:11:03 pm**
>
> ... although i am now thinking about purchasing the original metcal tips if what you referred to in a previous post is true about efficiencies of the two manufactures tips ...

Hi Christopher,

sorry for the late reply. Please be aware that whatever i meassured is _not_ representative. I simply lack the proper tools to do suitable testing. What i was refering to is that the Thermaltronics tips do behave a bit different compared to the Metcal tips. This does _not_ mean that they are worse, it only means that my supply may need slightly different adjustments as far as idle power, etc., is concerned. The TT tips work just fine, that is, on a original Metcal supply as well as my DIY supply. The only real "problem" i had was that one type of TT tip started to glow dark-red when idling compared to the same Metcal tip. But this was easily fixed by simply lowering the idle supply voltage to the RF stage (the adjustable R's are on my board for a reason... hehe...)

However, that being said, there is a vastly larger supply of used and new Metcal tips for cheap on eBay than there is for TT tips. But this may very well change in the future.

Greetings,

Chris

Report to moderator Logged

mamalala
Supporter

Posts: 777
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #293 on:** November 05, 2013, 07:04:32 pm »
Say Thanks Reply Quote

Hi all,

since i get eMails about PCB's for the DIY unit, i am considering to have a new batch made. However, the question is what to do and how many. Since my original design consisted of two boards (the main RF board, and the rather optional supply/µC board), there are are several ways. One is to only make the RF boards, and have you folks do your own supply/µC boards (since other people prefer other choices of µC, if any at all). Note that the RF board works just fine on it's own, all that is needed are the supply voltages. The whole µC stuff is just bling-bling (well, OK, plus the sleep/etc. stuff).

So, here i am wondering what to do. Just get a batch of the actual RF boards done. Or make another batch of the µC board as well. But then, i'm also wondering if a slightly bigger board that contains all the sections would be preferred. The latter means that the PCB will become a bit bigger, so that it will have the power supply sections as well, plus a header for whatever µC control is wanted (that is, the actual µC would be a plug-in-module thingy, up to you what you plug in there). It would be Euro-Card size (160mm x 100mm) or slightly smaller, so it should fit in the many available encloures for that.

Please let me know here, and i'll se what i can do. In any case, i see demand for the circuit as PCB's, and i'm just wondering how to proceed.

Greetings,

Chris

Report to moderator Logged

CristopherD
Contributor

Posts: 6

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #294 on:** November 06, 2013, 01:08:19 pm »
Say Thanks Reply Quote

hey Chris
let me be the first to say i would love a set of these boards, i was just about to get a couple made when i saw this post.
i also know a couple of people here who would get a set as well, depending on time frame.
i think the current board arrangement suits most well, that way people can choose weather they want the UC or not.
regards. Christopher

Report to moderator Logged

richard.cs
Frequent Contributor

Posts: 662
Country:

Electronics engineer from Southampton, UK.

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #295 on:** November 06, 2013, 03:46:07 pm »
Say Thanks Reply Quote

Hi Chris,

I would be interested in buying a PCB, but probably just the RF board. Any idea of the price per board?

Report to moderator Logged

mamalala
Supporter

Posts: 777
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #296 on:** November 06, 2013, 03:47:39 pm »
Say Thanks Reply Quote

Quote from: CristopherD on November 06, 2013, 01:08:19 pm

> hey Chris
> let me be the first to say i would love a set of these boards, i was just about to get a couple made when i saw this post.
> i also know a couple of people here who would get a set as well, depending on time frame.
> i think the current board arrangement suits most well, that way people can choose weather they want the UC or not.
> regards. Christopher

In that case it would probably be better if you get a batch done. In the next weeks i won't be getting to it, and then there is the long shipping time from China. If i would do them, then some time and cost is added to get them shipped to your place. So i think it's more cost efficient and faster if you get them done, since you have some people who also want some.

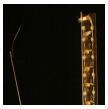
If you do, and there should be some leftovers, i'm sure that some folks here would be interrested in them. Just announce it here then.

Greetings,

Chris

Report to moderator Logged

mikeselectricstuff
Super Contributor



Posts: 11971
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #297 on:** November 06, 2013, 03:50:02 pm »

Say Thanks Reply Quote

I think the most useful option would be a board that has enough onboard to be useable standalone with maybe just a couple of LEDs as the user interface (maybe RGB), but that people can add their own add-on if they want anything clever like a display etc.

Report to moderator Logged

Youtube channel:Taking wierd stuff apart. Very apart.
Mike's Electric Stuff: High voltage, vintage electronics etc.
Day Job: Mostly LEDs

mamalala
Supporter

Posts: 777
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #298 on:** November 06, 2013, 03:50:58 pm »

Say Thanks Reply Quote

Quote from: richard.cs on November 06, 2013, 03:46:07 pm

> Hi Chris,
>
> I would be interested in buying a PCB, but probably just the RF board. Any idea of the price per board?

Hi Richard,

as i just mentioned in my reply to Christopher, it will still be some time before i get another batch ordered. Last batch was done at iTead, the 10x10cm service @ 10 pcs. So it would be that price, plus shipping from them to me, divided by 10, and then plus shipping from me to whereever it would go. Too lazy to look it up right niw, but rather cheap.

Greetings,

Chris

Report to moderator Logged

mamalala
Supporter

Posts: 777
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #299 on:** November 06, 2013, 03:53:22 pm »

Say Thanks Reply Quote

Quote from: mikeselectricstuff on November 06, 2013, 03:50:02 pm

> I think the most useful option would be a board that has enough onboard to be useable standalone with maybe just a couple of LEDs as the user interface (maybe RGB), but that people can add their own add-on if they want anything clever like a display etc.

With the power supply section included, you mean? If so, that is basically what i had in mind. Make it a bit bigger to put the rectifier and voltage regulators there, so it can be used stand-alone, plus the header to connect to some more fancy stuff if one wants.

Greetings,

Chris

Report to moderator Logged

calexanian
Super Contributor

Posts: 1866
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #300 on:** November 07, 2013, 03:15:14 am »

Say Thanks Reply Quote

Made up an adapter cable at the shop today to connect my Metcal MX hand piece directly to the output of my Yaesu FT-1000D. Tuned to 20 meter (14.100 to be exact) and put a whopping 10 watts carrier on it and hit the auto tuner and bingo! I turned the tuner off and it actually is a reasonable enough match. I did not look up at the meter but it did not trip the automatic protect and the auto tuner brought it to 1:1 in a split second so it was happy. At about 20 watts carrier the tip started getting a tad hot but at 10 to 15 it actually did some nice soldering. Unfortunately the going rate on a FT1000D is about 2 grand or more these days so i will stick with the MX 500 unit I own, but the exercise tells us that matching to these tips is really easy and they are not picky on frequency. Tomorrow I will be ordering some 12 volt pills (Look that up you young whipper snappers) and building a oscillator and power amp that I can run off a battery.

Report to moderator Logged

Charles Alexanian
Alex-Tronix Control Systems

Tazz
Contributor
Posts: 15
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #301 on:** November 08, 2013, 10:38:50 am »
Say Thanks Reply Quote

> **Quote from: mamalala on November 06, 2013, 03:53:22 pm**
>
> > **Quote from: mikeselectricstuff on November 06, 2013, 03:50:02 pm**
> >
> > I think the most useful option would be a board that has enough onboard to be useable standalone with maybe just a couple of LEDs as the user interface (maybe RGB), but that people can add their own add-on if they want anything clever like a display etc.
>
> With the power supply section included, you mean? If so, that is basically what i had in mind. Make it a bit bigger to put the rectifier and voltage regulators there, so it can be used stand-alone, plus the header to connect to some more fancy stuff if one wants.
>
> Greetings,
>
> Chris

If it get done, you could add one or two unit for me in your batch

Report to moderator Logged

dfnr2
Regular Contributor
Posts: 227
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #302 on:** November 08, 2013, 06:35:19 pm »
Say Thanks Reply Quote

Just in case anyone is interested, I had 10 sets of PCB's made a while back, but never had the chance to play with them. I would like to revisit the project sometime, but I have a different design in mind.

They are 2 layer 1.6mm (0.062") FR4 with green solder mask and silk screen on both sides. I am happy to offer them for my cost, which was about $10 per pair, plus postage to you. PM me if you are interested.

Dave

« Last Edit: November 08, 2013, 06:39:55 pm by dfnr2 »

Report to moderator Logged

CristopherD
Contributor
Posts: 6

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #303 on:** November 20, 2013, 06:44:25 am »
Say Thanks Reply Quote

Pm sent

Report to moderator Logged

Verydeep
Newbie
Posts: 1

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #304 on:** December 11, 2013, 11:07:47 am »
Say Thanks Reply Quote

Good day!
My name is Sergey. I am radio amator from Russia.
I am trying to repeat this device. Can somebody say will IPP530N15N3G MOSFET from Infineon work properly in power amplifier?
Can You give me recommendations on other components used in RF stage?

Thanks.

Report to moderator Logged

peter.mitchell
Super Contributor

Posts: 1568
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #305 on:** February 21, 2014, 02:31:23 am »
Say Thanks Reply Quote

Actually mate, you just happen to be one lucky sonofagun, RS components singapore sells the metcal advanced handpeice for $115sgd free express delivery. No joke.

Also, I'm in the process of doing a bit of a board redesign, removing all the unnessecary stuff and integrating it all.
If you want, when I get my final design boards back I can send you one and a BOM (or even the parts inc if you pay, ill just add them to my order quantities)

Report to moderator Logged

peter.mitchell
Super Contributor

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #306 on:** February 21, 2014, 02:36:00 am »
Say Thanks Reply Quote

http://singapore.rs-online.com/web/p/soldering-iron-accessories/6750708/ link

Report to moderator Logged

Posts: 1568
Country:

tom66
Super Contributor

Posts: 3452
Country:
Electronic Engineer & Hobbyist

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #307 on:** March 12, 2014, 10:44:00 pm »
Say Thanks Reply Quote

Use a hobby RC Li-Po pack. I have a 11.1V (3S) 1050mAh pack here, costing $4.50 from HobbyKing in Hong Kong. It can supply 11 amps continuously and about 45 amps burst.
Make sure to add a protection circuit to prevent overdischarge (<9V for pack) and fuse the input. They can supply a scary amount of power into a dead short.

Report to moderator Logged

peter.mitchell
Super Contributor

Posts: 1568
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #308 on:** March 13, 2014, 12:16:34 pm »
Say Thanks Reply Quote

In my design, for a wide input range there is a LT3791-1 buck-boost converter, provided you can supply the current, the iron will run at full power from as low as 6v all the way to 55v, it will start up at as low as 5.5v and once started it will provide around 15w from 3v!

I'm at the stage in design/layout where i'm tweaking, trying to get certain things to work 100% (like auto power off), and get the heat dissipation all the way down so no special enclosures or big heatsinks are needed.

Report to moderator Logged

mamalala
Supporter

Posts: 777
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #309 on:** March 20, 2014, 01:00:25 pm »
Say Thanks Reply Quote

Quote from: 3roomlab on March 12, 2014, 10:24:22 pm

> just to add something on the sub topic of making at portable. i was quite amused to find a low voltage mosfet that is quite fast, so i thought i have a go at it in a simulation (note its not accurate) (R9 = soldering iron load, i tried to measure its DC resistance, it was about 1.3ohms).

Yeah, the only problem is that the DC resistance has no meaning in RF-land. A cold tip has roughly 50 ohms impedance at that frequency, according to a friend of mine who checked it out on a spectrum analyzer. So you need to drive that load, and not the 1.something ohms you see at DC. That's the reason for the transformer and stuff in the circuit. At the output, during heat up, you can get voltage in excess of 100 volts p-p.

Greetings,

Chris

Report to moderator Logged

AndersAnd
Frequent Contributor

Posts: 568
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #310 on:** April 28, 2014, 03:27:12 pm »
Say Thanks Reply Quote

Quote from: mamalala on February 18, 2013, 01:50:49 pm

> **Quote from: az113 on February 18, 2013, 12:13:29 am**
>
> > P.S. Why you use IRF510?
> > It has a 0.5ohm internal resistance, may be something similar to IRFb4019 with 0.008ohm be more efficient?
> >
> > P.P.S. Sorry, IRF630/IRF640/IRF740 i mean. Still, it is a UHF modulator

Basically for two simple reasons:

- RF circuits are not really my field of expertise, so for the initial design i limited myself to the types that i had already used once in circuits operating at the same or higher frequencies, so i would know they should work in that application.

- Because i wanted to reduce the overall complexity of the circuit, i chose to use a readily available FET driver chip instead of the much more complex driver circuit used in the original Metcal supply. However, that chip is very tiny, and to avoid overheating i chose a FET with a really low gate charge and capacitance.

(Edit: Of course i might have been too paranoid with that. I just chose to stay on the safe side so i can get something to work correctly)

Of course that is not to say that only the IRF510 would work. But since i lack proper equipment to really evaluate other FET's, it would be up to others to see what else can be used there. The IRFB4019 that you mentioned looks interresting. It has even faster switching times, while still having a relatively low total gate charge. Might be worthwile to experiment with that one.

Greetings,

Chris

I've just repaired two MX500 power supplies (won at an eBay auction), with the help of the schematic and documentation here: https://www.mikrocontroller.net/attachment/193474/MX-500P-11.pdf
Mirror: http://scopetechniques.com/Metcal/MX-500P-11.pdf

The documentation says:
Q3 = VN0109N5 http://scopetechniques.com/Metcal/465-1342-0-VN0109.pdf / http://scopetechniques.com/Metcal/VN0109N5.pdf
Q4 = IRF530(N) http://www.irf.com/product-info/datasheets/data/irf530npbf.pdf

But in the two defect MX500's I bought they were different:
Q3 = IRF510 http://www.irf.com/product-info/datasheets/data/irf510pbf.pdf
Q4 = IRF640N http://www.irf.com/product-info/datasheets/data/irf640npbf.pdf
Both branded International Rectifier.

The amber/orange led lit up all the time in my two defect devices while the green led was always off.
I found out Q4 was shorted in both devices and after replacing it with a new IRF640N both devices work again.
It looks like Q3 (IRF510) had been replaced before in at least one of the devices, so not sure if they came with Q3 = IRF510 and Q4 = IRF640N from the factory. But it seems to work, at least so far.
Has anyone else seen an MX500 with Q3 = IRF510 and Q4 = IRF640N?
Looks like VN0109N5 from Supertex is obsolete, so maybe Metcal started using IRF510 instead?
Now when you search Supertex.com VN0109 seems to only be available in wafer / dies and TO-92 housing called VN0109N3, but no TO-220 option.
And for Q4, IRF640N is a 200 V MOSFET, while IRF530(N) from the schematic is only rated at 100 V, so maybe they have replaced it because there was problems with too high voltage spikes, toasting the IRF530's? Doesn't look like IRF530N is obsolete.
Haven't done any measurements after repairing them, so not sure about the voltages Q4 handles? But since the IRF640N was toast in both of them, maybe that's not the issue?

Much to my surprise I also received a Metcal solder stand with the defect power supplies, even though this wasn't advertised. A very nice surprise as Metcal solder stands are actually very expensive and I didn't have any. Later I received a new and very nice MX-H1-AV handpiece as a birthday gift.
This came from RS Components where MX-H1-AV seems to be quite cheap compared to many others for some reason, even though RS usually isn't know for being cheap. So if anyone needs a new MX-H1-AV alloy handpiece for your DIY, Metcal or Thermaltronics/Easy Braid power supply, try to check out the price at you national RS Components site.

« Last Edit: February 09, 2015, 08:45:52 am by AndersAnd »

Report to moderator Logged

AndersAnd
Frequent Contributor
Posts: 568
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #311 on:** May 05, 2014, 06:28:34 pm »

Say Thanks Reply Quote

Also posted this in another topic here: https://www.eevblog.com/forum/projects/broken-metcal-rfg-30-soldering-base-unit-fixed/msg438916/#msg438916
But thought I would post it in this DIY topic too, if someone wants to make their own Metcal hand-piece clone.
It's a bit hard to see what value the capacitor has, can anyone see what capacitor this is?

Quote from: mamalala on April 30, 2014, 09:22:50 am

Quote from: AndersAnd on April 30, 2014, 05:54:53 am

Isn't there a feed-through capacitor instead of a series capacitor as we talked about earlier from here onwards: https://www.eevblog.com/forum/projects/diy-metcal-13-56-mhz-rf-supply/msg310381/#msg310381https://www.eevblog.com/forum/projects/diy-metcal-13-56-mhz-rf-supply/msg310381/#msg310381

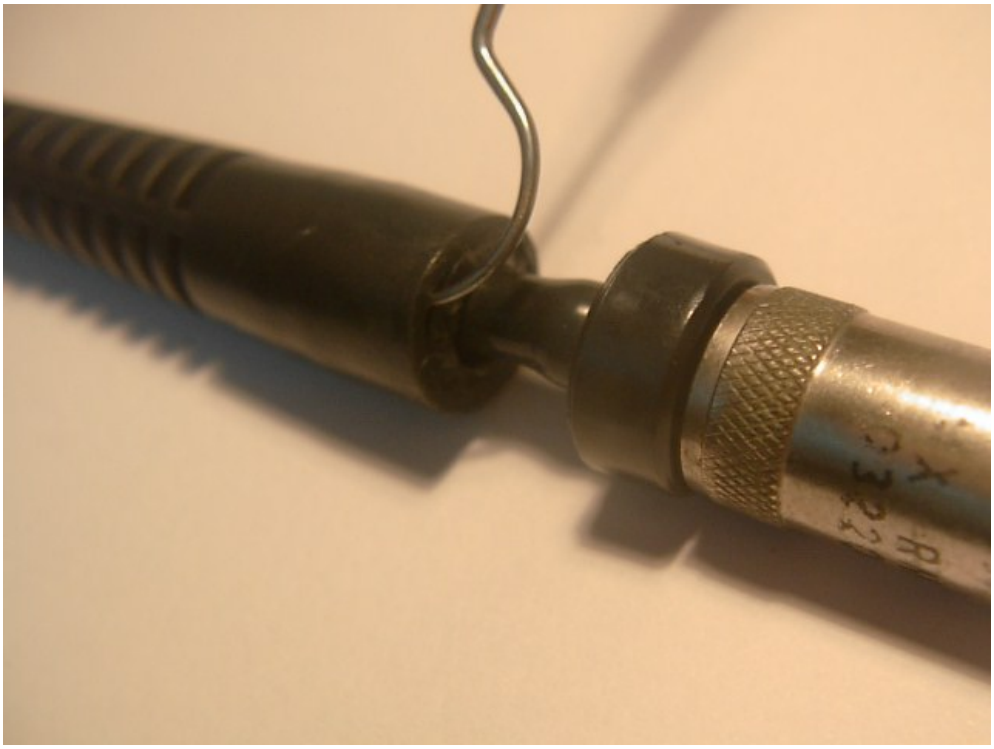
From what my friend told me, there _seems_ to be none, according to the analyzer. Of course something could have gone wrong, and there is one and he just missed it, i don't know. After all, there is also the capacitance from the cable, so that any internal cap was simply "hidden" due to that.

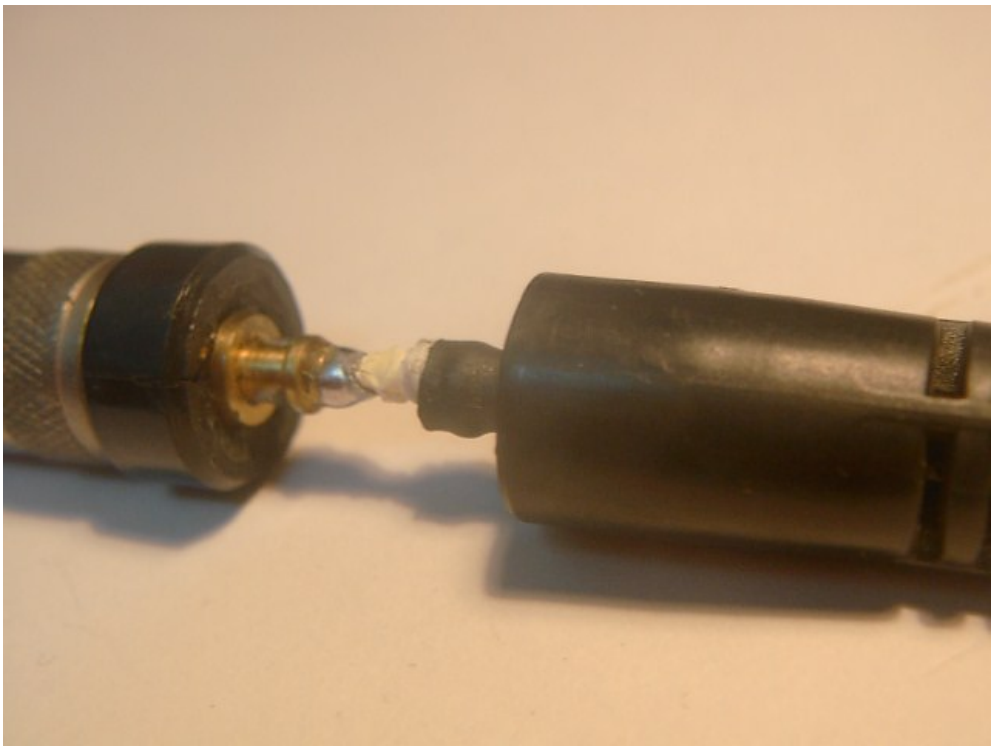
Greetings,

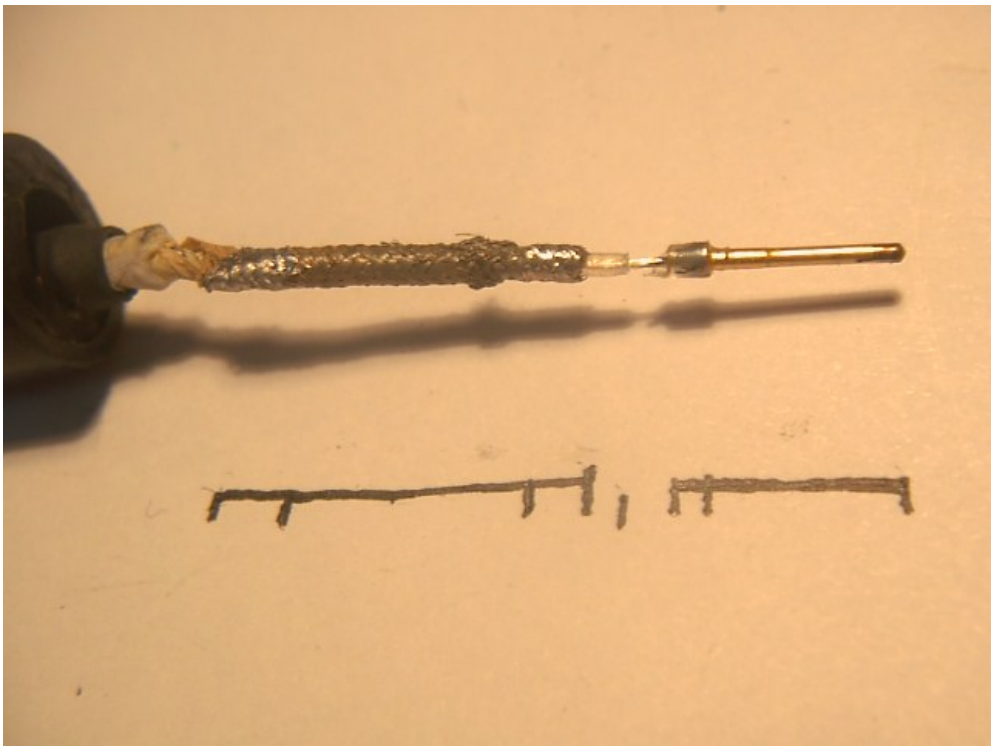
Chris

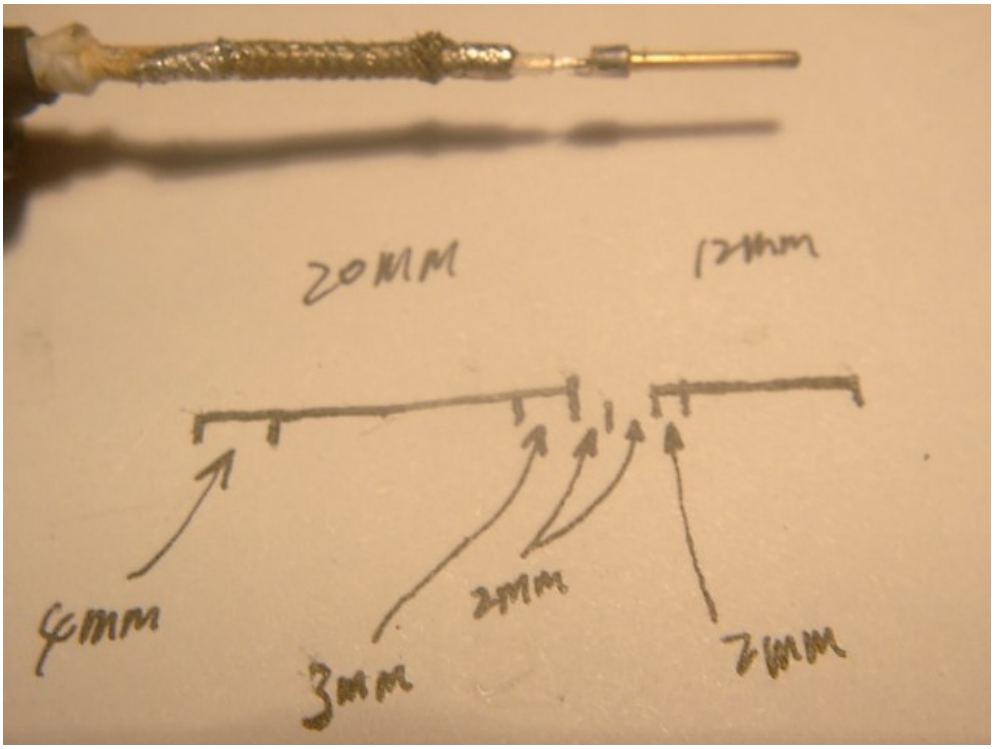
Found these old pics of a disassembled Metcal MX-RM3E https://imgur.com/a/RvDVu#0
They were posted in this topic in Oct. 2012: https://www.eevblog.com/forum/reviews/for-jbc-fans-out-there-jbc-tips-anatomy/msg151939/#msg151939

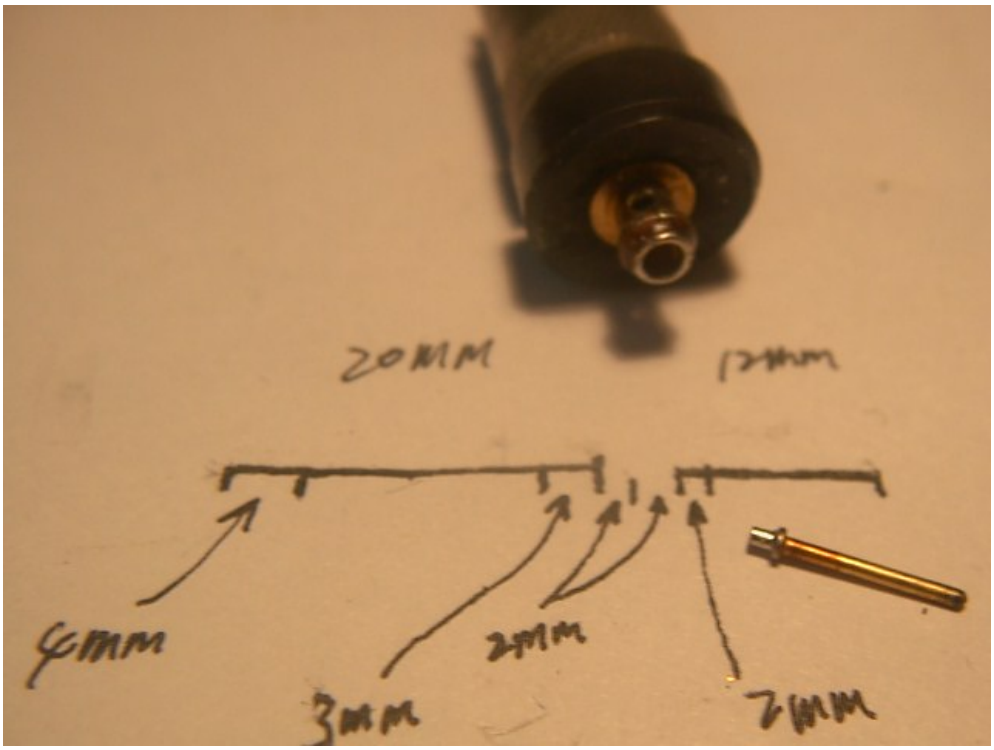
The last pictures shows there actually is a small capacitor in parallel with a 22µH inductor.








20MM
12MM
4MM
3MM
2MM
2MM


20MM
12MM
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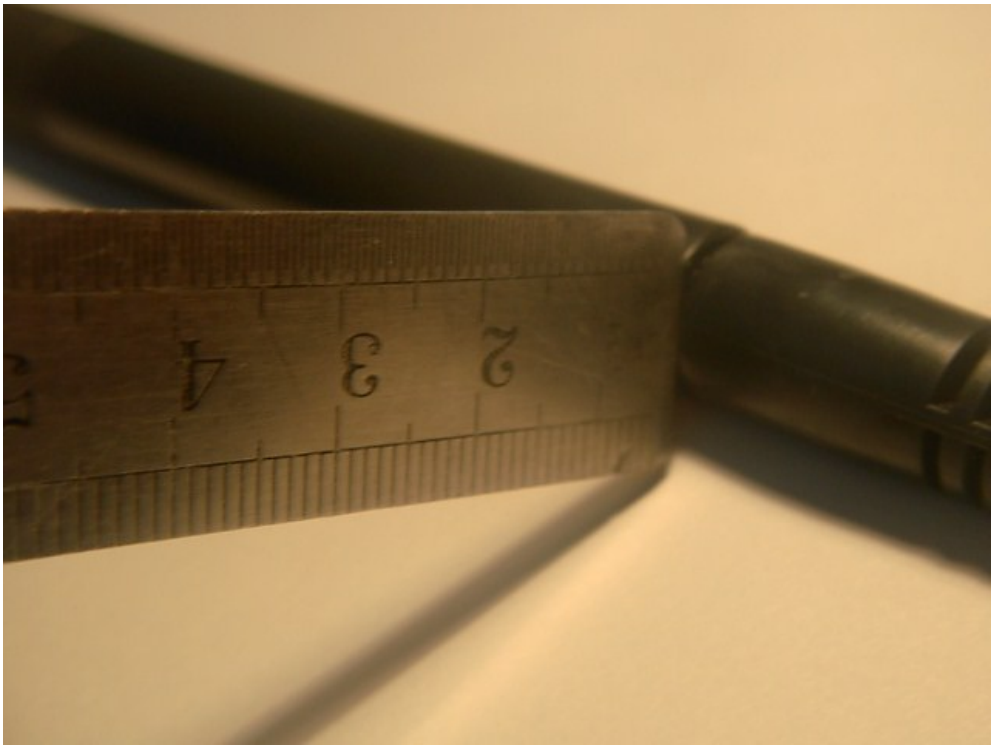
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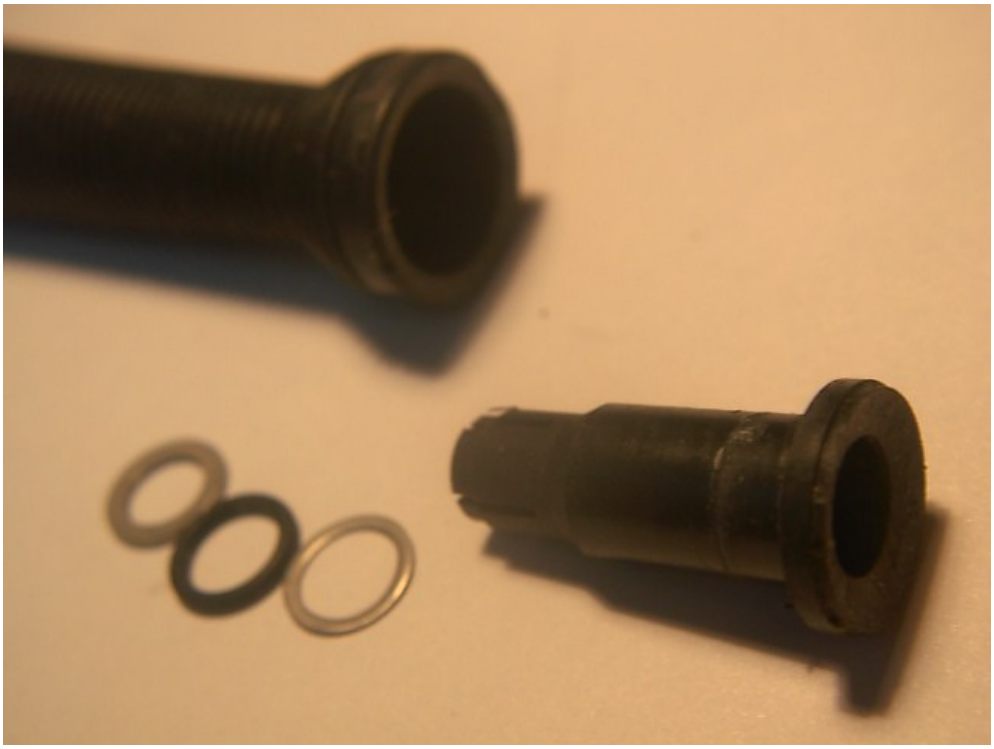


20MM
3MM
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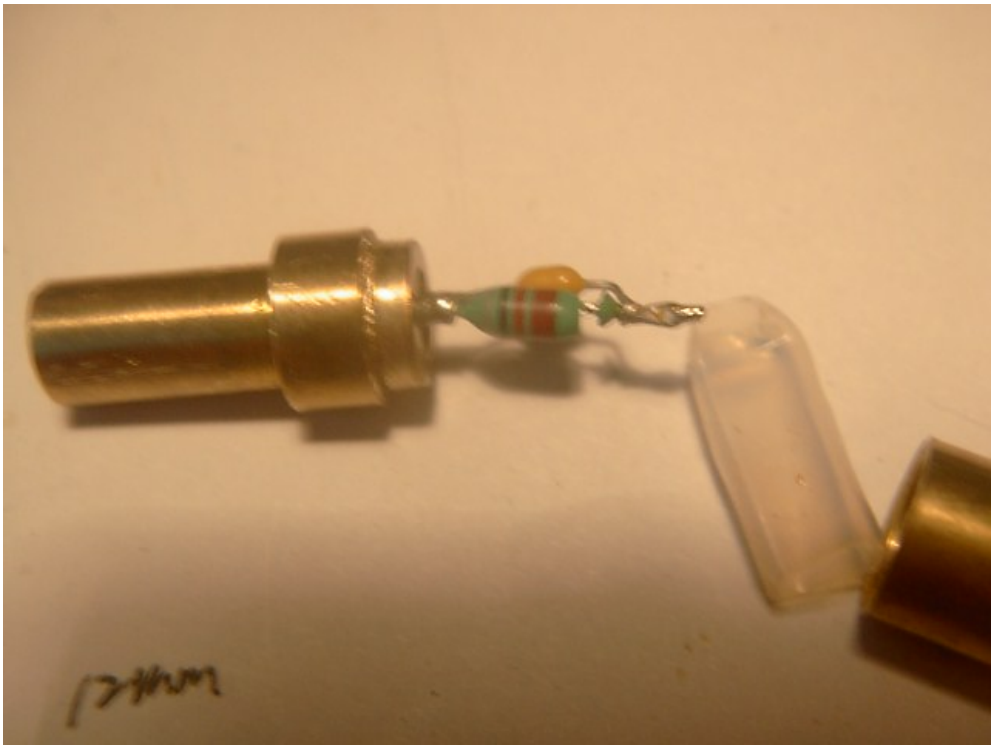

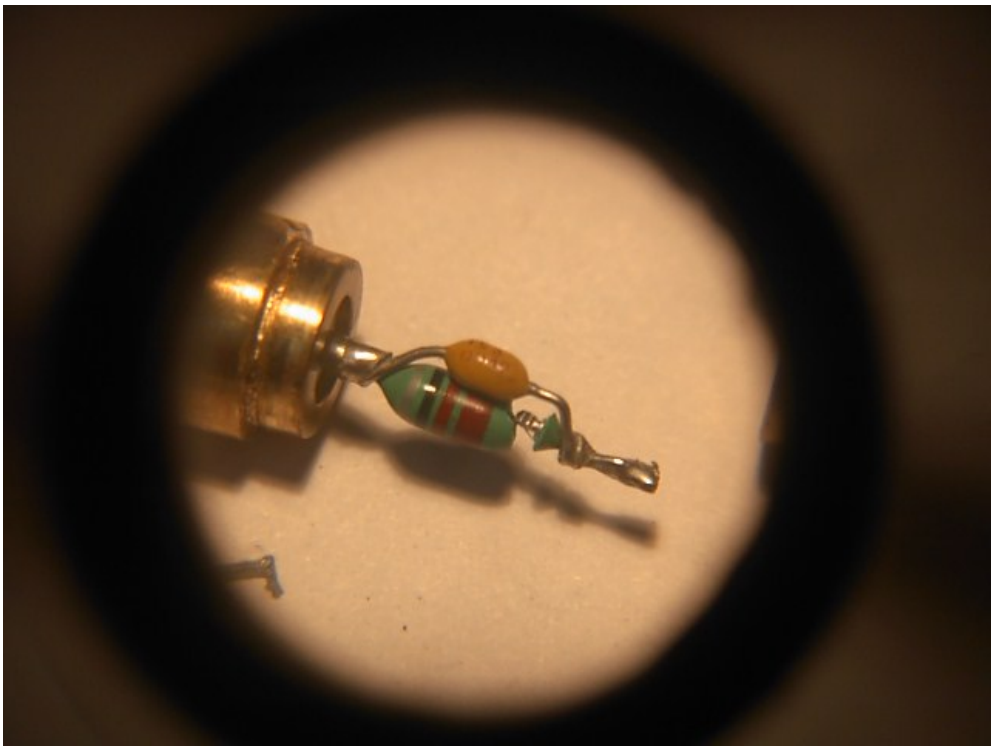

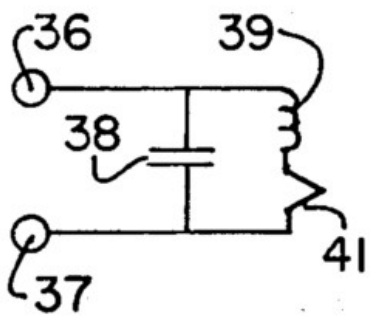
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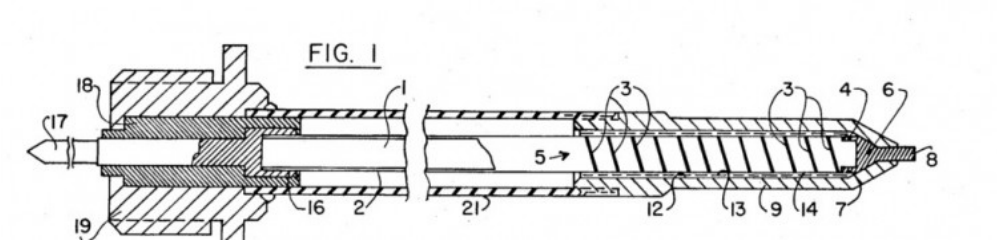

« *Last Edit: May 05, 2014, 06:32:53 pm by AndersAnd* »

Report to moderator Logged

mamalala

Supporter

Posts: 777

Country:

Re: DIY Metcal 13.56 MHz RF Supply

« **Reply #312 on:** May 05, 2014, 09:19:26 pm »

Say Thanks Reply Quote

Thanks for the images. That's rather strange then, i think. The images do not really match what i was seeing in the original patent, and it does not match what can be seen in the drawing you posted either. In the original patent, it looks as if there is only one capacitor, in series to the element. In you drawing, it looks as if a cap (38) is in parallel to a serial combonation of inductor (39) and element (41) (assuming that 36 and 37 are the feed-in ponts of the RF signal). But then, in your photo it looks as if there is a parallel combination of capacitor and inductor, which in turn is then in series with the element.

Really strange... Who knows, maybe they changed the design several times? If that stuff is still there today, then i guess my friend simply missed it when testing the handpiece on the NA.

Greetings,

Chris

Report to moderator Logged

3roomlab

Frequent Contributor

Posts: 949

Country: 00

can you tell me how to cal sesame street meter?

Re: DIY Metcal 13.56 MHz RF Supply

« **Reply #313 on:** May 06, 2014, 12:45:15 am »

Say Thanks Reply Quote

i have a tricky question.

i once read in ARRL handbook about using a length of coax as VSWR sense by slipping in 1 or 2 more sense wires under the braid, so instead of having the PCB trace as the sense, i know the coax would work ... but im not sure how to calculate the length of this coax ... ? 1/4 lambda = approx 215inches ! so i dont think its based on wavelength?

i saw this version http://www.njqrp.org/qhbextra/3/3.html75.jpg
which could possibly reduce the size of the sense segment, but im not sure how

« *Last Edit: May 06, 2014, 12:49:23 am by 3roomlab* »

Report to moderator Logged

spheres of influence, example linustechtips. can you feel the brainwashing? showing off equipment, etc. were you swayed and baited? with immense popularity (and social "titles"), can you afford to disagree?

richard.cs

Frequent Contributor

Posts: 662

Country:

Electronics engineer from Southampton, UK.

Re: DIY Metcal 13.56 MHz RF Supply

« **Reply #314 on:** August 08, 2014, 01:33:33 pm »

Say Thanks Reply Quote

Hi All,

Just wondering if anyone's still working on this? It's on my to-do list but other projects keep cropping up.

3roomlab - it doesn't have to be a 1/4 wave, what you're making is a high impedance transmission line (the inner of your sense wire agains the braid through the thickness of the sense wire's insulation) with a weak coupling to the main coax. The strength of the coupling is dependant on length (proportional for lengths << than lambda) but calculating the exact value might be tricky. It's an interesting idea and I might throw it into HFSS at some point to see how it looks.

Richard

Edit: Results for the coupler

I modelled stuffing a bit of wire up the braid of some RG58, assuming that it just stretches out the braid. Wire was 1 mm OD PVC with 0.2 mm copper inner. It distorts the impedance of the coax a bit (I got 73 ohm) and looks like 60 ohms against the braid. Both are close enough to 50 ohms not to care about it too much* :-). Over a 100 mm length the forward coupling was -56 dB and the reverse coupling was -96 dB. This works better than I expected although the coupling is pretty weak. :-)

*If it was 73 ohms all the way then S11 looking into the main coax would be -15 dB, but for a short (100 mm) length that carries on in 50 ohms afterwards it's more like -50 dB.

« *Last Edit: August 12, 2014, 11:00:20 am by richard.cs* »

Report to moderator Logged

mamalala

Supporter

Posts: 777
Country:

Re: DIY Metcal 13.56 MHz RF Supply

« **Reply #315 on:** August 08, 2014, 05:08:08 pm »

Say Thanks Reply Quote

Quote from: richard.cs on August 08, 2014, 01:33:33 pm

> Hi All,
>
> Just wondering if anyone's still working on this? It's on my to-do list but other projects keep cropping up.

Yes, i do, sometimes. I'm in the process of a major overhaul of the circuitry and layout, to (hopefully) simplify and improve some things. However, right now i can't spend much on any prototyping stuff, so it will have to wait for a while. Once i got something to show, i will probably open a new thread for the version 2 of this supply.

Greetings,

Chris

Report to moderator Logged

David Hess

Super Contributor

Posts: 9902
Country:

DavidH

Re: DIY Metcal 13.56 MHz RF Supply

« **Reply #316 on:** August 17, 2014, 01:17:47 am »

Say Thanks Reply Quote

A lateral power MOSFET like those made by Semelab might make a better replacement.

Report to moderator Logged

zayance

Contributor

Posts: 26
Country:

Re: DIY Metcal 13.56 MHz RF Supply

« **Reply #317 on:** August 20, 2014, 04:38:54 pm »

Say Thanks Reply Quote

Hi There,

I made a small batch of PCB's for this project.
I'll need only two of these, and since i won't be needing the spares i have, i tought of proposing them here.
I have 11 in Stock right now

Please don't hesitate to send me a PM if interested, as i really would like to get rid of these.

PCB Silkscreen for the RF generator (not the controller) has been moved in numbers since it was imported and assembled as a panel in Eagle (little mistake)
BUT BOM / Build instructions and Schematic were modified accordingly, so won't be a prob, i can email these to print for people that bought the boards of course.

it would be possible to include some of the hard to get bits, scroll down for Reichelt Shopping card,
link to the **updated BOM sheet with manufacturers n°:**
https://docs.google.com/spreadsheet/ccc?key=0Al25JwaqoqLrdENzU05vQlZHYThWemVJOHRIbU9Zamc&usp=sharing

PRICES: (again it's a non profit action, just adding numbers)

I'm making the PCB price incl. all, PPfees and Shipping worldwide (for sake of ease):

One PCB (Controller board + Generator) : 21Euros
Two PCB's (controller board + Generator) : 41Euros

for info:
PCB MFG Price: 16.5Euros
Shipping Worldwide: 2.8Euros to 5.75Euros (depending on quantity)
PPfees: +4% (i make this one a little higher because Paypal can be off sometimes)

Depending on interest, "Hard to get Bits" prices will add up in a Group Buy manner etc...

It would be possible to add these kind of Small dissipators on the list too, but might check somewhere else to avoid LARGE Shipping time
http://www.ebay.com/itm/5pcs-13x13x11mm-High-Quality-Aluminum-Heat-Sink-For-Chip-Electronic-H36-/181109747336?pt=LH_DefaultDomain_0&hash=item2a2afb6e88

For cutting them apart, you'll still need to cut, with a saw, some "plain" parts on each end before beeing able to break apart.

« *Last Edit: August 20, 2014, 05:44:22 pm by zayance* »

Report to moderator Logged

zayance
Contributor
Posts: 26
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #318 on:** August 23, 2014, 11:00:14 am »
Say Thanks Reply Quote

For now only two folks interested, and 8 PCB's left.

Anyone else?

Report to moderator Logged

Precipice
Frequent Contributor
Posts: 403
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #319 on:** August 23, 2014, 11:11:16 am »
Say Thanks Reply Quote

I'm one of those two. If anyone's keen, but can't face the surface mount soldering, I'd be happy to run their boards through the machine as I do mine. No guarantees of quick turnaround, and I'd only do the surface mount. Proper lead-free solder & machine placement, though.

Report to moderator Logged

peter.mitchell
Super Contributor

Posts: 1568
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #320 on:** August 23, 2014, 12:05:52 pm »
Say Thanks Reply Quote

Quote from: zayance on August 20, 2014, 04:38:54 pm

Hi There,

I made a small batch of PCB's for this project.
I'll need only two of these, and since i won't be needing the spares i have, i tought of proposing them here.
I have 11 in Stock right now

Please don't hesitate to send me a PM if interested, as i really would like to get rid of these.

PCB Silkscreen for the RF generator (not the controller) has been moved in numbers since it was imported and assembled as a panel in Eagle (little mistake)
BUT BOM / Build instructions and Schematic were modified accordingly, so won't be a prob, i can email these to print for people that bought the boards of course.

it would be possible to include some of the hard to get bits, scroll down for Reichelt Shopping card,
link to the **updated BOM sheet with manufacturers n°:**
https://docs.google.com/spreadsheet/ccc?key=0Al25JwaqoqLrdENzU05vQlZHYThWemVJOHRIbU9Zamc&usp=sharing

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Two PCB's (controller board + Generator) : 41Euros

for info:
PCB MFG Price: 16.5Euros
Shipping Worldwide: 2.8Euros to 5.75Euros (depending on quantity)
PPfees: +4% (i make this one a little higher because Paypal can be off sometimes)

Depending on interest, "Hard to get Bits" prices will add up in a Group Buy manner etc...

It would be possible to add these kind of Small dissipators on the list too, but might check somewhere else to avoid LARGE Shipping time
http://www.ebay.com/itm/5pcs-13x13x11mm-High-Quality-Aluminum-Heat-Sink-For-Chip-Electronic-H36-/181109747336?pt=LH_DefaultDomain_0&hash=item2a2afb6e88

For cutting them apart, you'll still need to cut, with a saw, some "plain" parts on each end before beeing able to break apart.

Just curious who did your pcb manufacture with the matte black silkscreen and enig, they look beautiful!

Report to moderator Logged

zayance
Contributor
Posts: 26
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #321 on:** August 25, 2014, 04:23:10 pm »
Say Thanks Reply Quote

It's a China based manufacturer, nice quality and good service.
But i've seen other manufacturers based in Asia having similar quality.
Now for double sided, and maybe a little more they sem to be good, can't tell for any complex stuff tough.

http://www.pcbcart.com/

Report to moderator Logged

peter.mitchell
Super Contributor

Posts: 1568
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #322 on:** August 26, 2014, 08:28:50 am »
Say Thanks Reply Quote

> **Quote from: zayance on August 25, 2014, 04:23:10 pm**
>
> It's a China based manufacturer, nice quality and good service.
> But i've seen other manufacturers based in Asia having similar quality.
> Now for double sided, and maybe a little more they sem to be good, can't tell for any complex stuff tough.
>
> http://www.pcbcart.com/

Ahhh, ive used pcb cart before - although they didn't have matte black soldermask then?

Report to moderator Logged

mamalala
Supporter

Posts: 777
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #323 on:** August 28, 2014, 05:53:50 pm »
Say Thanks Reply Quote

Hi all,

just wanted to say, zayance sent me those PCB's and they look just great! Thanks very much for that, zayance!

If you plan to build one, go for it. Right now i'm rather busy with other stuff, plus i'm short on funny-money to spend on private projects right now, so the next version of the supply board will take some time.

Greetings,

Chris

Report to moderator Logged

zayance
Contributor
Posts: 26
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #324 on:** August 29, 2014, 08:36:59 pm »
Say Thanks Reply Quote

Shameless Bump

Report to moderator Logged

zayance
Contributor
Posts: 26
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #325 on:** September 02, 2014, 06:08:22 pm »
Say Thanks Reply Quote

Hi There,

End of this week i'll start ordering parts for the few members who were interested.
I will have spares (unfortunatly), so i can still provide PCB's for people interested in the future, but will not reorder at Reichelt etc... (you'll have to grab that on your own).

Thanks.

T.

Report to moderator Logged

Precipice
Frequent Contributor

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #326 on:** September 02, 2014, 06:46:52 pm »
Say Thanks Reply Quote

Posts: 403
Country:

I'm still very much up for two sets! Maybe you should stick the spares on Tindie? Not everyone who'll be tempted will have seen this...

Report to moderator Logged

zayance
Contributor
Posts: 26
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #327 on:** September 07, 2014, 10:17:23 am
Say Thanks Reply Quote
»

Hi there,

So closing the feeler to order the parts for people interested.
Will see what to do with the unwanted spares, thanks for the suggestion Precipice.

Keep in touch.

T.

Report to moderator Logged

Corporate666
Supporter

Posts: 2001
Country:
Remember, you are unique, just like everybody else

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #328 on:** September 07, 2014, 10:34:25 pm
Say Thanks Reply Quote
»

Quote from: Precipice on August 23, 2014, 11:11:16 am

> I'm one of those two. If anyone's keen, but can't face the surface mount soldering, I'd be happy to run their boards through the machine as I do mine. No guarantees of quick turnaround, and I'd only do the surface mount. Proper lead-free solder & machine placement, though.

I am really late to this party... sorry if this is all obvious, but as I understand these are aftermarket boards that will work with original Metal handsets?

I have an MX-500 that's had a few problems with the base unit in the past. If I'm correct about the boards, I'd be interested in getting a couple. And you would be able to send them on to me (at some future time - I'm in no rush) populated with the SMT parts and I'd source and add the through hole myself and take care of enclosure, etc?

If I got that right, and if your offer is still open, I'm in.

Report to moderator Logged

It's not always the most popular person who gets the job done.

zayance
Contributor
Posts: 26
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #329 on:** September 08, 2014, 08:15:27 am
Say Thanks Reply Quote
»

Hi There,

Quote

> these are aftermarket boards that will work with original Metal handsets

yes

Quote

> I have an MX-500 that's had a few problems with the base unit in the past

won't be an exact replacement.

Quote

> And you would be able to send them on to me (at some future time - I'm in no rush) populated with the SMT parts and I'd source and add the through hole myself and take care of enclosure, etc?

I'm not the one who was proposing the SMD soldering service, ask forum member Precipice about that.

> **Quote**
>
> If I got that right, and if your offer is still open, I'm in.

Well i was going to conclude, but there are some people interested so still open until i get my numbers and all.

Are you in for one board? Please confirm, prices and infos are a little up.

Best,

T.

Report to moderator Logged

Precipice
Frequent Contributor
Posts: 403
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #330 on:** September 08, 2014, 10:09:12 am
Say Thanks Reply Quote
»

> **Quote from: zayance on September 08, 2014, 08:15:27 am**
>
> I'm not the one who was proposing the SMD soldering service, ask forum member Precipice about that.

Yeah, no problem. If you have your boards bundled with mine, I'll stuff them when I do mine, and bill you for the parts used and post them out. No idea how much they'll cost, but I'll not take the piss.

Steve

Report to moderator Logged

Corporate666
Supporter
Posts: 2001
Country:
Remember, you are unique, just like everybody else

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #331 on:** September 08, 2014, 06:20:23 pm
Say Thanks Reply Quote
»

> **Quote from: zayance on September 08, 2014, 08:15:27 am**
>
> won't be an exact replacement.
>
> I'm not the one who was proposing the SMD soldering service, ask forum member Precipice about that.
>
> Well i was going to conclude, but there are some people interested so still open until i get my numbers and all.
>
> Are you in for one board? Please confirm, prices and infos are a little up.
>
> Best,
>
> T.

Hi T,

Yep, I realize it won't be an exact replacement - but will work with my handset, that's fine. I'll work out the details with Precipice and get the boards through him - thanks!

Report to moderator Logged

It's not always the most popular person who gets the job done.

Corporate666
Supporter
Posts: 2001
Country:
Remember, you are unique, just like everybody else

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #332 on:** September 08, 2014, 06:21:50 pm
Say Thanks Reply Quote
»

> **Quote from: Precipice on September 08, 2014, 10:09:12 am**
>
> > **Quote from: zayance on September 08, 2014, 08:15:27 am**
> >
> > I'm not the one who was proposing the SMD soldering service, ask forum member Precipice about that.
>
> Yeah, no problem. If you have your boards bundled with mine, I'll stuff them when I do mine, and bill you for the parts used and post them out. No idea how much they'll cost, but I'll not take the piss.
>
> Steve

Hi Steve,

That is a very kind offer, thanks! As I said, I am in no rush at all... so if it takes some weeks or even months to get the boards done, that's fine by me.

I am not sure what the cost is for the boards/shipping to you, and if you would like me to PayPal $$ to you for that or to zayance directly and have them drop-shipped to you, but just let me know what is easiest for you and I will do it.

Thanks, guys!

Report to moderator Logged

It's not always the most popular person who gets the job done.

zayance
Contributor
Posts: 26
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #333 on:** September 15, 2014, 10:06:12 am
Say Thanks Reply Quote
»

Allright folks, so here are the numbers for the little Groupbuy, and some Screen capture for you to have a look.

PCB price excl PPfees: **16.5Euros**
Hard to Get Bits, one set: **5.29Euros**
Shipping from reicheilt participation: **1.99Euros (divided between people interested incl. me)**
Shipping Costs (priority international):
One set: **2.8Euros**
Two Set: **5.75Euros**

So here is the total cost for the ones interested:(incl.Shipping/PPfees)
Precipice (2 sets): **53.4Euros incl.all** PAID
richard.cs (2 sets): **53.4Euros incl.all** PAID
salbayeng (2sets): **53.4Euros incl.all**
corporate666 (2sets): **53.4 incl.all** (ships to precipice) PAID

My Paypal adress: **zayance at gmail dot com**

Parts will be ordered as soon as the Money is collected.

Thanks again!

« *Last Edit: September 17, 2014, 10:30:34 pm by zayance* »
Report to moderator Logged

Corporate666
Supporter
Posts: 2001
Country:
Remember, you are unique, just like everybody else

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #334 on:** September 15, 2014, 07:56:28 pm
Say Thanks Reply Quote
»

Zayance,

I was actually going to get 2 sets... so it's OK to just PayPal you the same amount as Precipice (53.4Euros)??

I will do it this evening when I get back from work - thanks!!!

Report to moderator Logged

It's not always the most popular person who gets the job done.

Precipice
Frequent Contributor
Posts: 403
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #335 on:** September 15, 2014, 08:40:30 pm
Say Thanks Reply Quote
»

Just paid you - thanks!

Report to moderator Logged

zayance
Contributor
Posts: 26

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #336 on:** September 15, 2014, 08:44:39 pm
Say Thanks Reply Quote
»

Country:

@corporate666: Sure no prob.

@Precipice: Received, Thanks!

Report to moderator Logged

Corporate666

Supporter

Posts: 2001
Country:

Remember, you are unique, just like everybody else

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #337 on:** September 15, 2014, 11:39:02 pm
»

Say Thanks Reply Quote

Just paid - thank you Zayance!

Report to moderator Logged

It's not always the most popular person who gets the job done.

zayance

Contributor

Posts: 26
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #338 on:** September 19, 2014, 09:32:13 am
»

Say Thanks Reply Quote

Update:
I'm waiting for one last person to pay.
I've sended him a PM.

Thanks for your patience.

T.

Report to moderator Logged

salbayeng

Frequent Contributor

Posts: 277
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #339 on:** September 19, 2014, 09:48:01 am
»

Say Thanks Reply Quote

Oops , I'm the tardy one, all paid up now though.

Report to moderator Logged

zayance

Contributor

Posts: 26
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #340 on:** September 20, 2014, 10:31:43 am
»

Say Thanks Reply Quote

Hi There,

Parts are ordered.

Keep in touch.

T.

Report to moderator Logged

zayance

Contributor

Posts: 26
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #341 on:** September 24, 2014, 09:21:35 am
»

Say Thanks Reply Quote

Parts are all here.

Will ship asap.

Thanks again.

T.

PS: Please let me know by PM when these are received.

Report to moderator Logged

zhkbx
Newbie
Posts: 1

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #342 on:** October 02, 2014, 11:22:28 am »
Say Thanks Reply Quote

to zayance,may I ask do you have any MX-500 PCB left?thanks

Report to moderator Logged

zapta
Super Contributor
Posts: 6004
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #343 on:** October 04, 2014, 07:49:27 am »
Say Thanks Reply Quote

Will this power supply work with the Hakko FX100 inductive hand-piece? Its tips are priced more reasonably that Metcal (click on the Related Tabs in the link below).

http://www.hmcelectronics.com/product/Hakko/FX1001-52

Report to moderator Logged

Drain the swamp.

AndersAnd
Frequent Contributor
Posts: 568
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #344 on:** October 04, 2014, 01:59:18 pm »
Say Thanks Reply Quote

Quote from: zapta on October 04, 2014, 07:49:27 am

> Will this power supply work with the Hakko FX100 inductive hand-piece? Its tips are priced more reasonably that Metcal (click on the Related Tabs in the link below).
>
> http://www.hmcelectronics.com/product/Hakko/FX1001-52

I wasn't even aware Hakko had started ~~cloning Metcal~~ making 13.56 MHz Curie Point Induction Soldering Systems.

According to the quote below they are indeed compatible with Metcal's 13.56 MHz power supplies. The Hakko soldering iron even fits in the Metcal stand (and probably the other way around too). So they should work with this DIY power supply too.

http://www.stratesysgroup.com/Product_Reviews/HakkoFX100

Quote

> Hakko's FX-1001 soldering iron handle uses a standard RF connector to attach to the power supply and runs at 13.56 MHz, the same frequency that Metcal uses in their older MX-500 and newer MX-5000 series (it also fits into their stand). It will not work in the formerly branded OKi products as these use a lower frequency of 450 KHz. This means that with the purchase of the FX1001-51 for about $85, a user can switch over to the superior, affordable Hakko T31 tips and start saving money right away. Once the competitor's power supply dies out, the Hakko FX100-04 power supply can be purchased to give a further performance improvement, including the Boost Mode.

Hakko FX-100 Induction Heat Soldering System by American Hakko

Hakko FX-100 Soldering System by American Hakko — How to Use the Menu

« Last Edit: October 04, 2014, 02:15:54 pm by AndersAnd »

Report to moderator Logged

zayance
Contributor
Posts: 26
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #345 on:** October 04, 2014, 02:34:44 pm »
Say Thanks Reply Quote

Good to know.

Thanks.

Report to moderator Logged

mamalala

Re: DIY Metcal 13.56 MHz RF Supply
Say Thanks Reply Quote

Supporter

Posts: 777
Country:

« **Reply #346 on:** October 04, 2014, 10:39:46 pm »

Quote from: AndersAnd on October 04, 2014, 01:59:18 pm

> I wasn't even aware Hakko had started ~~cloning Metcal~~ making 13.56 MHz Curie Point Induction Soldering Systems.

Given that the original patents from Metcal now expired, i guess we will see a lot more inductive systems coming out in the future.

But yea, good to know about Hakko. And yes, it should work on the DIY supply as well.

Greetings,

Chris

Report to moderator Logged

zayance

Contributor

Posts: 26
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #347 on:** October 13, 2014, 08:07:36 pm »

Say Thanks Reply Quote

Hi there,
Everybody has received their package safe and sound?

Best,

T.

Report to moderator Logged

richard.cs

Frequent Contributor

Posts: 662
Country:

Electronics engineer from Southampton, UK.

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #348 on:** October 13, 2014, 09:51:17 pm »

Say Thanks Reply Quote

I have thank you. :-)

Report to moderator Logged

salbayeng

Frequent Contributor

Posts: 277
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #349 on:** October 14, 2014, 06:08:47 am »

Say Thanks Reply Quote

Also Thermaltronics (in Australia and USA) make induction soldering stations, and quite well priced replacement cartridges and tips / handles .
http://www.thermaltronics.com/replacement_tips.php
They are color coded into 600F 750F 800F , blue yellow red.
There is a keyhole shaped slot in their soldering stand so you can change tips/ cartridges while operating.

Basically any induction soldering iron that has a coaxial connector in the lead should work with the 13.56 system, It's usually a "F" connector = same as used on US television sets for the antenna.

Report to moderator Logged

Precipice

Frequent Contributor

Posts: 403
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #350 on:** October 14, 2014, 07:32:47 am »

Say Thanks Reply Quote

Quote from: zayance on October 13, 2014, 08:07:36 pm

> Everybody has received their package safe and sound?

I have, and am assembling the pile of parts... Thanks!

Report to moderator Logged

AndersAnd

Frequent Contributor

Posts: 568
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #351 on:** October 14, 2014, 08:56:17 am »

Say Thanks Reply Quote

Quote from: salbayeng on October 14, 2014, 06:08:47 am

> Also Thermaltronics (in Australia and USA) make induction soldering stations, and quite well priced replacement cartridges and tips / handles .
> http://www.thermaltronics.com/replacement_tips.php

They are color coded into 600F 750F 800F , blue yellow red.
There is a keyhole shaped slot in their soldering stand so you can change tips/ cartridges while operating.

Basically any induction soldering iron that has a coaxial connector in the lead should work with the 13.56 system, It's usually a "F" connector = same as used on US television sets for the antenna.

Thermaltronics have already been mentioned and tested to work with this DIY supply earlier in this topic. Thermaltronics was founded by former Metcal employees once the Metcal patents expired.
Thermaltronics are also sold rebadged as Easy Braid: http://www.easybraidco.com/hand-soldering
As far as I know EasyBraid branded solder stations are only sold by DigiKey and Amazon US.
Amazon only sell the top series EB9000 though.
EasyBraid at Digi-Key: www.digikey.com/Suppliers/us/Easy-Braid.page

So so far there's 4 compatible brands to choose from for 13.56 MHz solder pens and tips:

1. Metcal
2. Thermaltronics
3. Easy Braid
4. Hakko

« *Last Edit: October 14, 2014, 09:12:59 am by AndersAnd* »

Report to moderator Logged

martin5256
Newbie
Posts: 2

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #352 on:** October 24, 2014, 10:22:39 pm »

Say Thanks Reply Quote

Hello could somebody make a partslist for mauser or another store it would be nice if you could order a kit just an idea

Report to moderator Logged

zayance
Contributor
Posts: 26
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #353 on:** October 26, 2014, 06:00:43 pm »

Say Thanks Reply Quote

Quote from: martin5256 on October 24, 2014, 10:22:39 pm

> Hello could somebody make a partslist for mauser or another store it would be nice if you could order a kit just an idea

---

There is a BOM on Reply #330 that was made for the Boards i had ordered, so you have parts refs there,
but unfortunatly the Silkscreen is different from original File of this one, Silkscreen is different for the RF Generator.

Alos all parts for building this one are not available from Mouser, you need some parts that can be found @ Reichelt,
if you haven't read the latest posts i made.
+ Not many are interested on this one, so not sure about a KIT.

Best,

T.

« *Last Edit: October 26, 2014, 06:03:30 pm by zayance* »

Report to moderator Logged

zapta
Super Contributor
Posts: 6004
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #354 on:** October 26, 2014, 07:52:16 pm »

Say Thanks Reply Quote

For the people that build these power supply, please post pictures of your soldering stations when done.

Report to moderator Logged

Drain the swamp.

martin5256
Newbie
Posts: 2

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #355 on:** October 30, 2014, 11:29:22 am »

Say Thanks Reply Quote

Quote from: zayance on October 26, 2014, 06:00:43 pm

> **Quote from: martin5256 on October 24, 2014, 10:22:39 pm**
>
> > Hello could somebody make a partslist for mauser or another store it would be nice if you could order a kit just an idea

> There is a BOM on Reply #330 that was made for the Boards i had ordered, so you have parts refs there,
> but unfortunatly the Silkscreen is different from original File of this one, Silkscreen is different for the RF Generator.
>
> Alos all parts for building this one are not available from Mouser, you need some parts that can be found @ Reichelt,
> if you haven't read the latest posts i made.
> + Not many are interested on this one, so not sure about a KIT.
>
> Best,
>
> T.

You im back

so im only 15 but im on an electrotechnician school and so on i wouldn´t say people arent interested on a kit but they are to lazy to ask i was looking at parts on farnel and i wasn´t on the half and there were 200€ i mean if you could put the cost down get some boards a nice case and you could create a good brand the design is nice and mamalala had some work with it but deam if he could make a kit i think if he puted it on dangerous prototipes and the pcb on seedstudios he could make some money

i am interested in metcal irons becouse my curent is a tesla one an it works nice but you know you have to move on

so if we could put all the components in one place to sell it would be more then good and i think people would buy it when it hac a cost like a used metcal

guys it is nice what you do and you are great at it so i wana see some progres

greatings form slovakia

Report to moderator Logged

zayance
Contributor
Posts: 26
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #356 on:** November 13, 2014, 08:15:32 pm »

Say Thanks Reply Quote

> **Quote from: martin5256 on October 30, 2014, 11:29:22 am**
>
> > **Quote from: zayance on October 26, 2014, 06:00:43 pm**
> >
> > > **Quote from: martin5256 on October 24, 2014, 10:22:39 pm**
> > >
> > > Hello could somebody make a partslist for mauser or another store it would be nice if you could order a kit
> > > just an idea
> >
> > There is a BOM on Reply #330 that was made for the Boards i had ordered, so you have parts refs there,
> > but unfortunatly the Silkscreen is different from original File of this one, Silkscreen is different for the RF Generator.
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> > Alos all parts for building this one are not available from Mouser, you need some parts that can be found @ Reichelt,
> > if you haven't read the latest posts i made.
> > + Not many are interested on this one, so not sure about a KIT.
> >
> > Best,
> >
> > T.
>
> You im back
>
> so im only 15 but im on an electrotechnician school and so on i wouldn´t say people arent interested on a kit but they are to lazy to ask i was looking at parts on farnel and i wasn´t on the half and there were 200€ i mean if you could put the cost down get some boards a nice case and you could create a good brand the design is nice and mamalala had some work with it but deam if he could make a kit i think if he puted it on dangerous prototipes and the pcb on seedstudios he could make some money
>
> i am interested in metcal irons becouse my curent is a tesla one an it works nice but you know you have to move on
>
> so if we could put all the components in one place to sell it would be more then good and i think people would buy it when it hac a cost like a used metcal
>
> guys it is nice what you do and you are great at it so i wana see some progres
>
> greatings form slovakia

True i get your point, parts at Farnell are usually expensive compared to some other suppliers, some

would say, "well if you want genuine and no problems of counterfeit etc... go for those Big supplier" but anyway the BOM gives hints on what to use, package etc... so you can bring parts cost down depending on where and what you choose, giving that you use correct package/model, anyway you got my point.
Of course a Kit would save cash, since you'll have exact count parts and no extras, plus the advantage of buying by multiple etc...
BUT who got the time for this haha, not sure if mamalala would have, and neither would i, plus the fact that it might bother some brand out there who knows???
I made a partial kit for helping my extra boards to get out of here, and that was some time put to it etc...
Interest on these weren't off the hook, and we can understand why, most won't even bother buidling a Solder Station , since you already need one to do so haha .

I still need to build mine YET! (soon tough)

Cheers,

T.

Report to moderator Logged

richard.cs
Frequent Contributor
Posts: 662
Country:
Electronics engineer from Southampton, UK.

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #357 on:** November 14, 2014, 01:01:32 pm »
Say Thanks Reply Quote

I've spent some time hunting back through the thread as I'm about to order components. Could someone please confirm if my understanding is correct here.

1) The BOM from post #330 matches the silkscreen boards that I got from zayance?
2) It's electrically the same circuit as posted way back in #103?
3) The component identifiers on the board/bom do **not** match the schematic?
4) No schematic with matching component identifiers has been posted?

If that's all correct then zayance, would you be able to post a matching schematic please? I assume it must exist since you had the CAD files to get the board made. If it doesn't it's not a big problem but it would save me quite a bit of time.

Many thanks
Richard

Report to moderator Logged

zayance
Contributor
Posts: 26
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #358 on:** November 14, 2014, 02:00:11 pm »
Say Thanks Reply Quote

Wait didn't you get the email i've sended with the files for it?
Meaning updated Schematic etc...

Basically it's exactlly the same latest board as mamalala only diff here is that there was a prob in the silk on the Generator side,
since i made one PCB to have both designs, Eagle pushed the Silkscreen numbers beside of just copy/pasting (logic and bummer).
I also moved the silk for some components here and there to make the assembly and it's visualisation easier, that's all.
So i made a Corrected BOM AND a corrected Schematic + Build doc according to the right Tname and values etc....
Something that i've sended to people who bought the boards, including you if my memory is not failing already??
Please let me know

I repeat, All the rest is the same

Best,

T.

Report to moderator Logged

richard.cs
Frequent Contributor

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #359 on:** November 20, 2014, 04:18:50 pm »
Say Thanks Reply Quote

Posts: 662
Country:
Electronics engineer from Southampton, UK.

The quick-release style F-plug grips onto sockets with screw threads just fine. :-) For the record my supply will probably end up with a N connector on the output and a N-F adaptor living on it the whole time, it'll make life easier if I ever design my own handpiece.

First solder on my RF board today (did the LM22676 on the hotplate at work in my lunchbreak).

Report to moderator Logged

richard.cs
Frequent Contributor
Posts: 662
Country:
Electronics engineer from Southampton, UK.

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #360 on:** November 26, 2014, 12:44:09 pm » Say Thanks Reply Quote

I'm currently building up the RF board. The first test with the buck converter worked perfectly putting 11.74 V into my dummy load.

I've hit a problem in the area around IC7 - In the schematic and BOM R40 is listed as 22k, in the build guide it is 2k2, which is correct?

Also having gone through all the documentation again there is green comment text next to R41 saying "200R" despite this being a 1k. Whilst examining this it also occurred to me that the choice of R39 (the pot) or R54 and R55 (fixed divider) will make the circuit perform differently. With the fixed resistors R41 is effectively 1050 Ohms to 2.5V, with the pot fitted and in the middle R41 is effectively ~~3500~~ 2250 Ohms to 2.5V and, this being a non-inverting amplifier where the value of R41 matters, this has a direct effect on the gain. I have fitted R39.

I'm using zayance's board and the design pack he sent me.

Edited to correct a couple of mistakes
« *Last Edit: November 26, 2014, 10:23:57 pm by richard.cs* »

Report to moderator Logged

mamalala
Supporter

Posts: 777
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #361 on:** November 26, 2014, 02:47:57 pm » Say Thanks Reply Quote

> **Quote from: richard.cs on November 26, 2014, 12:44:09 pm**
>
> I've hit a problem in the area around IC7 - In the schematic and BOM R40 is listed as 22k, in the build guide it is 2k2, which is correct?
>
> Also having gone through all the documentation again there is green comment text next to R41 saying "200R" despite this being a 1k. Whilst examining this it also occurred to me that the choice of R39 (the pot) or R54 and R55 (fixed divider) will make the circuit perform differently. With the fixed resistors R41 is effectively 1050 Ohms to 2.5V, with the pot fitted and in the middle R41 is effectively 3500 Ohms to 2.5V and, this being an inverting amplifier where the value of R41 matters, this has a direct effect on the gain. I have fitted R39.
>
> I'm using zayance's board and the design pack he sent me.

Yea, all that stuff was left in that state while i was still experimenting with the performance of the unit. In the actual unit i have here, as well as the ones i gave away, i have (using zayance's part numbers):

R40 = 22k
R41 = 200R
R54 = 100R
R55 = 100R
R39 is not installed.

Sorry for the confusion.

Greetings,

Chris

Report to moderator Logged

mamalala
Supporter

Posts: 777
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #362 on:** November 26, 2014, 02:58:22 pm » Say Thanks Reply Quote

BTW, that part of the circuit doesn't have that much influence anyways. A RF signal is picked up before the last L of the output filter and rectified, then fed through an adjustable pot. That is then fed into the OpAmp to generate a volatge that is injected at the center of the divider at the buck regulator. When the tip heats up it causes a mismatch, which makes that voltage rise. Since that is then injected into the feedback network of the regulator, the supply voltage to the RF stage will be lowered.

That particular section was me experimenting with different offsets to that voltage, in an attempt to get a much sharper regulation curve, but turned out not to be really needed that way (thus the footprint of the adjustable R still there, while not being used anymore and instead replaced by the 100R/100R divider).

It will basically work either way. The only important thing is that this stage has enough gain to make the signal large enough, so that the buck converter will regulate down sufficiently. If it would not then the tip will continue to absorb quite some energy, causing it to glow dark-red after a while right at the top of the slug inside the cartridge (that is, right where the coil in the cartridge is).

Feel free to experiment a bit with that section. It's not perfect, and i guess still some room for improvement there. But then, i'm not that much of an RF guy, so i left it at "good enough to be usable".

Greetings,

Chris

Report to moderator Logged

richard.cs
Frequent Contributor
Posts: 662
Country:
Electronics engineer from Southampton, UK.

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #363 on:** November 26, 2014, 10:22:40 pm » Say Thanks Reply Quote

Thanks for the reply. I think given that I've fitted all the other resistors, and also just in case I feel like playing with the offset I will leave R39 installed and R41 at 1k as it is now and fit 200k to R40. This would give me a gain of 90 instead of 89, so no significant change. It would rise a bit if the pot is pulled away from centre but I'm probably unlikely to do that and it doesn't really sound like it matters anyway.

Unless anyone can see a good reason not to do that?

Report to moderator Logged

richard.cs
Frequent Contributor
Posts: 662
Country:
Electronics engineer from Southampton, UK.

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #364 on:** November 27, 2014, 03:40:14 pm » Say Thanks Reply Quote

Hi All,

I will soon be placing another Farnell order to get some of the parts I missed last time. I've decided to build up the controller board too, originally I was just going to add a cheap ebay dc-dc module for the 12V rail and call it done but the auto sleep functionality is just too nice. :-)

I've just re-read the whole thread and been left with a few questions:

1) In zayance's schematic there is, from transformer to output, 47nF x6 series, 22pF x2 shunt, 1uH series, 56pF x5 shunt, 1uH series, 56pF x3 shunt, 400nH series, 56pF x4 shunt. I've read various posts about missing out or fitting extra 56pF capacitors, is the above correct or should I add/remove some capacitors?
2) Is the firmware attached to post #204 the most recent available?
3) Have any binaries been posted or could someone send me one please? I will be using the PIC18F2620.
4) What's the optimum/min/max supply voltage? I've seen 24 mentioned as usable but low, and 26, 28 and 30V mentioned various times. I will probably build with a 50 Hz transformer but I'd like to pick the best secondary voltage.

Report to moderator Logged

mamalala
Supporter

Posts: 777
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #365 on:** November 27, 2014, 05:04:34 pm » Say Thanks Reply Quote

> **Quote from: richard.cs on November 27, 2014, 03:40:14 pm**
>
> 1) In zayance's schematic there is, from transformer to output, 47nF x6 series, 22pF x2 shunt, 1uH series, 56pF x5 shunt, 1uH series, 56pF x3 shunt, 400nH series, 56pF x4 shunt. I've read various posts about missing out or fitting extra 56pF capacitors, is the above correct or should I add/remove some capacitors?
> 2) Is the firmware attached to post #204 the most recent available?
> 3) Have any binaries been posted or could someone send me one please? I will be using the PIC18F2620.
> 4) What's the optimum/min/max supply voltage? I've seen 24 mentioned as usable but low, and 26, 28 and 30V mentioned various times. I will probably build with a 50 Hz transformer but I'd like to pick the best secondary voltage.

Attached are three images from my rather dusty development unit that show how many caps i have installed. I did the same cap placement on subsequent units. Again, feel free to fiddle with that a bit, i went for "as much like a sine at the output as possible" plus "large Vpp output into a 50 ohms RF dummy load". Also again, it probably isn't perfect, and some room for improvement left in the filter section. Did you note the update to the coil winding scheme that happened later? Should be

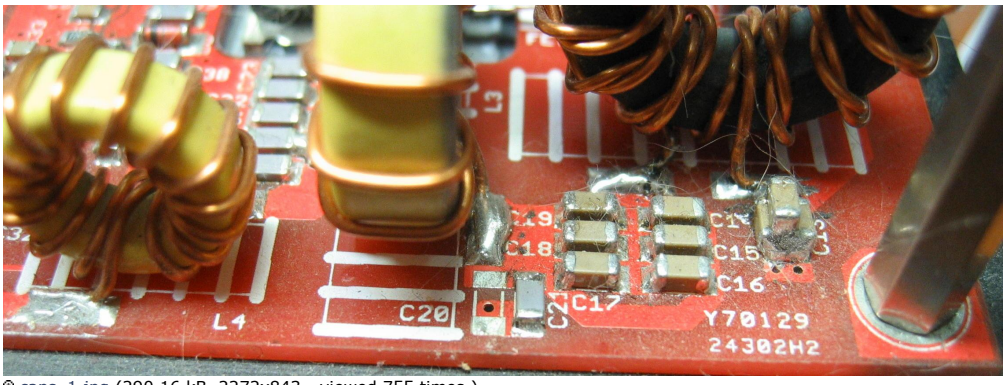
documented, if you can't find it i will make some pics of the current ones as well.

Also attached are two ZIP files, one containing only the compiled .cof and .hex files, the other contains the sources (the whole MPLab-X tree, in fact). The project compiles with Microchips C18 compiler.

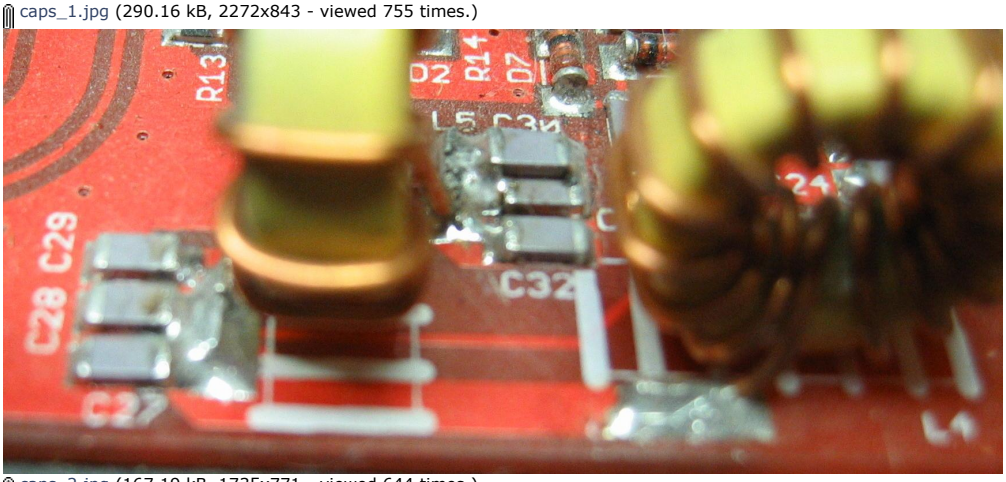
About the voltage, 24 volts is enough to get it working well, i use an old 24V transformer from an old soldering station. Just don't go too high, the buck regulator can't take too much.

Greetings,

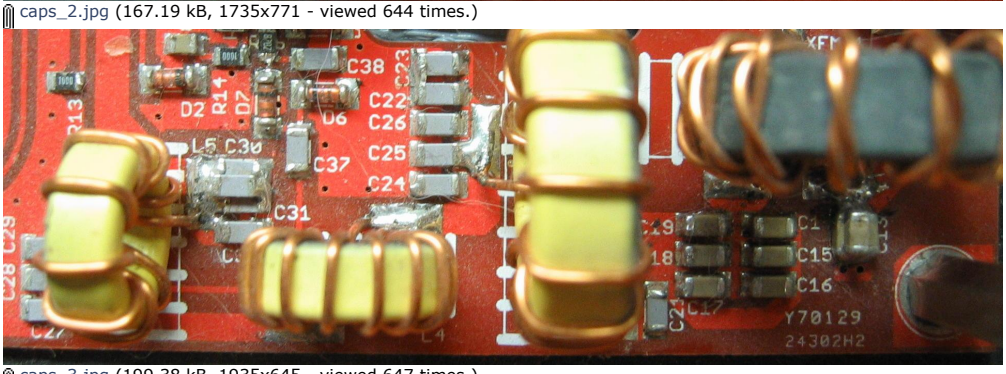
Chris



caps_1.jpg (290.16 kB, 2272x843 - viewed 755 times.)



caps_2.jpg (167.19 kB, 1735x771 - viewed 644 times.)



caps_3.jpg (199.38 kB, 1935x645 - viewed 647 times.)

RF_Supply_FW.zip (112.14 kB - downloaded 380 times.)

RF_Supply_FW_SRC.zip (179.99 kB - downloaded 370 times.)

Report to moderator Logged

mamalala

Supporter

Re: DIY Metcal 13.56 MHz RF Supply

« **Reply #366 on:** November 27, 2014, 05:26:16 pm »

Say Thanks Reply Quote

Oh, and as i had mentioned back then, be careful with the LCD connection. I did the original design using a display that had VCC and GND swapped, compared to the "standard". So make extra sure that yours does fit the pinout on the board.

Greetings,

Posts: 777
Country:

Chris

Report to moderator Logged

richard.cs
Frequent Contributor
Posts: 662
Country:
Electronics engineer from Southampton, UK.

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #367 on:** November 27, 2014, 06:07:49 pm » Say Thanks Reply Quote

~~It looks like you have, from transformer to output, 47nF x6 series, 22pF x2 **22pF x1 shunt**, 1uH series, 56pF x5 shunt, 1uH series, 56pF x3 **56pF x4 shunt**, 400nH series, 56pF x4 **56pF x3** shunt. That's essentially what I've got in the schematics except for a missing 22pF shunt (I assume, it looks identical to the 56pF) and one of the final capacitors moved to the stage before. This is consistent with your post 82, zayance's board has an extra pair of pads at final output for another shunt capacitor which it looks like I don't need and I'll still need to stack an extra capacitor on the group before. I appreciate some tweaking might be needed here.~~

The most recent update I saw on the coils was taking a few turns off when you went from 11 MHz to 13.56 MHz. The instructions I have say 11 turns L3, 14 turns L5, 10 turns L6 but the photos show 13, 15 and 11. The text for the transformer says 13 turns but the photo shows 14. I guess this means the text was updated and the photos were not, do these numbers look right to you?

I imagine a 24 V rms transformer will give about 32 V dc after the rectifier so I'll go with that. LCD pinout noted, that'll get swapped in the ribbon cable if necessary.

Many thanks for all your help.

Richard

EDIT: After comparing the schematics, my PCB and the photos I was wrong about capacitors.
Zayance's extra capacitor is in the right place to be the same as in Mamalala's photos
The black soldermask looks very good but it does make it hard to see the tracks, I was looking at the final inductor backwards.

« *Last Edit: December 10, 2014, 09:22:49 pm by richard.cs* »

Report to moderator Logged

mamalala
Supporter

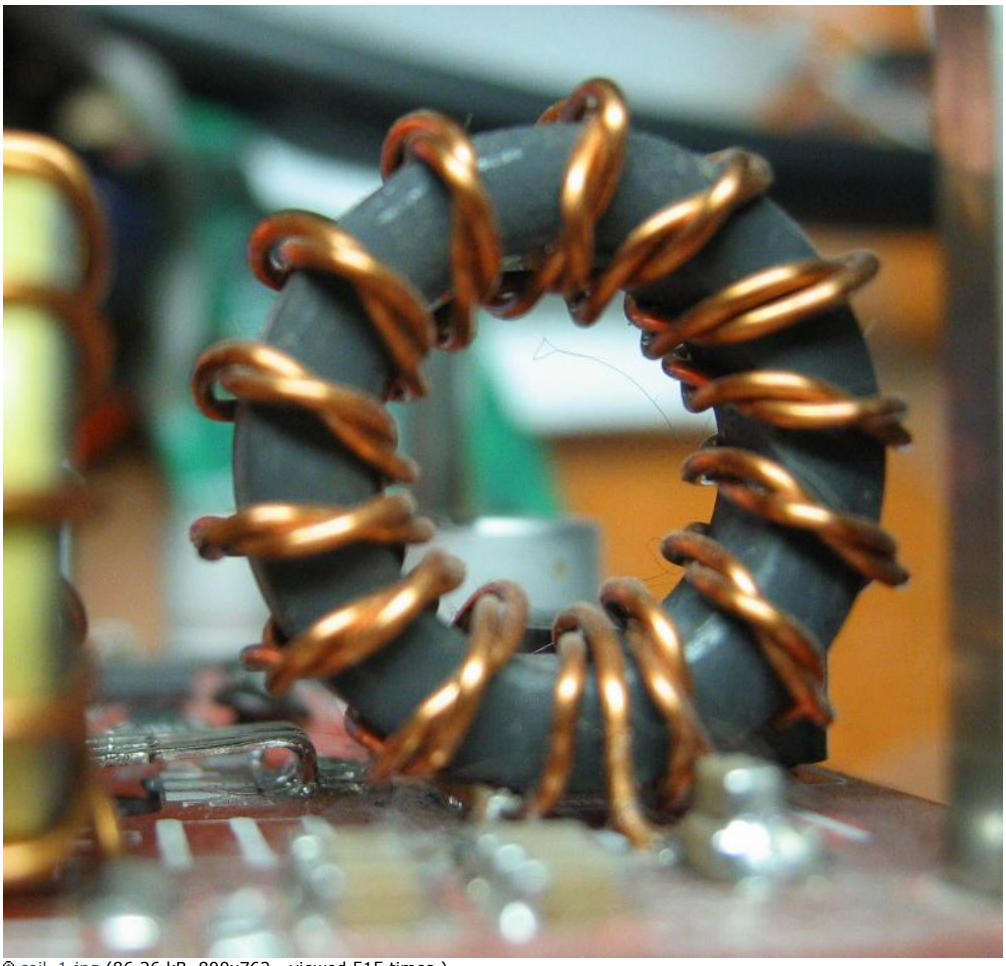
Posts: 777
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #368 on:** November 27, 2014, 06:19:22 pm » Say Thanks Reply Quote

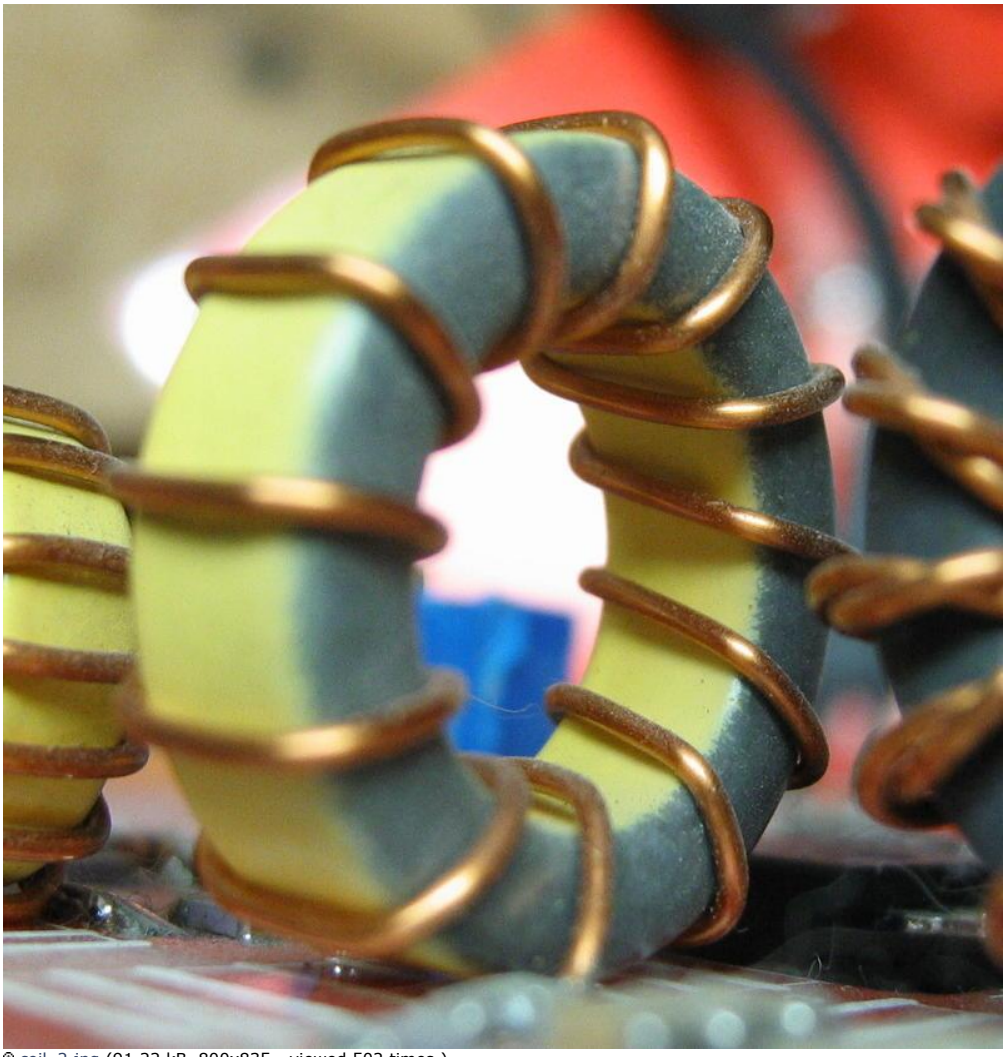
Here are images of what i used for the RF transformer and the coils, numbered from first to last.

Greetings,

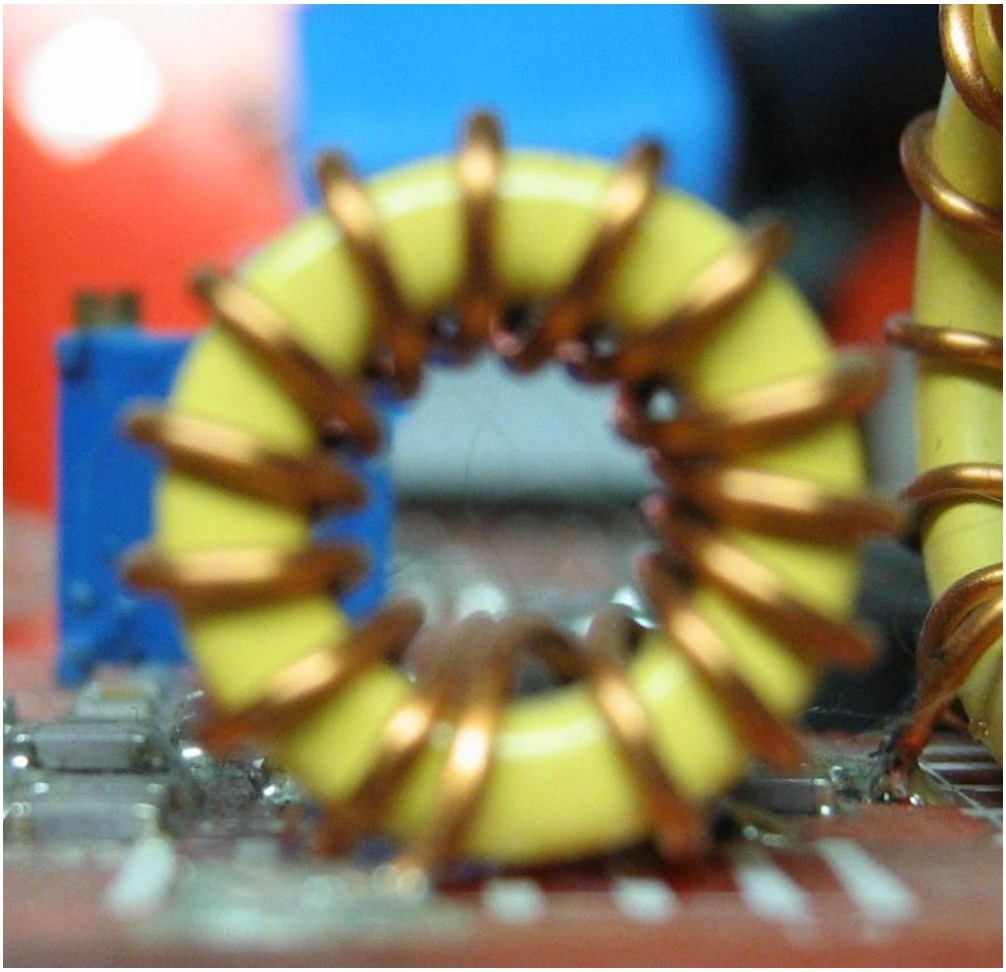
Chris



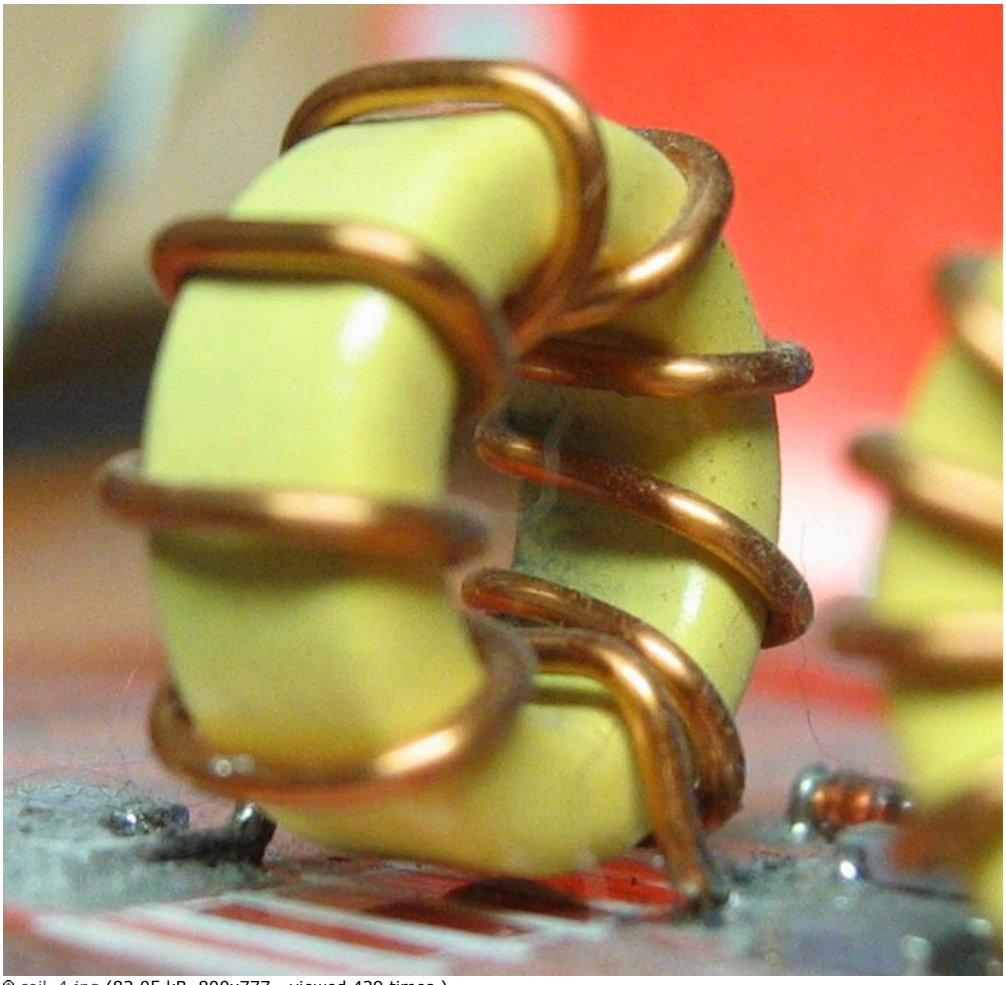
coil_1.jpg (86.26 kB, 800x762 - viewed 515 times.)



coil_2.jpg (91.22 kB, 800x835 - viewed 502 times.)



coil_3.jpg (81.62 kB, 800x771 - viewed 413 times.)



coil_4.jpg (82.05 kB, 800x777 - viewed 429 times.)

Report to moderator Logged

richard.cs
Frequent Contributor
Posts: 662
Country:
Electronics engineer from Southampton, UK.

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #369 on:** November 27, 2014, 06:34:22 pm »
Say Thanks Reply Quote

I make that 14 turns bifilar, 12 turns, 15 turns, 9 turns. That's different again

I'll use your photos as a starting point and go from there. When I'm done I plan to post a log of tweaks and changes I made to get it going.

Report to moderator Logged

mamalala
Supporter

Posts: 777
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #370 on:** November 27, 2014, 06:36:48 pm »
Say Thanks Reply Quote

> **Quote from: richard.cs on November 27, 2014, 06:34:22 pm**
>
> I'll use your photos as a starting point and go from there. When I'm done I plan to post a log of tweaks and changes I made to get it going.

Sounds great!

Greetings,

Chris

ETA: And if you are going to experiment there, make sure to get a bunch of spare IRF's, they are easy to fry

« *Last Edit: November 27, 2014, 06:39:01 pm by mamalala* »

Report to moderator Logged

richard.cs
Frequent Contributor

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #371 on:** November 27, 2014, 07:01:08 pm »
Say Thanks Reply Quote

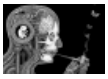
Posts: 662
Country:
Electronics engineer from Southampton, UK.

I still intend to roll my own design at some point, I'm still toying with the idea of a mains-derived DC bus (probably using either phase-angle control or a PFC chip to get the variable voltage), generating the RF at high voltages and getting the isolation from an RF transformer. When first conceived that combination of voltage and frequency put it in valve territory with all the associated problems but someone at work recently drew my attention to these: http://uk.farnell.com/cree/c2m1000170d/mosfet-n-ch-1700v-4-9a-sic-to247/dp/2361497 - A 1700V, 4.9A silicon carbide MOSFET with relatively low gate capacitance for only £3.07. Now that does look interesting...

I'm very tempted to put a few in my next order and see what they're capable of. It might even drop acceptably into your design as a near-indestructible output stage, it would be a nice quick test of if they work at all at 13 MHz.

Report to moderator Logged

extide
Regular Contributor



Posts: 93
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #372 on:** December 02, 2014, 11:18:03 pm »
Say Thanks Reply Quote

So, has anyone put together an updated guide on the part values to use? I have read through the whole thing. I am planning on building 1 or 2 of these, using the original gerbers uploaded towards the beginning of the thread. If not I might go ahead and put together an updated set of instructions.

Thanks,

This is AWESOME by the way!

EDIT: I am aware of the BOM on post 33 -- however it uses zayance's part numbers. Is there a table to convert them back to the original numbers?
« *Last Edit: December 03, 2014, 12:15:50 am by extide* »

Report to moderator Logged

richard.cs
Frequent Contributor

Posts: 662
Country:
Electronics engineer from Southampton, UK.

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #373 on:** December 03, 2014, 01:13:27 pm »
Say Thanks Reply Quote

I'm building one up at the moment and was planning to put some details together when finished. For now I would suggest you look at posts #378, #385 and #387. An equivilence table between the two sets of component IDs would be nice but I don't have one. There are various conflicts I have found (in zayance's build pack anyway) between the BOM and the build instructions but nothing serious.

Whilst you could use the origonal gerbers I would suggest a few of changes:
1) Add in pads for the extra 56 pF capacitor.
2) Put some thermal relief in. I've found a lot of areas where something that carries no real current (d.c. or RF) like a logic pulldown is unsolderable with a small iron because one end is hard-down onto a large area of ground plane.
3) Consider swapping the LCD pinout to the standard one.
4) A little bit of BOM rationalisation would be nice. For example the Aux supply capacitor for the switcher (can't remember the number now) is currently the only 1206 10nF in the design and could have been the same as the 10nF 0805's scattered everywhere.
5) Depending on your skill with surface mount soldering the pads might benefit from tweaking slightly - they're perfect for reflow but a little tight for hand work.

These aren't criticisms of the design or the work that's been done so far, just things that would be nice-to-have if you're making more boards anyway.

Report to moderator Logged

richard.cs
Frequent Contributor

Posts: 662
Country:
Electronics engineer from Southampton, UK.

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #374 on:** December 10, 2014, 10:27:04 pm »
Say Thanks Reply Quote

Hello All,

I've now got mine to the point where it can be tested as soon as an output FET and heatsink are fitted. Rather disappointingly I've just realised my only M3 tap is broken so I think I'll stop here for tonight and hopefully get the heatsink finished tomorrow.

One comment on that - the mounting holes on the board are 3.2 mm, this is a perfectly normal size for clearance M3 but I suspect that for many people with an electronics-only background getting four tapped holes in position to within perhaps 0.2 mm will be difficult, and being tapped the heatsink holes can't simply be opened out a little bigger. Might I suggest that loose-fitting 3.5 mm or even 4 mm holes might be preferable on a future board revision.

Report to moderator Logged

richard.cs
Frequent Contributor
Posts: 662
Country:
Electronics engineer from Southampton, UK.

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #375 on:** December 12, 2014, 07:16:18 pm »
Say Thanks Reply Quote

Progress update - it nearly works. I've seen lots of RF transiently when messing about.

The op-amp appears to be pulling the output right down because it thinks there's RF from the detector when there's not (much). It's non-inverting input (pin 3) is at about 2.1V, as is the slider and the top of R45. There are no volts across R26 (160k) though so it's clearly not coming from the detector, something somewhere must be leaking about 0.4 mA into here to hold it up against the 5k of R45. Naturally I've looked for solder splashes and poked around with the meter, no real success. Winding R45 to the midpoint doesn't change anything narrowing the source of voltage to the op-amp side of the pot, and given the impedance to ground has fallen and the voltage hasn't changed it suggests a short to some relatively low-Z 2.1V node.

Early on I did see about 10V peak of RF into the load, now I see more like 2V. It was a slow drift downwards and may simply have been something changing as things warmed up given it's not designed to regulate that low. Op-amp output is around 2.7V, it was a tiny bit lower. Volts from the switcher are now about 600 mV, was about 2V. The op-amp should be able to swing almost to the rails so the fact it's not saturating is interesting, it feels almost like a short to another op-amp pin only I can't find one.

One last thing, now that I'm examining the op-amp part of the circuit in detail, I don't see any connection between the input of IC7G$2, a node labelled VREG, and the output of the buck converter which is labelled V+. Have I missed something or is this an error?

Report to moderator Logged

richard.cs
Frequent Contributor
Posts: 662
Country:
Electronics engineer from Southampton, UK.

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #376 on:** December 12, 2014, 07:47:33 pm »
Say Thanks Reply Quote

Another update - Pin 11 on IC7 was floating so the whole op-amp was without a ground connection. ~~I now get 7.4V on L2 and about 25V peak RF out whatever I do with R45. Not sure if it's another bug in my construction or if I've killed the op-amp.~~

When I power up with R45 wound all the way clockwise I draw 1.75A @ 30V, I get 55V peak of RF into the load and 17.4V on L2. I can adjust R45 a little but I'm limited by my PSU going into I-limit long before I get to 21 Volts (there's a lot of ripple, I set a limit of 2A and it limits in an odd intermittent way when the meter indicates 1.8A). I can find more 30V power easily enough, but drawing nearly 2A with R45 all the way clockwise is quite different from the "few hundred milliamps" in the build guide. I notice however that there's a note in the schematic saying 80k next to the 160k resistor R26, and elsewhere in the build guide it says 120k.

If 80k were fitted to R26 then half the RF voltage would be needed to get into regulation, and a quarter the input power giving perhaps 400-500 mA input. What have other people fitted here? I guess it sets both the minimum power that can be regulated and the loop gain.

Edit: I've used Zayance's numbering,R45 is R19 in the original pack, R26 is R18.

Edit2: With a beefier PSU I can get to 21V on L2. At this point I have 62V peak RF into 50 Ohms (just shy of 40 Watts) and about 380 mV on VFB. I can hear a hissing sound but I'm not sure if it's from the buck converter or the RF transformer, maybe the control loop is unstable and oscillating at audio frequency? Thoughts?

« Last Edit: December 12, 2014, 08:41:12 pm by richard.cs »

Report to moderator Logged

zayance
Contributor
Posts: 26
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #377 on:** December 12, 2014, 09:08:01 pm »
Say Thanks Reply Quote

Hi there,

Sorry again for the Silk numbering issue, that was a major bummer that passed my quick QC, since it took a while before ordering the batch, i went too fast at the end and s..it happened.
Anyway, back then i had asked mamalala if there were some things i could change (revision) since i was ordering a batch, and he basically just replied, "don't need to bother really this one works as is..." and i can only trust him.
Now of course any revision could make things better, i was not willing to take the deep, and wanted this one just to be doing what it was meant to do haha.

Cool that you've started building this thing, can't find the time on my side.
concerning your problems, i'm sure Mamalala will help, he's been very nice to me when asking for infos..., even if the silk bummer might confuse a little
All i can say is that the Boards were just copy pasted and silk moved a bit for helping visibility, all the rest was going from original file.

« *Last Edit: December 12, 2014, 09:10:10 pm by zayance* »

Report to moderator Logged

richard.cs
Frequent Contributor
Posts: 662
Country:
Electronics engineer from Southampton, UK.

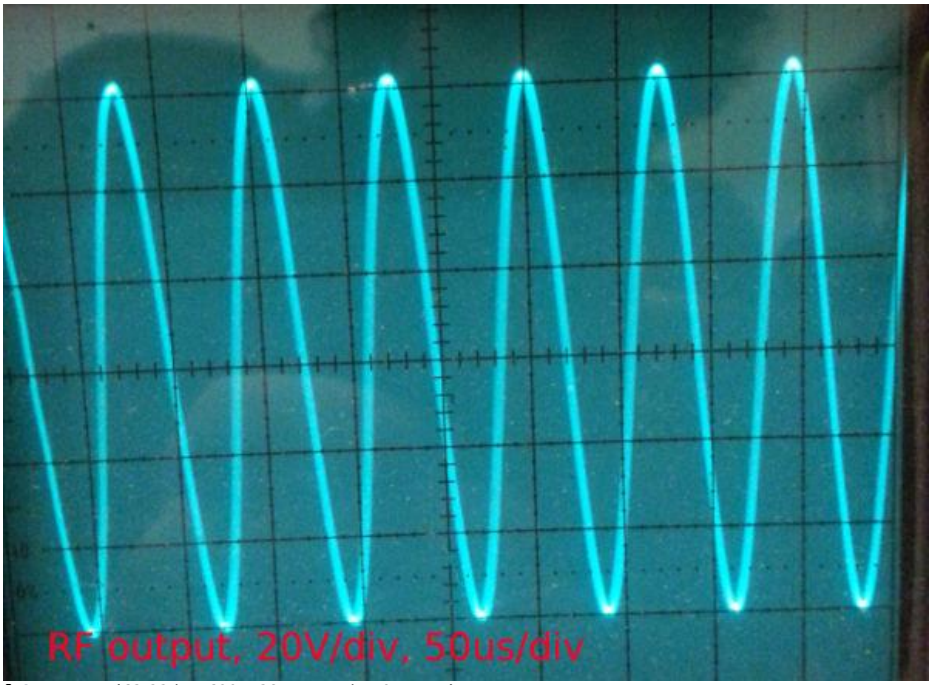
Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #378 on:** December 12, 2014, 09:29:52 pm »

Say Thanks Reply Quote

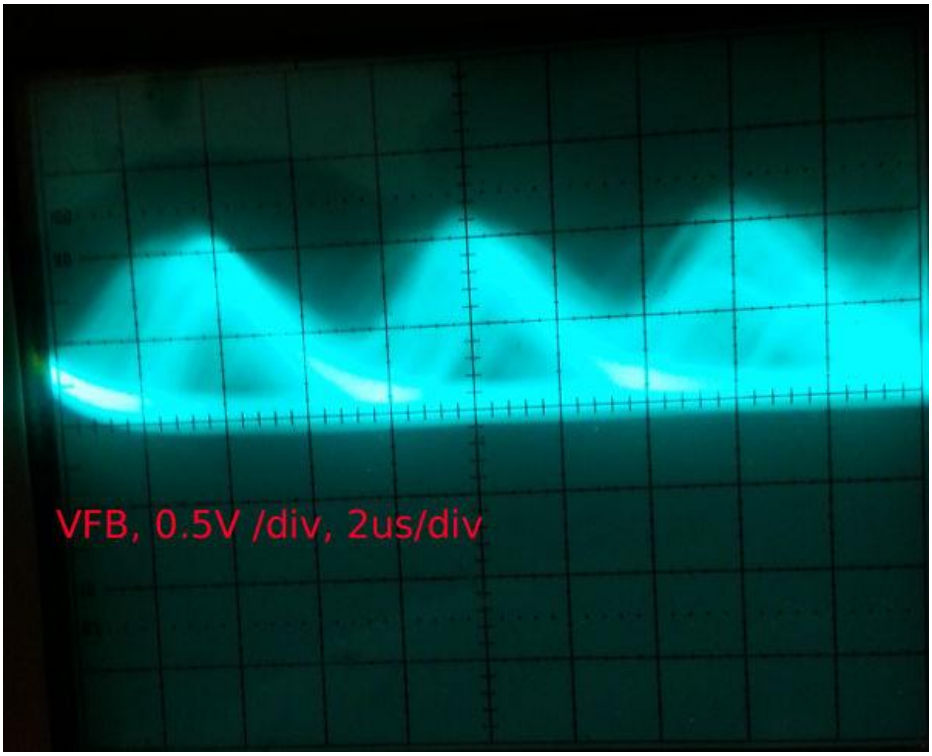
A couple of photos of waveforms attached. The RF output looks fairly nice, assuming 60 V peak into 50 Ohms is right when adjusted for 21 V on L2.

The voltage on VFB is interesting though, it seems to be a series of pulses at about 170 kHz, although it wobbles around a lot and I can't get it to sync any better than that. Maybe mine is being odd or maybe everyone's does that? In any case my digital multimeter thinks it looks like 380 mV and the DC on L2 looks fine with just a bit of the 13 MHz on it. Apologies for the poor photos but I think they show what I'm seeing well enough. I suspect the wobble is the much lower frequency stuff that I can hear from somewhere, presumably one of the inductors, as a white-noise like hiss. Sometimes it goes quiet, I think at lower output voltages but it's not entirely predictable and I don't have any scope traces from when it's silent.

Zayance - the silkscreen thing is unfortunate but I'm very grateful to you for taking the time to make and distribute some boards, don't worry about it



Output.jpg (63.22 kB, 600x438 - viewed 419 times.)



VFB.jpg (44.31 kB, 600x485 - viewed 404 times.)

Report to moderator Logged

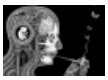
hardware_freak
Newbie
Posts: 2

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #379 on:** December 13, 2014, 12:08:53 am »
Say Thanks Reply Quote

If anybody has any PCB left I am really interested in this project. On the other side, if somebody thinks about ordering a batch, I am in with 2-3 PCBs. I live in Germany so if any parts from reichelt are needed... I could order them. I also have an farnell account if this helps.

Report to moderator Logged

extide
Regular Contributor



Posts: 93
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #380 on:** December 13, 2014, 08:22:12 pm »
Say Thanks Reply Quote

I am definitely planning on building up one of these with both boards. It may be a couple months out though. We might be able to work out something where I can send you boards and you can order and send me parts, and I can send money if the parts are more expensive than the boards. I will probably get them made locally here in the US at www.oshpark.com -- the purple PCB place.

Report to moderator Logged

mamalala
Supporter

Posts: 777
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #381 on:** December 14, 2014, 02:24:48 pm »
Say Thanks Reply Quote

Quote from: richard.cs on December 03, 2014, 01:13:27 pm

> Whilst you could use the origonal gerbers I would suggest a few of changes:
> 1) Add in pads for the extra 56 pF capacitor.
> 2) Put some thermal relief in. I've found a lot of areas where something that carries no real current (d.c. or RF) like a logic pulldown is unsolderable with a small iron because one end is hard-down onto a large area of ground plane.
> 3) Consider swapping the LCD pinout to the standard one.
> 4) A little bit of BOM rationalisation would be nice. For example the Aux supply capacitor for the switcher (can't remember the number now) is currently the only 1206 10nF in the design and could have been the same as the 10nF 0805's scattered everywhere.
> 5) Depending on your skill with surface mount soldering the pads might benefit from tweaking slightly - they're perfect for reflow but a little tight for hand work.

Good points. About the 10nF in 1206, i used that to squeeze the incomming supply track under it.

Greetings,

Chris

Report to moderator Logged

mamalala
Supporter

Posts: 777
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #382 on:** December 14, 2014, 02:31:34 pm »

Say Thanks Reply Quote

> **Quote from: richard.cs on December 12, 2014, 07:47:33 pm**
>
> **Edit2:** With a beefier PSU I can get to 21V on L2. At this point I have 62V peak RF into 50 Ohms (just shy of 40 Watts) and about 380 mV on VFB. I can hear a hissing sound but I'm not sure if it's from the buck converter or the RF transformer, maybe the control loop is unstable and oscillating at audio frequency? Thoughts?

Yes, that looks about right. I have the hissing as well, during heatup. Funny enough, the original STSS as well as the MX500 supplies i have also give out some slight noise while heating up. But then, i haven't looked into the overall stability of the control loop, so there may well be some room for improvement there. However, be aware that there is the output cap's and a whole filter section bewteen the DC output of the buck converter, and the place where the RF signal is picked up for the feedback. Without making the whole response way slower, i would guss that some noise/"wobbling" is normal and expected.

That loop can't get too slow, or too much RF would go into a suddenly mismatched load, likely to blow the output FET. And in the other direction, it may negatively impact performance if there is a sudden change in thermal load on the tip, and the supply needs to crank up the output power.

But i can only repeat myself again: I'm not an RF expert art all, this was basically my first real RF circuit, so i'm certain that there are quite some places to improve the thing. At least it is something that basically works, so people can use it, while those who have an actual clue about the RF stuff (which i just don't really have) can improve the thing

Greetings,

Chris

Report to moderator Logged

richard.cs
Frequent Contributor

Posts: 662
Country:

Electronics engineer from Southampton, UK.

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #383 on:** December 14, 2014, 05:30:26 pm »

Say Thanks Reply Quote

Thanks for the replies, it sounds like my board is working normally then

I built up the power supply part of the control board this morning, it'll be nice to get away from having a big stack of bench supplies for the three rails and also rule out any interaction between the switcher and my bench psu.

Report to moderator Logged

richard.cs
Frequent Contributor

Posts: 662
Country:

Electronics engineer from Southampton, UK.

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #384 on:** December 14, 2014, 08:41:16 pm »

Say Thanks Reply Quote

It works!

Heated a sttc-147 tip in a few seconds, dropped back to about 500mA (at 30 V) in shortly after the solder melted and I could see it respond to cooling the tip by adding solder or wiping it on a sponge. This is with the complete RF board and a part-assembled control board providing the 5 V and 12 V supplies.

Just need to finish the control board now and do the mechanics.

Report to moderator Logged

richard.cs
Frequent Contributor

Posts: 662
Country:

Electronics engineer from Southampton, UK.

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #385 on:** December 14, 2014, 10:22:33 pm »

Say Thanks Reply Quote

A quick question - how is the encoder connected?

The software refers to the four inputs as A, B, K and S, the schematic as A, B, C, D, and as far as I can tell from the documentation the intention is to have an encoder with a built-in push button and use long and short pushes. To my mind that gives two inputs for the rotation, one for the button, one spare input and GND as the return for all four, is that correct? And if so which is which?

I have a few spare encoders but none with buttons and it sounds like a nice way of doing it. Any suggested part numbers?

Regards
Richard

Edit: A repeat of my question from #395, I think it got lost amongst the rest of the post. Are the nodes VREG and V+ on the RF board connected? Should they be?

« *Last Edit: December 14, 2014, 10:24:56 pm by richard.cs* »

Report to moderator Logged

richard.cs

Frequent Contributor

Posts: 662

Country:

Electronics engineer from Southampton, UK.

Re: DIY Metcal 13.56 MHz RF Supply

« **Reply #386 on:** December 28, 2014, 03:28:01 pm »

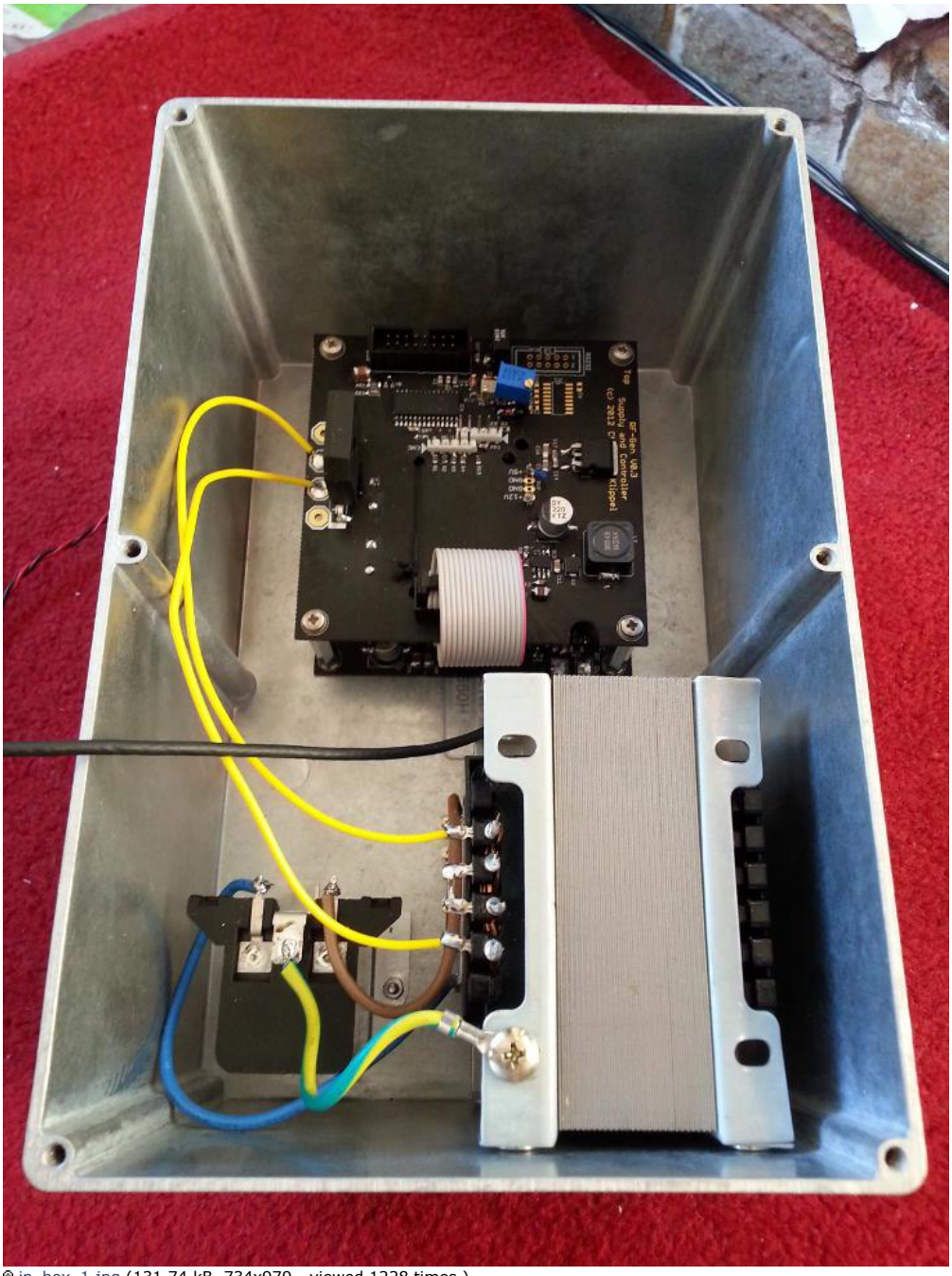
Say Thanks Reply Quote

Another update: I unmounted the boards from the heatsink and re-assembled in a large diecast box. The MOSFET sits in a hole in the box directly onto the heatsink with only a mica washer in between, elsewhere the box is sandwiched between the RF board and the heatsink with liberal amounts of thermal paste because the surfaces aren't entirely flat and there is kapton tape over the non-ground tracks on the underside.

I powered it up to test it after that and it still works though I noticed some odd behaviour. I am uncertain if it is new, I was cooling the tip much more than in previous tests because I wanted to check the output MOSFET didn't get too hot. The supply seems to work normally except that sometimes I can cool the tip heavily and the output power observed on the LCD does not seem to increase as would be expected, likewise the tip seems to cool rather too much. I hope I've not broken anything but I imagine the RF board was flexed a little as it was screwed down and I did give it a brush with some alcohol after getting thermal paste everywhere. The other difference is that this is now powered from a transformer rather than a bench supply. I'm going to try taking some measurements of the buck converter output while doing different things later but it seems almost as though the change in temperature isn't "noticed" but I don't really see how that could happen.

I have identified what I hope is a nice boost converter module that I intend to fit between the existing PCBs and the box wall above the transformer. That would give me the option of 10-30V d.c. input which might be useful on occasion.

box_and_heatsink.jpg (67.64 kB, 627x754 - viewed 782 times.)



in_box_1.jpg (131.74 kB, 734x979 - viewed 1228 times.)

Report to moderator Logged

mamalala

Supporter

Posts: 777
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #387 on:** December 28, 2014, 06:54:16 pm »

Say Thanks Reply Quote

Quote from: richard.cs on December 14, 2014, 10:22:33 pm

A quick question - how is the encoder connected?

The software refers to the four inputs as A, B, K and S, the schematic as A, B, C, D, and as far as I can tell from the documentation the intention is to have an encoder with a built-in push button and use long and short pushes. To my mind that gives two inputs for the rotation, one for the button, one spare input and GND as the return for all four, is that correct? And if so which is which?

I have a few spare encoders but none with buttons and it sounds like a nice way of doing it. Any suggested part numbers?

Regards
Richard

TA and TB are for the encoder itself (RB1 and RB2 of the PIC), TC is the pushbutton (RB4 on the pic), the fourth one is unused.

Don't really have a part number at hand, i usually bus a bunch of encoders from a surplus dealer on eBay, like, 10 ALPS encoders w/ button function for 5 euros or so. Baiscally any simple mechanical encoder should work.

> **Quote from: richard.cs on December 14, 2014, 10:22:33 pm**
>
> **Edit:** A repeat of my question from #395, I think it got lost amongst the rest of the post. Are the nodes VREG and V+ on the RF board connected? Should they be?

They are connected through the inductor L2. VREG goes into the inductor, V+ comes out (and powers the FET). Forgto to put a netname label in the schematic to make it more visible, sorry.

Greetings,

Chris

Report to moderator Logged

mamalala
Supporter

Posts: 777
Country:

Re: DIY Metcal 13.56 MHz RF Supply

« **Reply #388 on:** December 28, 2014, 07:01:29 pm »

Say Thanks Reply Quote

> **Quote from: richard.cs on December 28, 2014, 03:28:01 pm**
>
> I powered it up to test it after that and it still works though I noticed some odd behaviour. I am uncertain if it is new, I was cooling the tip much more than in previous tests because I wanted to check the output MOSFET didn't get too hot. The supply seems to work normally except that sometimes I can cool the tip heavily and the output power observed on the LCD does not seem to increase as would be expected, likewise the tip seems to cool rather too much.

Someone else (Widlarizer on IRC) also noted that behaviour on a few occasions, but it seems to be gone now. He also found out that the control loop is unstable, who knows, maybe that could be the issue. What he did was to a a 1k+22n series combination in parallel to R23 (close to the OpAmp) on the RF board. Dunno if that is what solved the issue for him.

Another possible source maybe the microcontroller. It uses one pin to manipulate the voltage that the buck converter creates. High-Z = nomral operation, low = boost power, high = reduce power for auto-sleep. It may be that there is some glitch in the firmware that pulls that pin high. On the RF board it is the signal VLIM on pin 3 of the header. If the problem persists, you can try to remove R11 (close to the buck converter and the SMD pot R32 there). This would basically disable that function and make it work in normal mode always. If the problem is then gone, i may have a bug in the firmware. If not, the problem must be elsewhere.

I don't have my DIY station here right now, so i can't check, sorry.

Greetings,

Chris

Report to moderator Logged

mamalala
Supporter

Posts: 777
Country:

Re: DIY Metcal 13.56 MHz RF Supply

« **Reply #389 on:** December 28, 2014, 07:06:14 pm »

Say Thanks Reply Quote

Also, a more general note regarding the power supply. Seems that there is an issue that, on rare occasions, may damage the FET or the buck converter (or both). Originally, the unit was designed to be turned on/off through the encoder (simply pushing it once shortly to toggle betwen on/off). Once it is turned off that way (or the unit has shut itself off after the selected sleep time), it is safe to "pull the plug", i.e. remove the main supplly into the unit.

However, if the external power is removed while the unit is turned on, for example by simply unplugging it, that rare condition may show up and damage the FET or buck converter. So be warned. Will have to see what i can do about it once i get my unit back.

Greetings,

Chris

Report to moderator Logged

richard.cs
Frequent Contributor

Posts: 662
Country:

Re: DIY Metcal 13.56 MHz RF Supply

« **Reply #390 on:** December 28, 2014, 11:18:48 pm »

Say Thanks Reply Quote

It sounds like I've got a few things to try. Tip impedance measurements I made a while back also suggest that the tips are the best match to 50 ohms at just a little below normal temperature and not quite as good when cold, that might not help either.

Electronics engineer from Southampton, UK.

Regarding the failure mode on switch-off; perhaps it just needs an undervoltage lock-out on the input, that would be pretty easy to implement, probably tied into the same enable line as the tip detect. I'll admit I have just turned mine off a few times while it was heating and I haven't broken it yet (unless that's somehow the cause of what I've observed). I have spare mosfets but not buck converters.

Report to moderator Logged

richard.cs

Frequent Contributor

Posts: 662
Country:

Electronics engineer from Southampton, UK.

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #391 on:** December 29, 2014, 07:03:55 pm »

Say Thanks Reply Quote

A better way of doing an undervoltage lock out might be to use the enable pin on the 12V buck regulator on the control board. Pull it down with 10k in parallel with an LED or low voltage zener (clamping the enable pin voltage safely under all conditions). Pull it up with a 22V zener and a 1k series resistor to the dc input. This way neither the microcontroller nor the RF board get enabled below about 23V.

Report to moderator Logged

Zero999

Super Contributor

Posts: 12899
Country:

Hero999

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #392 on:** December 29, 2014, 07:10:02 pm »

Say Thanks Reply Quote

I remember someone in this thread worrying about the impedance mismatch causing problems. I think it's unlikely to be that bad, given the wavelength at 13.56MHz is 22.1m the lead would have to be quite long to cause a problem.

Report to moderator Logged

richard.cs

Frequent Contributor

Posts: 662
Country:

Electronics engineer from Southampton, UK.

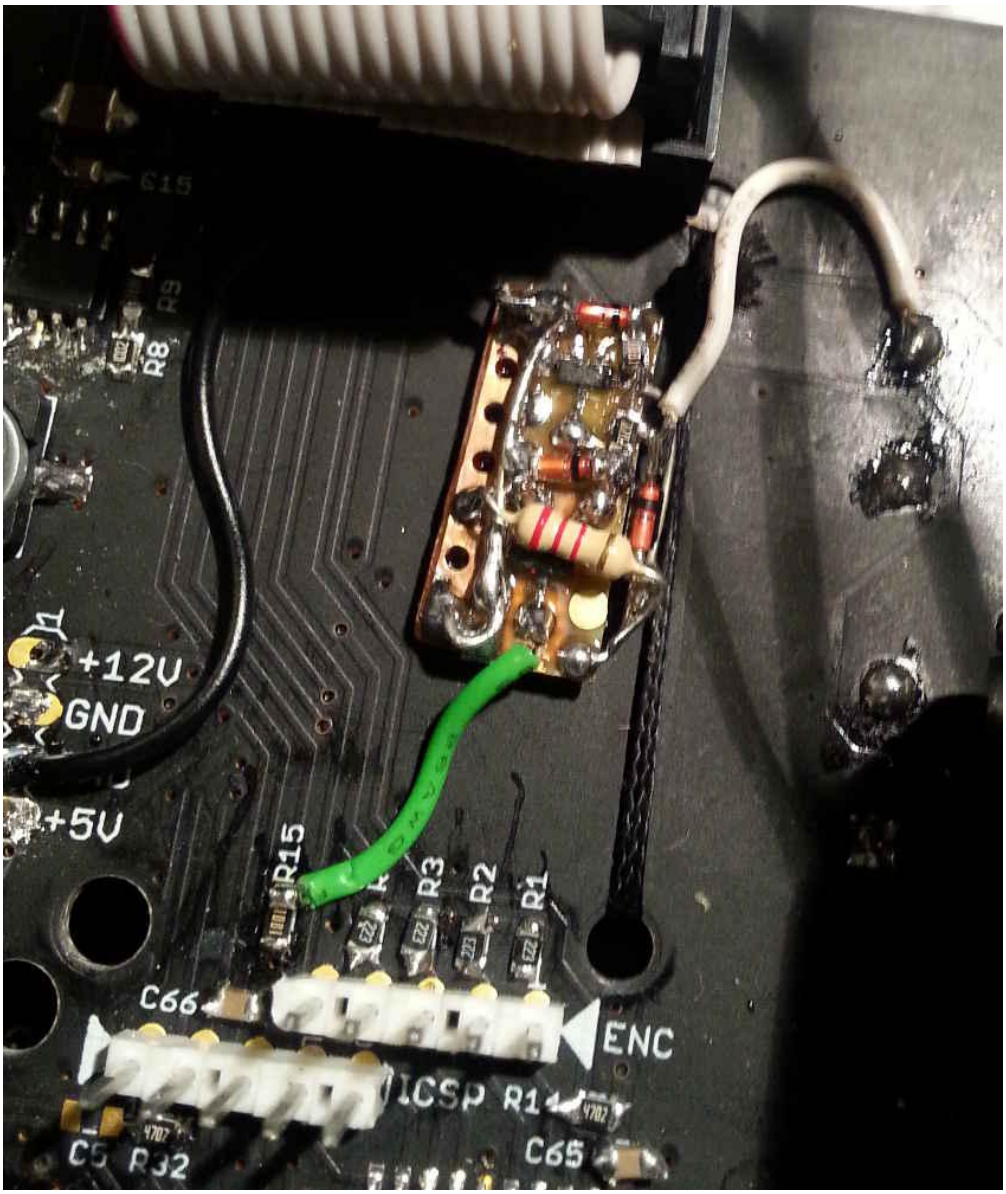
Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #393 on:** March 11, 2015, 09:33:30 pm »

Say Thanks Reply Quote

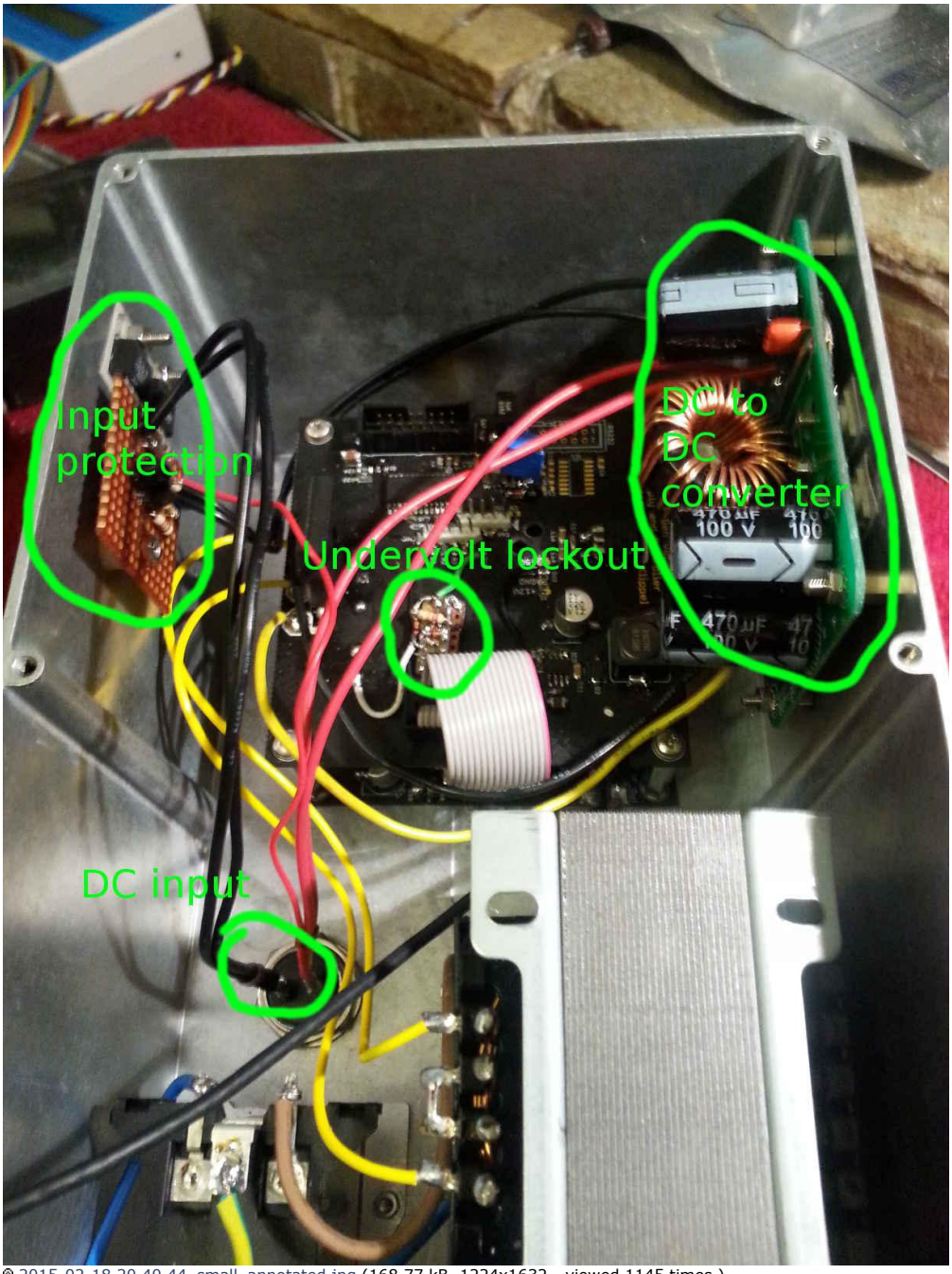
It's finished! Or very nearly anyway.

Since my last post I have modified the board with an undervoltage lockout circuit, mounted a boost converter module in the case for low-voltage d.c. input (10-30 V), and made up a small reverse polarity / overvoltage protection circuit for the new d.c. input, photos attached. Still to do is some input filtering on the DC lines, debugging the occasional odd behaviour seen previously and some general tidying up.

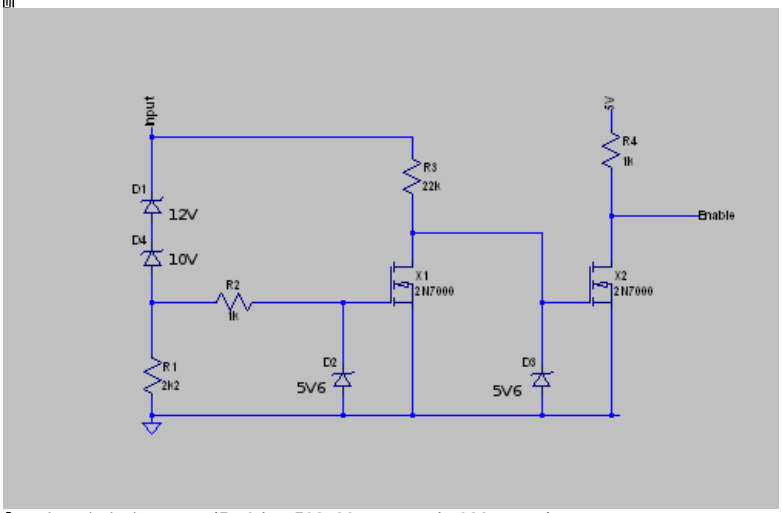
Edit: added schematics.



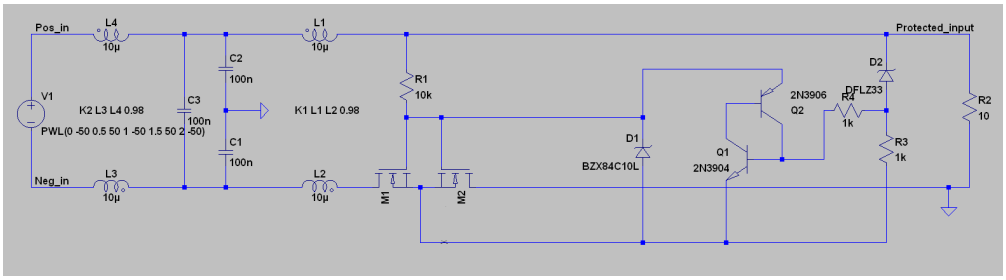
2015-02-18 20.27.23_small.jpg (87.6 kB, 845x1001 - viewed 1315 times.)



2015-02-18 20.40.44_small_annotated.jpg (168.77 kB, 1224x1632 - viewed 1145 times.)



Undervolt_lockout.png (5.78 kB, 503x324 - viewed 1038 times.)



Input_protection.png (23.63 kB, 1573x428 - viewed 991 times.)

« *Last Edit: March 11, 2015, 09:44:56 pm by richard.cs* »

Report to moderator Logged

girolamo
Contributor
Posts: 11

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #394 on:** April 17, 2015, 02:20:28 pm »

Say Thanks Reply Quote

> **Quote from: zayance on August 23, 2014, 11:00:14 am**
>
> For now only two folks interested, and 8 PCB's left.
>
> Anyone else?

Hi
Can i obtain a pair of this pcb?How can i proceed for this?
Thanks

Report to moderator Logged

girolamo
Contributor
Posts: 11

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #395 on:** June 12, 2015, 11:45:41 am »

Say Thanks Reply Quote

Hello everyone!
I have read with pleasure all posts and I decided to build such a soldering iron.I believe that the performance of the technology applied in this project ,make this soldering iron ideal for a service gsm ,where I work now. But now I'd like a colleague on the site to help me with the programming PIC18F2620.In this respect I would like last file hex required for programming. Thank you in advance

Report to moderator Logged

ha7az
Newbie
Posts: 2
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #396 on:** August 11, 2015, 11:21:40 am »

Say Thanks Reply Quote

Hello!

Interesting project.

What is the final pcb set and ARM hex?

Report to moderator Logged

The following users thanked this post: hurtmanissimo

ha7az
Newbie
Posts: 2
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #397 on:** August 13, 2015, 09:22:12 pm »

Say Thanks Reply Quote

The topic is dead?

Report to moderator Logged

girolamo
Contributor
Posts: 11

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #398 on:** August 31, 2015, 07:53:14 pm »

Say Thanks Reply Quote

Is there anyone who can give me a help?It's about the value of R18 and R19 in limitid circuit power and boost control power on power suply board ,original schematics.?
Thank you

Report to moderator Logged

richard.cs
Frequent Contributor
Posts: 662

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #399 on:** August 31, 2015, 10:19:34 pm »

Say Thanks Reply Quote

I don't have the schematics in front of me now but I might be able to help. What's your question specifically? Just what values they should be?

Country:

Electronics engineer from Southampton, UK.

Report to moderator Logged

girolamo

Contributor

Posts: 11

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #400 on:** September 01, 2015, 09:38:28 pm

Say Thanks Reply Quote

»

yes..only value of this resistors..i supose to be lower value.ten?..hundred ohms?

Report to moderator Logged

richard.cs

Frequent Contributor

Posts: 662
Country:

Electronics engineer from Southampton, UK.

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #401 on:** September 02, 2015, 07:05:12 am

Say Thanks Reply Quote

»

It's buried in post 184, I don't know if a build guide for the controller was ever written but if it is this should be in it. First of all setup the RF controller according to it's build guide (adjust R32 so the d.c. output buck converter is 22V while the RF output feeds a 50 Ohm dummy load. Then put a real tip in and make the adjustments described below. All voltages are measured at the output of the buck converter on the RF board, this is effectively the output mosfet drain voltage.

I've included the start of the post with component changes but if you are using recent documents those changes should already be in. I've highlighted the bit I think you need.

Quote from: mamalala on March 22, 2013, 11:03:06 am

Hi all,

a few notes and status updates here.

First of all, i noticed somethig weird regarding the power output. Either the supply voltage radings found in the MX500 document are wrong, or my circuit is way more efficient/better-tuned. If i set the idle voltage to around 18 volts, i get some of the tips glowing dark-red around where the coil is! That means way too much power is pumped into the cartridge for too long. Setting the idle voltage to around 12.5 to 13.5 volts, which is way lower than what can be found in the document, makes everything work nice again. Of course this value is for small/medium sized tips. Larger tips idle at a slightly higher voltage (13.5 to 14.5 volts).

Anyways, during heatup (or boosted power at wakeup) a supply of around 21.5 volts goves a nice, fast heatup time.

I also made slight modifications to some part values. The reason is that i am currently very busy working on the firmware, and thus found out a few things. Here are the changes:

- On the RF board, use a 100 Ohms resistor for R11 (this one involves the µC-controlled power limit/boost function)

- Again on the RF board, change R8/R9 to 4.7 Ohms. Those are the gate resistors of the IRF510.

- Still on the RF board, change R33/R34 to 100 ohms each. This provides a lower impedance of the VCC/2 voltage for the OpAmp in the control-loop.

- The last change on the RF board is to use 22 Kilo-Ohms for R23 and 1 Kilo-Ohm for R24. These are also for the control-loop OpAmp, setting a higher gain.

- On the controller board, the variable resistor to set the boost power should be 1 Kilo-Ohms, that way a nice adjustment is possible. The one for the limited power is 10 Kilo-Ohms.

The maximum supply voltage as given by adjusting R32 on the RF board should be around 21.5 volts (no boost/limit active, purely the control loop). Regarding the idle voltage fo the tips, here is a rough overview for some tips:

Between 12.5 and 13.5 volts_

STTC-147
STTC-126
STTC-037
STTC-025

Between 13.5 and 14.5 volts:

STTC-011
SMTC-147

As for the limited and boosted voltages, it turns out that in limit-mode a voltage of around 10 volts, and in boost mode a voltage of around 18 volts give good results. **For example, adjusting with a STTC-147 tip would be done the following way:**

- Insert the cold tip. Power up in normal mode and monitor the voltage. Adjust R32 so that it never exceeds 21.5 volts. If it does, let the tip cool down again and repeat this step.

- Once the tip reached temperature, adjust an idle voltage of about 13.5 volts using R19. Let the tip cool down and repeat the previous step. If required repeat these two steps as often as required to rech these values. Should be very easily done, however.

- Let the tip sit idle at normal power, that is, no limit or boost enabled, for about 10 minutes. Re-adjust R19

to give an idle voltage of around 13.3 volts. Let it sit that way for 10 more minutes, and if needed make slight adjustments to R19 to bring it back to 13.3 volts.

- Enable the power-limited mode. This is done by pulling the controlling microcontroller-pin to GND. That pin goes though an 1N4148 diode, then the 1k adjustable resistor, into the VLIM adjustment pin on the RF board, where it ends up at R11. The diode is connected with the cathode to the microcontroller pin and the anode to the adjustable resistor. Now adjust that 1k trimpot to give a supply voltage reading of between 10.0 and 10.2 volts.

- Now enable the power-boosted mode. This uses the same microcontroller pin, but this time pulled high to +5 volts. This signal now goes through another 1N4148 diode, then through the 10k trimpot, and again ends up at the VLIM pin of the RF board. This diode is connected with the anode at the microcontroller pin and the cathode at the adjustable resistor. Now set that 10k trimpot so that you get a supply voltage reading of roundabout 18 volts. When done switch back to normal mode...

This concludes the adjustments required to the circuit, and it should now be fully operational. The unit is now adjusted such that in normal mode the tip is kept hot and that load changes are quickly detectable. In normal mode the control loop will nicely adjust the supply voltage to keep the tip at the temperature. During limit-mode, which is very usefull to implement auto-sleep, any slight load change will cause a huge change in the available readings (forward-voltage, reflected-voltage, and subsequently the calculated SWR and power levels). Even pulling the handle out of the stand causes enough load change to give a huge delta-reading of the above values combined. Also, when waking up, the boost-mode now allows for a quicker recovery if needed.

I will explain how to use those values to detect changes, etc., in the next post later today explaining the firmware that i am working on.

Greetings,

Chris

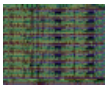
Report to moderator Logged

girolamo
Contributor
Posts: 11

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #402 on:** September 03, 2015, 07:11:18 pm
Say Thanks Reply Quote
»

Thanks to all...now everysing is clear now,but for my sttc-126 ,idle voltage[normal power]] i set it at around 8.7v.Tip is kyp all time clean.WhEN i pickup from stand ,voltage rise to 15,7 v, and recovery temperature quickly enough..
ut we have another problem.I bought MX-H1-AV that the part of his hand.It is very nice done but I don't know why his body is heating up strong enough In connector area inside.Taking out the tip, it is relatively cool!!that would be the reason? Also met someone this phenomenon?It is heatyng only alu part of pencil...To be a loophole rf and aluminum body is heated by induction in his turn?

Report to moderator Logged

timofonic
Frequent Contributor

Posts: 904
Country:
Eternal Wannabe Geek

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #403 on:** September 12, 2015, 02:53:10 am
Say Thanks Reply Quote
»

Quote from: mamalala on August 28, 2014, 05:53:50 pm

Hi all,

just wanted to say, zayance sent me those PCB's and they look just great! Thanks very much for that, zayance!

If you plan to build one, go for it. Right now i'm rather busy with other stuff, plus i'm short on funny-money to spend on private projects right now, so the next version of the supply board will take some time.

Greetings,

Chris

Quote from: zayance on November 14, 2014, 02:00:11 pm

Wait didn't you get the email i've sended with the files for it?
Meaning updated Schematic etc...

Basically it's exactlly the same latest board as mamalala only diff here is that there was a prob in the silk on the Generator side,
since i made one PCB to have both designs, Eagle pushed the Silkscreen numbers beside of just copy/pasting (logic and bummer).
I also moved the silk for some components here and there to make the assembly and it's visualisation easier, that's all.
So i made a Corrected BOM AND a corrected Schematic + Build doc according to the right Tname and values etc....
Something that i've sended to people who bought the boards, including you if my memory is not failing already??
Please let me know

I repeat, All the rest is the same

Best,

T.

Quote from: mamalala on November 26, 2014, 02:47:57 pm

Yea, all that stuff was left in that state while i was still experimenting with the performance of the unit. In the actual unit i have here, as well as the ones i gave away, i have (using zayance's part numbers):

R40 = 22k
R41 = 200R
R54 = 100R
R55 = 100R
R39 is not installed.

Sorry for the confusion.

Greetings,

Chris

Quote from: mamalala on November 27, 2014, 05:04:34 pm

Quote from: richard.cs on November 27, 2014, 03:40:14 pm

1) In zayance's schematic there is, from transformer to output, 47nF x6 series, 22pF x2 shunt, 1uH series, 56pF x5 shunt, 1uH series, 56pF x3 shunt, 400nH series, 56pF x4 shunt. I've read various posts about missing out or fitting extra 56pF capacitors, is the above correct or should I add/remove some capacitors?
2) Is the firmware attached to post #204 the most recent available?
3) Have any binaries been posted or could someone send me one please? I will be using the PIC18F2620.
4) What's the optimum/min/max supply voltage? I've seen 24 mentioned as usable but low, and 26, 28 and 30V mentioned various times. I will probably build with a 50 Hz transformer but I'd like to pick the best secondary voltage.

Attached are three images from my rather dusty development unit that show how many caps i have installed. I did the same cap placement on subsequent units. Again, feel free to fiddle with that a bit, i went for "as much like a sine at the output as possible" plus "large Vpp output into a 50 ohms RF dummy load". Also again, it probably isn't perfect, and some room for improvement left in the filter section. Did you note the update to the coil winding scheme that happened later? Should be documented, if you can't find it i will make some pics of the current ones as well.

Also attached are two ZIP files, one containing only the compiled .cof and .hex files, the other contains the sources (the whole MPLab-X tree, in fact). The project compiles with Microchips C18 compiler.

About the voltage, 24 volts is enough to get it working well, i use an old 24V transformer from an old soldering station. Just don't go too high, the buck regulator can't take too much.

Greetings,

Chris

Quote from: richard.cs on March 11, 2015, 09:33:30 pm

It's finished! Or very nearly anyway.

Since my last post I have modified the board with an undervoltage lockout circuit, mounted a boost converter module in the case for low-voltage d.c. input (10-30 V), and made up a small reverse polarity / overvoltage protection circuit for the new d.c. input, photos attached. Still to do is some input filtering on the DC lines, debugging the occasional odd behaviour seen previously and some general tidying up.

Edit: added schematics.

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STTC-126
STTC-037
STTC-025

Between 13.5 and 14.5 volts:

STTC-011
SMTC-147

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I will explain how to use those values to detect changes, etc., in the next post later today explaining the firmware that i am working on.

Greetings,

Chris

Any way to get the latest schematics and PCB files? I want to make them in KiCad too.

I got crazy trying to understand this. The information is too disperse and the topics are too much difficult for a noob like me. I just want to build a cool soldering station 😃

Any updates? Can someone do a summary and put an the updated information into one post? Please!

Thanks in advance!

« *Last Edit: September 12, 2015, 03:15:39 am by Circuiteromalaguito* »

Report to moderator Logged

danringer
Contributor
Posts: 11
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #404 on:** October 04, 2015, 08:05:58 pm »

Say Thanks Reply Quote

are any pcbs still available?

Report to moderator Logged

girolamo
Contributor
Posts: 11

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #405 on:** October 07, 2015, 09:26:46 am »

Say Thanks Reply Quote

Yes ,ihave a pair of them!

Report to moderator Logged

[PTM]
Newbie
Posts: 2

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #406 on:** October 16, 2015, 02:30:11 pm »

Say Thanks Reply Quote

hi there!
Where is i can found latest files?

Report to moderator Logged

Rinatka7
Newbie
Posts: 2
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #407 on:** October 18, 2015, 08:34:04 am »

Say Thanks Reply Quote

Hello.
I need your help!
I have broken metcal mx-h1-av handpiece, while i disassemble it i broke one legs in inductor.
Here it is photo of this inductor.
By color of lines seems that it is 11uH, but in another post - https://www.eevblog.com/forum/projects/broken-metcal-rfg-30-soldering-base-unit-fixed/msg438916/#msg438916 Anders said that it is 22uH.
Where is a true?
Thank you very much.
Could you please give to me a link to shop where i can buy this inductor.

64f61259f74b81dba5161b0fa27f9fb7.jpg (21.24 kB, 288x254 - viewed 481 times.)

Report to moderator Logged

hww
Newbie

Posts: 1
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #408 on:** December 04, 2015, 07:49:20 pm »

Say Thanks Reply Quote

Quote from: zayance on August 23, 2014, 11:00:14 am

> For now only two folks interested, and 8 PCB's left.
>
> Anyone else?

Is it still possible to order the PCBs? I wish to get it

« *Last Edit: December 04, 2015, 08:06:31 pm by hww* »

Report to moderator Logged

timofonic
Frequent Contributor

Posts: 904
Country:
Eternal Wannabe Geek

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #409 on:** December 04, 2015, 09:49:55 pm »

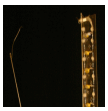
Say Thanks Reply Quote

> **Quote from: hww on December 04, 2015, 07:49:20 pm**
>
> > **Quote from: zayance on August 23, 2014, 11:00:14 am**
> >
> > For now only two folks interested, and 8 PCB's left.
> >
> > Anyone else?
>
> Is it still possible to order the PCBs? I wish to get it

I would love to have the original design in some file format...

Report to moderator Logged

mikeselectricstuff
Super Contributor



Posts: 11971
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #410 on:** December 11, 2015, 02:37:09 pm »

Say Thanks Reply Quote

Just doing some tidying up - have come across the V0.2 bare PCB from mamalala and a bag containing quite a few of the parts.
I doubt I'll ever get round to doing anything with them so will post free to anyone in the UK that wants them.

If no takers in UK for a couple of days I'll send overseas for GBP5 via paypal to cover postage costs.

Report to moderator Logged

Youtube channel:Taking wierd stuff apart. Very apart.
Mike's Electric Stuff: High voltage, vintage electronics etc.
Day Job: Mostly LEDs

timofonic
Frequent Contributor

Posts: 904
Country:
Eternal Wannabe Geek

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #411 on:** December 12, 2015, 01:47:09 pm »

Say Thanks Reply Quote

> **Quote from: mikeselectricstuff on December 11, 2015, 02:37:09 pm**
>
> Just doing some tidying up - have come across the V0.2 bare PCB from mamalala and a bag containing quite a few of the parts.
> I doubt I'll ever get round to doing anything with them so will post free to anyone in the UK that wants them.
>
> If no takers in UK for a couple of days I'll send overseas for GBP5 via paypal to cover postage costs.

Why so much praying to PBS? Can someone publish a comprehensive message in the first part work a summary and crowdsourcing schematics and layout for at least kicad and Eagle?

Report to moderator Logged

Neganur
Supporter

Posts: 1114
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #412 on:** December 18, 2015, 05:19:39 pm »

Say Thanks Reply Quote

> **Quote from: timofonic on December 12, 2015, 01:47:09 pm**
>
> Why so much praying to PBS? Can someone publish a comprehensive message in the first part work a summary and crowdsourcing schematics and layout for at least kicad and Eagle?

The what?

Report to moderator Logged

hurtmanissimo
Contributor

Posts: 6
Country:

is topic dead?
« **Reply #413 on:** February 17, 2016, 10:26:24 am »

Say Thanks Reply Quote

hi! little bit to slowpoke, but i`m find this perfect diy project

built it, and in result - have some questions.

the main questions is:

controller board does not swithch off rf_en then tip removed. the buck converter switch permanently when switch on by button and switch off by button.

it has no reaction on remove tip, but message - NO TIP is displayed correctly (circuit works), and sense installed tip.

this burn me some more fet`s

in code power_manager.c i find a place, which must to handle it, but i think there is something miss. i`m not expert in c programming

Code: [Select]

```
cur_tip = tip_detect_get_status();

        if(cur_tip != old_tip)
        {
            if(old_tip == TIP_MISSING)
            {
                power_manager_init_state();
                infodisplay_reset();
                if(power_manager_get_state() == PM_OFF)
                {
                    power_manager_set_state(PM_HEATUP);
                }
                else if(power_manager_get_state() == PM_MANUAL_OFF)
                {
                    power_manager_set_state(PM_MANUAL_NORMAL);
                }
```

anyone use/fix or made further development of original firmware?

will try to add an else statement , which must execute instead of setting work states then tip not present

like

Code: [Select]

```
if(power_manager_get_state() != PM_OFF)
    {
        logger_print_params();

        cur_tip = tip_detect_get_status();

        if(cur_tip != old_tip)
        {
            if(old_tip == TIP_MISSING)
            {
                power_manager_init_state();
                infodisplay_reset();
                if(power_manager_get_state() == PM_OFF)
                {
                    power_manager_set_state(PM_HEATUP);
                }
```

thanks

Report to moderator Logged

KJDS
Super Contributor
Posts: 2442
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #414 on:** February 17, 2016, 10:34:30 am »
Say Thanks Reply Quote

For those feeling lazy, then

https://www.eevblog.com/forum/buysellwanted/fs-uk-eu-metcal-power-supplies-stss-ps2v-02-mx500p-and-stands/

Report to moderator Logged

http://www.ebay.co.uk/sch/kjds_stuff/m.html?_nkw=&_armrs=1&_from=&_ipg=&_trksid=p3686

hurtmanissimo
Contributor

Posts: 6
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #415 on:** February 18, 2016, 05:59:52 am »
Say Thanks Reply Quote

yesterday try some code, and add switch rf part then there is no tip. tested, and it works fine disabling RF then tip removed, and enable then inserted back

then need some fix to not display any status messages like HEATED, HEATING in case of removed tip.

Code: [Select]

```
void tip_detect_process(void)
{
//      if(RFG_EN)
        if(power_manager_get_state() != PM_OFF)
        {
        if(TIP_DET == 0)
        {
            tip_status = TIP_MISSING;
            RFG_EN = 0;
        }
        else
        {
            tip_status = TIP_OK;
        }
        }
}
```

Report to moderator Logged

Cerebus
Super Contributor

Posts: 3396
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #416 on:** February 22, 2016, 12:17:13 am »

Say Thanks Reply Quote

Quote from: Wolfram.Chrome on February 21, 2016, 08:34:58 pm

Guys i dont understood ,where is the stuff ?
source code and schematics ??
loool im here around 5 minutes and still don't found the stuff about this thread talking

So it's not just me then. I've skimmed through the whole thread a couple of times and I can't get a handle on what's considered the best, latest and greatest version.

Would someone who has followed the history of the thread please be kind enough to post a summary of the state of affairs with pointers to where the current schematics etc. can be found?

Thanks,
Ian

Report to moderator Logged

Anybody got a syringe I can use to squeeze the magic smoke back into this?

Monkeh
Super Contributor

Posts: 5894
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #417 on:** February 22, 2016, 12:43:20 am »

Say Thanks Reply Quote

Quote from: Wolfram.Chrome on February 21, 2016, 08:34:58 pm

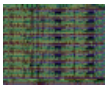
loool im here around 5 minutes and still don't found the stuff about this thread talking

Oh no! Five whole minutes! No instant gratification, total failure!

If your attention span is that short, this project is really not for you.

Report to moderator Logged

timofonic
Frequent Contributor



Posts: 904
Country:

Eternal Wannabe Geek

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #418 on:** February 23, 2016, 04:34:34 pm »

Say Thanks Reply Quote

Quote from: Wolfram.Chrome on February 22, 2016, 07:34:58 AM

> Guys i dont understood ,where is the stuff ?
> source code and schematics ??
> loool im here around 5 minutes and still don't found the stuff about this thread talking

It seems only gurus are able to decode this. I'm a newbie and get totally crazy trying to understand it, it's totally spread over tons of forum posts and such.

Anyone willing to explain this for us the poor dummies? Please!

Quote from: Monkeh on February 22, 2016, 11:43:20 AMQuote from: Wolfram.Chrome on February 22, 2016, 07:34:58 AM

loool im here around 5 minutes and still don't found the stuff about this thread talking

Oh no! Five whole minutes! No instant gratification, total failure!

If your attention span is that short, this project is really not for you.

Nice. This is another guru only project. It's okay! Get fun and look better than losers like me

Report to moderator Logged

The following users thanked this post: Wolfram.Chrome

mmagin
Frequent Contributor
Posts: 613
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #419 on:** February 23, 2016, 11:35:25 pm »
Say Thanks Reply Quote

Quote from: Monkeh on February 22, 2016, 12:43:20 am

Quote from: Wolfram.Chrome on February 21, 2016, 08:34:58 pm

loool im here around 5 minutes and still don't found the stuff about this thread talking

Oh no! Five whole minutes! No instant gratification, total failure!

If your attention span is that short, this project is really not for you.

I read the whole thread and I cannot find a complete schematic anywhere, even an outdated version. Also I'm a bit confused why this needs a microcontroller. The usual Metcal bases just supply a fixed RF output (with varying sorts of protection depending on the age of the design -- the early ones like I have I've been sternly warned to not operate unloaded.)

On a tangent, does anyone know how the impedance of the tip varies with temperature? It cannot be constant with the varying loading, but I'm curious how much it actually varies. And, is that base to cord connector totally proprietary?

Report to moderator Logged

Monkeh
Super Contributor
Posts: 5894
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #420 on:** February 23, 2016, 11:58:23 pm »
Say Thanks Reply Quote

Quote from: mmagin on February 23, 2016, 11:35:25 pm

And, is that base to cord connector totally proprietary?

You mean the bog standard F connector?

Report to moderator Logged

mmagin
Frequent Contributor
Posts: 613
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #421 on:** February 24, 2016, 01:04:15 am »
Say Thanks Reply Quote

Quote from: Monkeh on February 23, 2016, 11:58:23 pm

Quote from: mmagin on February 23, 2016, 11:35:25 pm

And, is that base to cord connector totally proprietary?

You mean the bog standard F connector?

Huh. Is it because mine looks weird due to the early version that has a locking ring that I never noticed that? I'm going to have to look more carefully when I get home.

Report to moderator Logged

mmagin
Frequent Contributor
Posts: 613
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #422 on:** March 04, 2016, 08:56:58 pm »
Say Thanks Reply Quote

Quote from: mmagin on February 24, 2016, 01:04:15 am

Quote from: Monkeh on February 23, 2016, 11:58:23 pm

> **Quote from: mmagin on February 23, 2016, 11:35:25 pm**
>
> And, is that base to cord connector totally proprietary?
>
> You mean the bog standard F connector?
>
> Huh. Is it because mine looks weird due to the early version that has a locking ring that I never noticed that? I'm going to have to look more carefully when I get home.

Yeah, I guess it is an F connector. Hardly matters much at 13.56 Mhz if it's a 50 or 75 ohm connector probably.

Report to moderator Logged

hurtmanissimo
Contributor

Posts: 6
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #423 on:** March 21, 2016, 06:52:57 am »
Say Thanks Reply Quote

Got talon tweezers with tact503. It heat-up, but not to work temperature (curie point not reached) , so power consumption stay high - 2.8a from 28v supply.

Trying to set bigger voltage by r32, it not make any visible diffs. During heatup voltage on L2 slowly rise to 25v.

Wait for larger sink, now - on 90x90x15 it heat up very quickly on that load. Even with additional blower it wont drop to normal mode. Staying in heatup mode (around 55-60% bar).

Think about rewind xformer from 0.7wire to 0.8 - not sure it will do anything, but i`m try it
Working with desolder gun , and other tips - fine. Fast heatup to working temperature, then idle..

Report to moderator Logged

hurtmanissimo
Contributor

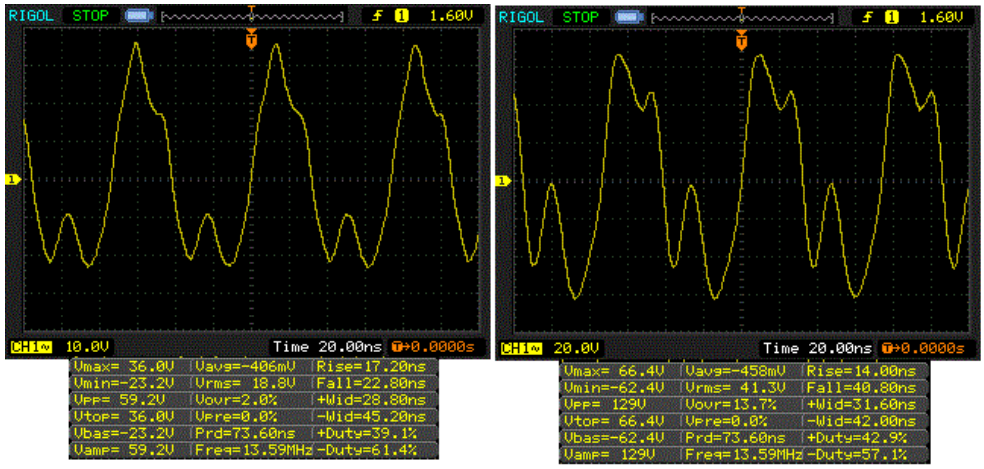
Posts: 6
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #424 on:** March 28, 2016, 01:39:48 pm »
Say Thanks Reply Quote

Have borrow from friend dso, and take some measuring with 50omh dummy.

dunno why there too large vpp, and waveform have little different from posted here by topicstarter mamalala.

any ideas about possible cause?



Images_OSC.gif (31.45 kB, 659x353 - viewed 766 times.)

Report to moderator Logged

Monkeh
Super Contributor

Posts: 5894
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #425 on:** March 28, 2016, 08:01:25 pm »
Say Thanks Reply Quote

> **Quote from: Wolfram.Chrome on March 28, 2016, 07:02:18 pm**

https://www.linkedin.com/pulse/diy-project-my-workshop-soldering-station-valeriya-p-
this woman has done the assembling of those 2 pcb's better and cleaner then most men's around here ...

Keeeeeeep digging.

Report to moderator Logged

AndersAnd
Frequent Contributor
Posts: 568
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #426 on:** April 10, 2016, 08:17:39 am »
Say Thanks Reply Quote

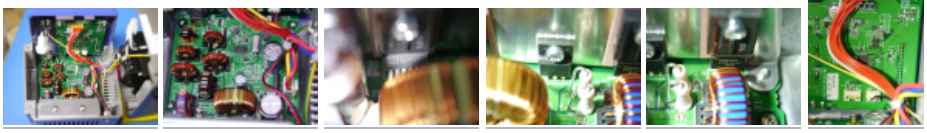
Quote from: Wolfram.Chrome on March 13, 2016, 03:01:01 pm

Anybody out here is thinking to re-design some part's of the pcb?(rf power supply)

I want to say that in the hakko fx100 we have the rf connector soldered directly in the part where the rf power output is.
In the diy metcal power supply we must to solder some kind of 75ohm of cable to make the connection over the iron handler and the power supply.
Is this a really good way to make less radio loss over the rf power connection?
because personally i think will be better to solder the connector directly on the pcb.
In this picture you can see what im talking about.

The link to the link to the image you posted doesn't work anymore. Looks like the direct link changes dynamically. Here's a new link:

And here's some more pictures: https://www.eevblog.com/forum/reviews/hakko-fx-100-any-good/msg772986/#msg772986



« *Last Edit: April 10, 2016, 08:20:18 am by AndersAnd* »

Report to moderator Logged

AndersAnd
Frequent Contributor
Posts: 568
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #427 on:** April 10, 2016, 08:23:46 am »
Say Thanks Reply Quote

Quote from: Wolfram.Chrome on March 28, 2016, 07:02:18 pm

https://www.linkedin.com/pulse/diy-project-my-workshop-soldering-station-valeriya-p-
this woman has done the assembling of those 2 pcb's better and cleaner then most men's around here ...

Looks like it forum member hhw who made a post earlier in this topic:
https://www.eevblog.com/forum/projects/diy-metcal-13-56-mhz-rf-supply/msg813905/#msg813905
Same avatar at LinkedIn as here in the forum:

Report to moderator Logged

timofonic
Frequent Contributor

Posts: 904
Country:
Eternal Wannabe Geek

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #428 on:** April 10, 2016, 09:22:51 pm »
Say Thanks Reply Quote

This project is buried in tons of posts.

Any hero willing to summarize it? If possible, what about asking a forum administrator to put a first post here with such information?

Report to moderator Logged

Iwanushka
Regular Contributor

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #429 on:** April 26, 2016, 07:50:12 pm »
Say Thanks Reply Quote

maybe someone has spare boards?

Report to moderator Logged

When all you've got is a hammer, everything starts looking like a nail.- Attrition.

Posts: 244
Country:

The following users thanked this post: Wolfram.Chrome

Iwanushka
Regular Contributor

Posts: 244
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #430 on:** April 26, 2016, 08:53:56 pm »

Say Thanks Reply Quote

> **Quote from: Wolfram.Chrome on April 26, 2016, 08:40:03 pm**
>
> > **Quote from: Iwanushka on April 26, 2016, 07:50:12 pm**
> >
> > maybe someone has spare boards?
>
> Iwanushk is that you from dangerprototype which unisolder 5.2 project ?
> LOOL

Yes, that's me!

Report to moderator Logged

When all you've got is a hammer, everything starts looking like a nail.- Attrition.

The following users thanked this post: Wolfram.Chrome

Iwanushka
Regular Contributor

Posts: 244
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #431 on:** April 27, 2016, 12:26:50 am »

Say Thanks Reply Quote

> **Quote from: Wolfram.Chrome on April 26, 2016, 09:27:52 pm**
>
> > **Quote from: Iwanushka on April 26, 2016, 08:53:56 pm**
> >
> > > **Quote from: Wolfram.Chrome on April 26, 2016, 08:40:03 pm**
> > >
> > > > **Quote from: Iwanushka on April 26, 2016, 07:50:12 pm**
> > > >
> > > > maybe someone has spare boards?
> > >
> > > Iwanushk is that you from dangerprototype which unisolder 5.2 project ?
> > > LOOL
> >
> > Yes, that's me!
>
> U r AWESOME

All I did was sell some surplus boards, that's all, all the credits go to sparkybg

Report to moderator Logged

When all you've got is a hammer, everything starts looking like a nail.- Attrition.

timofonic
Frequent Contributor

Posts: 904
Country:

Eternal Wannabe Geek

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #432 on:** April 29, 2016, 09:44:11 am »

Say Thanks Reply Quote

Are there schematics and PCB files about this project?

Do UniSolder by sparkybg supports RF soldering irons too? Last time I checked seems didn't support them. Please correct me if I'm wrong

« *Last Edit: April 29, 2016, 09:51:33 am by timofonic* »

Report to moderator Logged

AndersAnd
Frequent Contributor

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #433 on:** April 29, 2016, 11:56:05 am »

Say Thanks Reply Quote

> **Quote from: timofonic on April 29, 2016, 09:44:11 am**

Posts: 568
Country:

> Do UniSolder by sparkybg supports RF soldering irons too?

No.
Unisolder forum thread at dangerousprototypes:
http://dangerousprototypes.com/forum/viewtopic.php?f=56&t=7218&p=61175#p61175
« *Last Edit: April 29, 2016, 12:00:13 pm by AndersAnd* »

Report to moderator Logged

melgozan
Newbie
Posts: 1
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #434 on:** May 07, 2016, 10:01:26 pm »
Say Thanks Reply Quote

maybe someone has spare boards?

Report to moderator Logged

MRBadGuy
Contributor

Posts: 8
Country:
sometimes i feel like i break down and cry...

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #435 on:** May 10, 2016, 08:46:12 am »
Say Thanks Reply Quote

I have a few questions ,as my english is not yet perfect,for me actually is not very easy to understand all this materials.
So let's start with some dumbass questions.
1)To power up this thing can i use an already made power supply ? maybe one like this ?
LRS-75-24
or is better to go with an simple power-trasformer?
2)Which power-trasformer i must to get ,something like this?
output : 30vac and 80va ? it must be less or more ?
3)In the original metcal the tip inside the hadler goes to sleep when the handler is inside the stand ,but here is the same as in the original metcal ?

Report to moderator Logged

https://soundcloud.com/andymusic/freddy-mercury-mr-bad-guy

MRBadGuy
Contributor

Posts: 8
Country:
sometimes i feel like i break down and cry...

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #436 on:** May 11, 2016, 12:30:42 am »
Say Thanks Reply Quote

Oh my GOSHSHSH !!!
no reply ,no one ,this for me looks like this project is almost more then death.

Report to moderator Logged

https://soundcloud.com/andymusic/freddy-mercury-mr-bad-guy

richard.cs
Frequent Contributor
Posts: 662
Country:
Electronics engineer from Southampton, UK.

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #437 on:** May 11, 2016, 06:45:01 am »
Say Thanks Reply Quote

1, That type of power supply would work, the one in the photo is too small but LRS-75-24 would be enough.

2, The transformer I used was Farnell part number 1780865. 24 V 100 VA. There are plenty of other choices.

3, The magnetic stands saturate the tip and reduce the dissipation. That will work with this design if you use the right stand but you don't actually need to because this design uses directional couplers to detect forward and reverse power and the software on the PIC then makes a decision that the iron hasn't been used in a while and sets a low power mode. That mode keeps the tip cool for long life but is still hot enough that it can detect the heat loss (due to movement through the air) when you remove it from the stand.

There are PCB files and schematics available, they're attached way further back in the thread. I think many months ago and a couple of pages back there was a summary of what was on which posts.

Report to moderator Logged

The following users thanked this post: MRBadGuy

MRBadGuy
Contributor

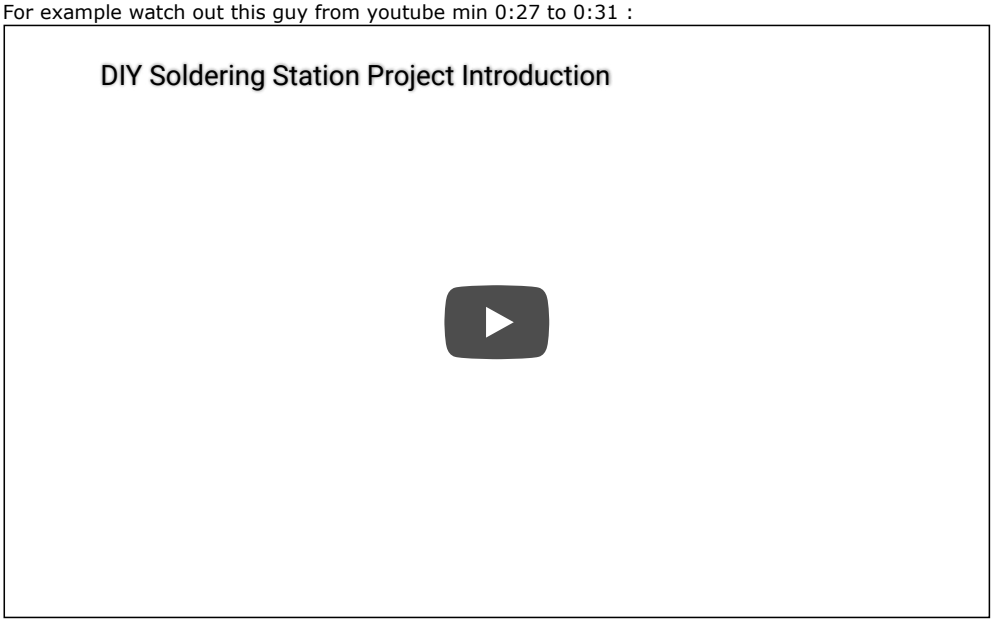
Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #438 on:** May 11, 2016, 07:53:21 am »
Say Thanks Reply Quote

> **Quote from: richard.cs on May 11, 2016, 06:45:01 am**

Posts: 8
Country:

sometimes i feel like i break down and cry...

Oki thanks you for the informations.
But i have some last questions to do.
Is the owner of this project don't care anymore about it ?
Because he must to make an update of the RF exit way on the pcb, to solder an connector-plug directly on the rf stage.
This will make an perfect swr tunning over the Power-Supply and the iron.
For example watch out this guy from youtube min 0:27 to 0:31 :



as you can hear, he claims to have problems with the hadler and in my personal opinion that problem is started by a wrong swr tunning caused by
the cable soldered on the RF powersupply.
We really need that update (At least i think this way)

« *Last Edit: May 11, 2016, 07:55:24 am by MRBadGuy* »

Report to moderator Logged

https://soundcloud.com/andymusic/freddy-mercury-mr-bad-guy

richard.cs

Frequent Contributor

Posts: 662
Country:

Electronics engineer from Southampton, UK.

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #439 on:** May 11, 2016, 08:24:41 am »

Say Thanks Reply Quote

I don't think that is likely to be a major problem. At these frequencies the odd impedance at the junction is only a very short length compared to the wavelength and it should really be fine. You could edit the files to add a connector footprint if you like but I am not convinced it will make a lot of difference.

Take a look at my page here: http://randomfunprojects.co.uk/metcal.html and look at the table near the top of the page, you'll see the SWR of the tips themselves is not great when cold, reasonable when warm, and (by design, to regulate the temperature) very high when hot.

Report to moderator Logged

The following users thanked this post: MRBadGuy

MRBadGuy

Contributor

Posts: 8
Country:

sometimes i feel like i break down and cry...

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #440 on:** May 11, 2016, 08:58:01 am »

Say Thanks Reply Quote

Quote from: richard.cs on May 11, 2016, 08:24:41 am

> I don't think that is likely to be a major problem. At these frequencies the odd impedance at the junction is only a very short length compared to the wavelength and it should really be fine. You could edit the files to add a connector footprint if you like but I am not convinced it will make a lot of difference.

Oki maybe you are right,but i still can't figure out why the iron hadler of that guy is getting so hot,it's obviuosly an issue ...
However if the DIY Metcal Station is abbandoned by the owner ,it's useless to waste the proper time here.
This makes me sad ,because i was in love with this project

« *Last Edit: May 11, 2016, 09:03:58 am by MRBadGuy* »

Report to moderator Logged

https://soundcloud.com/andymusic/freddy-mercury-mr-bad-guy

richard.cs
Frequent Contributor
Posts: 662
Country:
Electronics engineer from Southampton, UK.

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #441 on:** May 11, 2016, 09:22:36 am »
Say Thanks Reply Quote

I don't think it's been abandoned, you will get answers to reasonable questions if you're patient but I think most people won't bother answering things they know you could find just by reading through the thread. Set aside some time to start at the beginning and read it all, note down post numbers with anything that looks useful. All the information is here, you can take the schematics, the PCB files and the software, change if you want to, and build it.

Report to moderator Logged

The following users thanked this post: Iwanushka, MRBadGuy

idpromnut
Supporter

Posts: 613
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #442 on:** May 16, 2016, 11:33:03 pm »
Say Thanks Reply Quote

Quote from: MRBadGuy on May 11, 2016, 08:58:01 am

> Oki maybe you are right,but i still can't figure out why the iron hadler of that guy is getting so hot,it's obviuosly an issue ...
> However if the DIY Metcal Station is abbandoned by the owner ,it's useless to waste the proper time here.
> This makes me sad ,because i was in love with this project

Thanks for linking my video on my build of the DIY Metcal (or MeltCal!). I know you wanted me to post my project however I'm not quite ready and there are a few things I wanted to get on video and photograph before presenting something here. I'm working on a new controller/PSU PCB (my build involves fitting the MeltCal into an radiation measurement instrument case that I bought off EBay) that will be AVR based, and is rather designed specifically for my build.

The other bit that I'm working on (slowly) is getting the v0.3 (plus modifications by Widlarizer(irc) in one of the feedback loops on the RF board) converted into Kicad along with a PCB layout.

@MRBadguy:
Quote from: MRBadGuy on May 10, 2016, 08:46:12 am

> 1)To power up this thing can i use an already made power supply ? maybe one like this ?
> **idpromnut: You sure can!**
>
> 2)Which power-trasformer i must to get ,something like this? output : 30vac and 80va ?
> **idpromnut: I run my MeltCal at about 24-30VDC @ about 2-3A.**
>
> 3)In the original metcal the tip inside the hadler goes to sleep when the handler is inside the stand ,but here is the same as in the original metcal ?
> **idpromnut: yes, but the catch is that the "mechanism" is in the hand piece holder, and not strictly in the RF board. The holder has a magnet near where the tip rests, and this changes the impedance of the tip which I believe makes the tip reflect more RF back to the RF supply which the supply detects and the built in feedback loop reduces the RF power to the hand piece.**

« Last Edit: May 17, 2016, 02:17:26 am by idpromnut »
Report to moderator Logged

The following users thanked this post: Mephitus

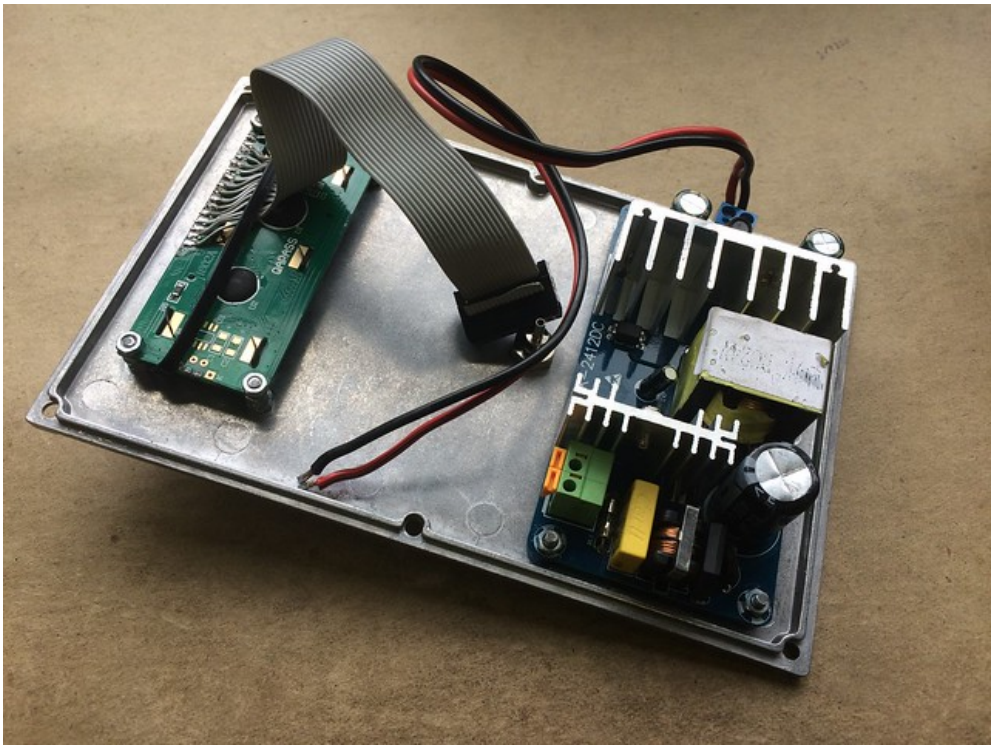
hurtmanissimo
Contributor

Posts: 6
Country:

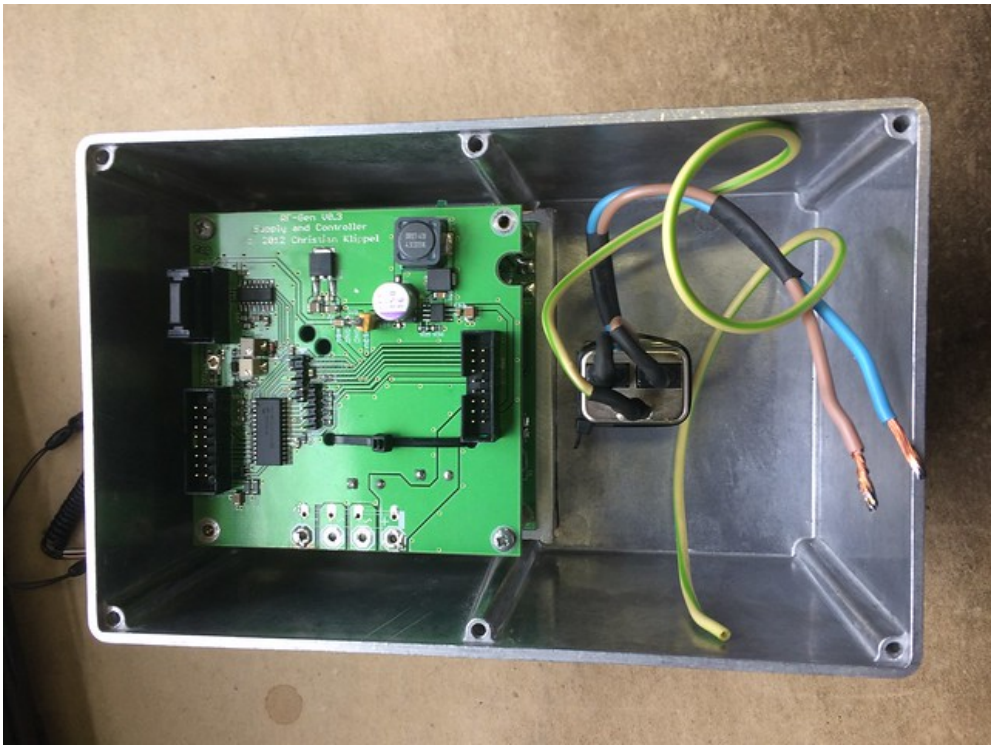
Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #443 on:** July 20, 2016, 11:42:06 am »
Say Thanks Reply Quote

Pack in enclosure. only turn knob not yet installed.

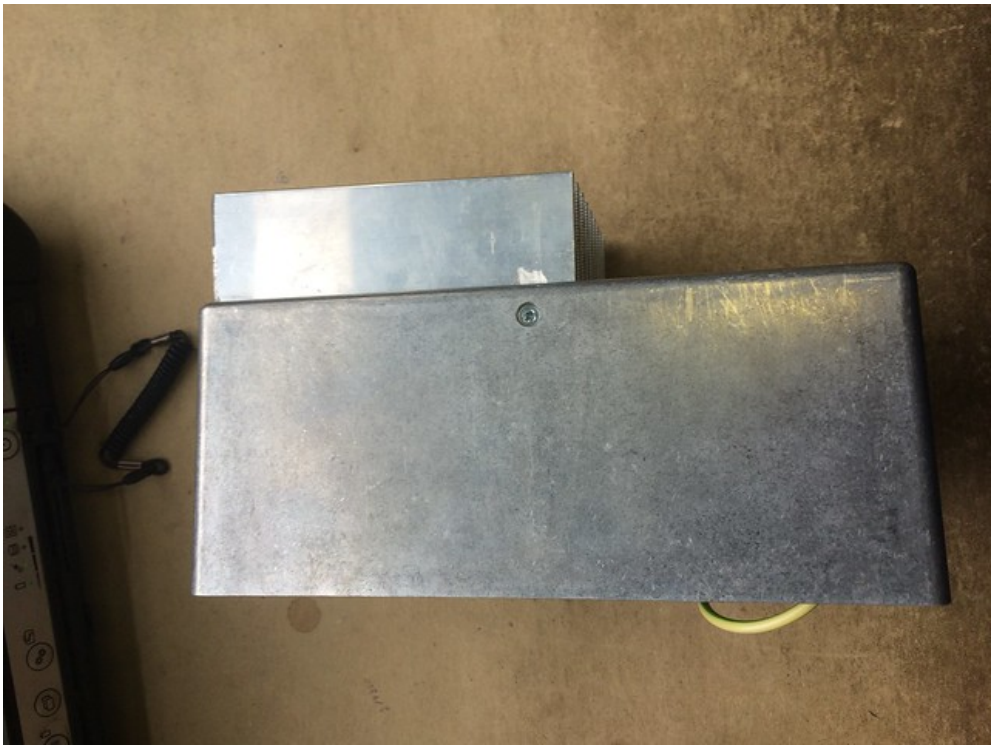
Metcal clone



Metcal clone



Metcal clone



Metcal clone

Metcal clone

Metcal clone

i`m use 26v spsu because large transformer eat alot of space, and it will not fit in that enclosure perfect

still not solve problem with large talon tips

they heat up, but build huge amount of reflected voltage, then irf die after overheating. (current consumption around 2.8a)

Report to moderator Logged

Deaniture
Contributor
Posts: 20
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #444 on:** October 23, 2016, 11:09:11 pm »
Say Thanks Reply Quote

I don't know whether this thread is still alive, but I was wondering if there were any boards available from the masterful creator of this project. This MX500 supply is something I would really like, only the real ones by Metcal are extortionately expensive.

Kind regards

D

Report to moderator Logged

Deaniture
Contributor
Posts: 20
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #445 on:** October 25, 2016, 01:19:00 pm »
Say Thanks Reply Quote

Also, if the creator of this project is no longer on this forum, and there are no boards left, I would quite happily be willing to get a small production run made for anybody interested?

Report to moderator Logged

richard.cs
Frequent Contributor
Posts: 662
Country:
Electronics engineer from Southampton, UK.

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #446 on:** October 25, 2016, 01:26:14 pm »
Say Thanks Reply Quote

mamalala is still on this forum occasionally according to his user page: "Last active 2016-10-13, 08:51:25" In the past he's been happy for people to get boards made, there have been at least three batches over the lifetime of this thread.

You'll probably have to hunt through the thread to get the latest build files but all the information is in there.

Report to moderator Logged

Deaniture
Contributor
Posts: 20
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #447 on:** October 25, 2016, 01:38:24 pm »
Say Thanks Reply Quote

Yes, thank you.

I have just had a chat with him, and he has no more boards left. I have had a look through the more recent posts, and people don't appear to have made any in any significant quantity. I will have another look but, as I say, I would be happy to make a small run of boards/kits if people were interested.

Thanks

D

Report to moderator Logged

wkb
Frequent Contributor

Posts: 540
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #448 on:** October 26, 2016, 08:18:09 pm »
Say Thanks Reply Quote

Quote from: Deaniture on October 25, 2016, 01:38:24 pm

> Yes, thank you.
>
> I have just had a chat with him, and he has no more boards left. I have had a look through the more recent posts, and people don't appear to have made any in any significant quantity. I will have another look but, as I say, I would be happy to make a small run of boards/kits if people were interested.
>
> Thanks
>
> D

I have a bare board set from him sitting in my stock here somewhere. In the meantime I have found myself a 2nd Metcal unit so this board set is surplus to requirements. Let me know if you want them, I paid EUR 10 for them, plus the stamps for shipping

Report to moderator Logged

The following users thanked this post: Deaniture

cwalex
Frequent Contributor
Posts: 302
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #449 on:** October 28, 2016, 11:20:00 am »
Say Thanks Reply Quote

I would be happy to go in for a PCB or kit if you end up getting some boards made.

Report to moderator Logged

The following users thanked this post: Deaniture

KeepItSimpleStupid
Contributor
Posts: 39

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #450 on:** October 31, 2016, 05:51:13 am »
Say Thanks Reply Quote

Interesting questions:

There's a tool called a "transfer punch". The idea is the tool fits in the hole to be transferred and has a point in the center. That gets you the location of hole #1 (from the wrong side), of course. To drill from the "bad side" get an "aircraft bit". e.g. http://www.mscdirect.com/browse/tn/Holemaking/Drilling-Drill-Bits/Metalworking-Multipurpose-Drill-Bits/Aircraft-Extension-Drill-Bits?navid=12106188

The "transfer punch" is not meant to center punch. Use a real center punch for that. Automatic center punches are the way to go. You just push rather than hot with a hammer.

Always when manually transferring something, transfer one hole and secure it. Then transfer another, secure. Transfer another and secure.

One of the best drills for sheet metal is a pilot point or brad point bit. The hoes, you will get will be round and not these triangular holes.

You may be able to find a bezel that will work. i.e. http://www.hobbytronics.co.uk/lcd-bezel-16x2 that will hide your cutting skills.

See https://www.lowes.com/projects/woodworking-and-crafts/hand-saw-buying-guide/article

You can do a lot with a hack saw and a coping saw. Generally you drill the corners with a hole big enough to insert the coping saw blade or even the hack saw blade or even an electric jig saw. The blade in the coping saw is removeable, so you insert it through the hole and then attach it back to the saw.

You can clamp some hard steel as a straight edge. If your dealing with sheet metal, there is a nibbler you can use.

Clean the edges up with a file and paint.

The next step up is a moto-tool like Proxxon or Dremel. The Dremel has way too much runout (side to side motion). there are youtube videos comparing the two.

Large round holes are best done with a step drill bit.

Report to moderator Logged

The following users thanked this post: salbayeng, Mephitus, Ig_sherwood

Monkeh
Super Contributor
Posts: 5894
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #451 on:** November 12, 2016, 01:34:20 am »
Say Thanks Reply Quote

Quote from: Ig_sherwood on November 11, 2016, 09:55:50 pm

> Can anyone help me to find some good chinese manufacturer of ceramic pcb ?
> I want to order some ceramic pcb for the rf stage .
>
> Example :

Uh.. why do you want a ceramic board for this?

Report to moderator Logged

Monkeh
Super Contributor
Posts: 5894

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #452 on:** December 03, 2016, 01:56:59 pm »
Say Thanks Reply Quote

Quote from: Ig_sherwood on December 03, 2016, 09:51:48 am

Country:

> **Quote from: Monkeh on November 12, 2016, 01:34:20 am**
>
> > **Quote from: Ig_sherwood on November 11, 2016, 09:55:50 pm**
> >
> > Can anyone help me to find some good chinese manufacturer of ceramic pcb ?
> > I want to order some ceramic pcb for the rf stage .
> >
> > Example :
>
> Uh.. why do you want a ceramic board for this?

Because i have already build my own unit ,but the problem in my case is the heat.
So i need an type of pcb which would be resistant to heat.

.. No, you need to get rid of the heat.

Report to moderator Logged

az113
Contributor

Posts: 6
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #453 on:** December 14, 2016, 02:29:18 am » Say Thanks Reply Quote

Hello again to all.
In search of incredible, i return to identify a MX-RM3e or newer MX-H1-AV tip's plug.
May be anyone identify it?

I buy some SMB connector, and i was very close - but no, it is slightly different.
Outer diameter of SMB female socket is 3.7mm instead 4mm in Metcal's tips, and inner pin diameter is 0,5mm, instead 1mm in Metcal ;(

Report to moderator Logged

David Hess
Super Contributor

Posts: 9902
Country:

DavidH

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #454 on:** December 14, 2016, 02:39:21 am » Say Thanks Reply Quote

> **Quote from: Ig_sherwood on December 03, 2016, 09:51:48 am**
>
> Because i have already build my own unit ,but the problem in my case is the heat.
>
> So i need an type of pcb which would be resistant to heat.

Like others said, this is the wrong way to go about it unless there are other considerations like physical size or operating environment.

What kind or type of RF transistor did you use?

High power transistors including RF ones have provisions to heat removal beyond only the printed circuit board. It would be better to select a different part which is packaged in a way which makes this possible.

Report to moderator Logged

macboy
Super Contributor

Posts: 1952
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #455 on:** December 16, 2016, 01:50:52 pm » Say Thanks Reply Quote

> **Quote from: az113 on December 14, 2016, 02:29:18 am**
>
> Hello again to all.
> In search of incredible, i return to identify a MX-RM3e or newer MX-H1-AV tip's plug.
> May be anyone identify it?
>
> I buy some SMB connector, and i was very close - but no, it is slightly different.
> Outer diameter of SMB female socket is 3.7mm instead 4mm in Metcal's tips, and inner pin diameter is 0,5mm, instead 1mm in Metcal ;(

It is an "F" connector, most commonly used for 75 ohm TV antenna connections in North America.

Report to moderator Logged

Monkeh
Super Contributor

Posts: 5894
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #456 on:** December 16, 2016, 03:19:32 pm » Say Thanks Reply Quote

> **Quote from: macboy on December 16, 2016, 01:50:52 pm**
>
> > **Quote from: az113 on December 14, 2016, 02:29:18 am**

> Hello again to all.
> In search of incredible, i return to identify a MX-RM3e or newer MX-H1-AV tip's plug.
> May be anyone identify it?
>
> I buy some SMB connector, and i was very close - but no, it is slightly different.
> Outer diameter of SMB female socket is 3.7mm instead 4mm in Metcal's tips, and inner pin diameter is 0,5mm, instead 1mm in Metcal ;(

It is an "F" connector, most commonly used for 75 ohm TV antenna connections in North America.

Not the handpiece connector, the *tip* connector. Fs are rather larger than 4mm.

Report to moderator Logged

Nitrous
Newbie
Posts: 1
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #457 on:** January 03, 2017, 09:54:14 pm » Say Thanks Reply Quote

Hi guys,

This is a great project. In more ways then the Metcal soldering station.
Has anyone "recently" picked up the challenge of putting a kit together?
Someone purchasing SMD parts in bulk with a simplified PCB bound be great!
Anyone else interested in someone offering a kit?

Nitrous

Report to moderator Logged

nowlan
Frequent Contributor
Posts: 639
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #458 on:** January 04, 2017, 06:37:14 am » Say Thanks Reply Quote

Just wondering how this rates vs buying a hako or weller. Do they perform? What is total cost with handle?

Report to moderator Logged

richard.cs
Frequent Contributor
Posts: 662
Country:
Electronics engineer from Southampton, UK.

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #459 on:** January 04, 2017, 01:26:59 pm » Say Thanks Reply Quote

The performance of mine is very good, and I like the smart sleep function which isn't supported on a standard one.

Report to moderator Logged

NavyBOFH
Contributor
Posts: 32
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #460 on:** July 28, 2017, 06:26:44 pm » Say Thanks Reply Quote

> **Quote from: Paulinho19 on March 08, 2013, 12:16:33 am**
>
> Great, we are back.
>
> What's new, My RF-Borad is finely working, the problem seem to be the XFMR, chris send me one of his and all problems went away. He only explanation that I can find is that RS send me the wrong ones. I will test them both next week with a network analyser to see what's the diference. I will also test a few Metcal tips.
>
> Meanwhile I finished my controller board design placed an order at iTead, my board are already on there way to Portugal.
>
> Paulo

Resurrecting the dead - but I like your layout for the control board! I was always wondering if you ever finished up your RF board design...

As for some of the more recent posts, I am thinking of grabbing the more recent fixes and stuffing them into the PCB somewhere and giving it a crack at making a handful to see how it works out. Mostly I am not a software person so I hope the firmware from 2013 is still the best for this project. I have a legit Metcal MX-500 at work with handle and about a half dozen tips to 1) assemble my board with and 2) compare the board with the "real deal" before ordering a Hakko handle and some tips for my own home use!

Report to moderator Logged

fireworks
Contributor
Posts: 35
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #461 on:** July 29, 2017, 03:42:03 pm »
Say Thanks Reply Quote

If you do that, please post your results here.
I'm interested in this project and I think others are too.

Report to moderator Logged

NavyBOFH
Contributor
Posts: 32
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #462 on:** July 29, 2017, 03:49:12 pm »
Say Thanks Reply Quote

I'm getting ready to order a set of PCBs to give it a spin. I had to re-read the entire thread but Paulo seemed to design his own control board to run off Arduino and his own code, while Chris' board ran a PIC controller and its own code. I think though my scouring I have found the most settled on BOM, PCB designs, and firmware.

Now the voltage protection circuit mentioned as a fix was probably intended for Chris' control board but I don't know if it was meant for Paulo's board as well - I'd have to look at both sets of schematics and see what the case might be. I also need to double check that there isn't conflicting information between build sources.

In the end I'd like to have at least one working setup to use on my own - barring any issues coming from making PCBs or sourcing the right parts. The debate I had for the longest time was which board to use for control and I think I'm going to print both just to experiment. Sadly I'm not much in the programming arena so I am going to zip up everything I found and post it here so I can get suggestions and ideas before sending out for PCB orders and taking orders for them on here.

Sent from my iPhone using Tapatalk

Report to moderator Logged

NavyBOFH
Contributor
Posts: 32
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #463 on:** July 29, 2017, 06:59:22 pm »
Say Thanks Reply Quote

This is what I have come up with so far: I have zipped each functional section into its own ZIP. One is the RF board, which seems to be the latest as of June 2013. The BOM is from zoltan and seems to be what Chris references as the "best list" available.

The control boards are the PIC board which Chris designed, along with his latest firmware, and the Arduino version from Paulo, with his firmware. Neither firmwares have been checked by myself so I don't know where we stand on those or if improvements can be made. There is also no BOM for either board, which might be helpful to some.

Let's see if we can complete these archives, get a good BOM for all of them, make some boards and test them out and refine the firmware as needed. If anyone want to try their hand at putting the over voltage protection circuit in the board that would be awesome since my free time is sparse in the next several weeks.

https://drive.google.com/open?id=0B9MnfIuHNf_INFlZaEwzbXdwOGc

Report to moderator Logged

NavyBOFH
Contributor
Posts: 32
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #464 on:** July 30, 2017, 07:33:10 pm »
Say Thanks Reply Quote

Here's my rough draft of including richard.cs' over voltage fix into the controller PCB. It's not the cleanest work I can do - nor am I sure I routed everything 100% (never used Eagle before so learning curve plus everything else)... but I hope someone will either approve it or tweak it so we can move to making some PCBs and getting this project started again for those that want it!

MetCal CTRL OverVoltageFix.zip (75.02 kB - downloaded 344 times.)

Report to moderator Logged

The following users thanked this post: Free_WiFi

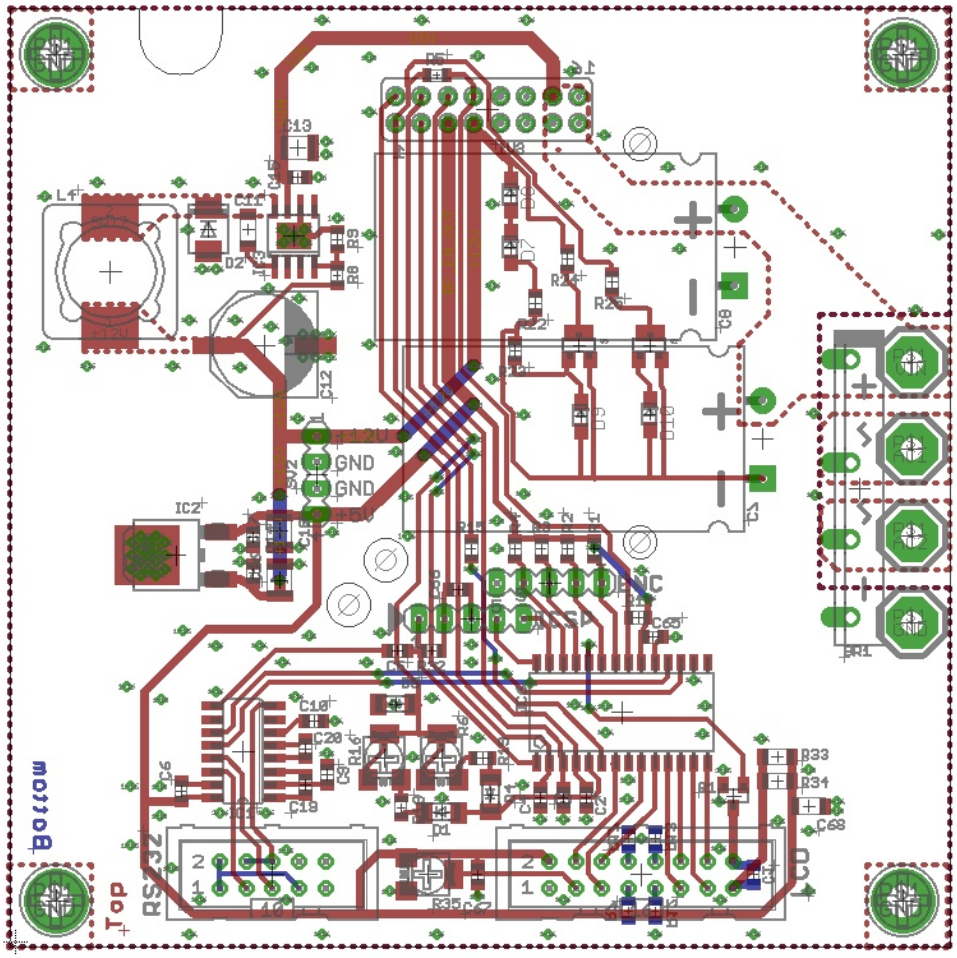
NavyBOFH
Contributor
Posts: 32
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #465 on:** July 30, 2017, 07:44:09 pm »
Say Thanks Reply Quote

Here's some screenshots of the PCB and the addition to the board for those that are mobile or don't have Eagle. I amended the schematic file for all of it too, which helped slightly with the routing process.

Other issue is the 2N7000 isn't in an SMD package until you go to the 2N7002 which changes resistance values as well. I don't know if it will make a large difference for this use or not, but if not then I would also think that a SOT23-6 package for both transistors would save some wiring and space as well. The diodes seemed to be a 1-for-1 between a 12V, 10V, and a 5V6 model, so hopefully there won't be much more to change.

EDIT: I noticed I left out a trace from Q2 gate to Q3 drain. I corrected that issue in my files here and posting here for continuity. I will send the files to anyone interested just to make sure if someone is changing or fixing the files we can all be on the same page.



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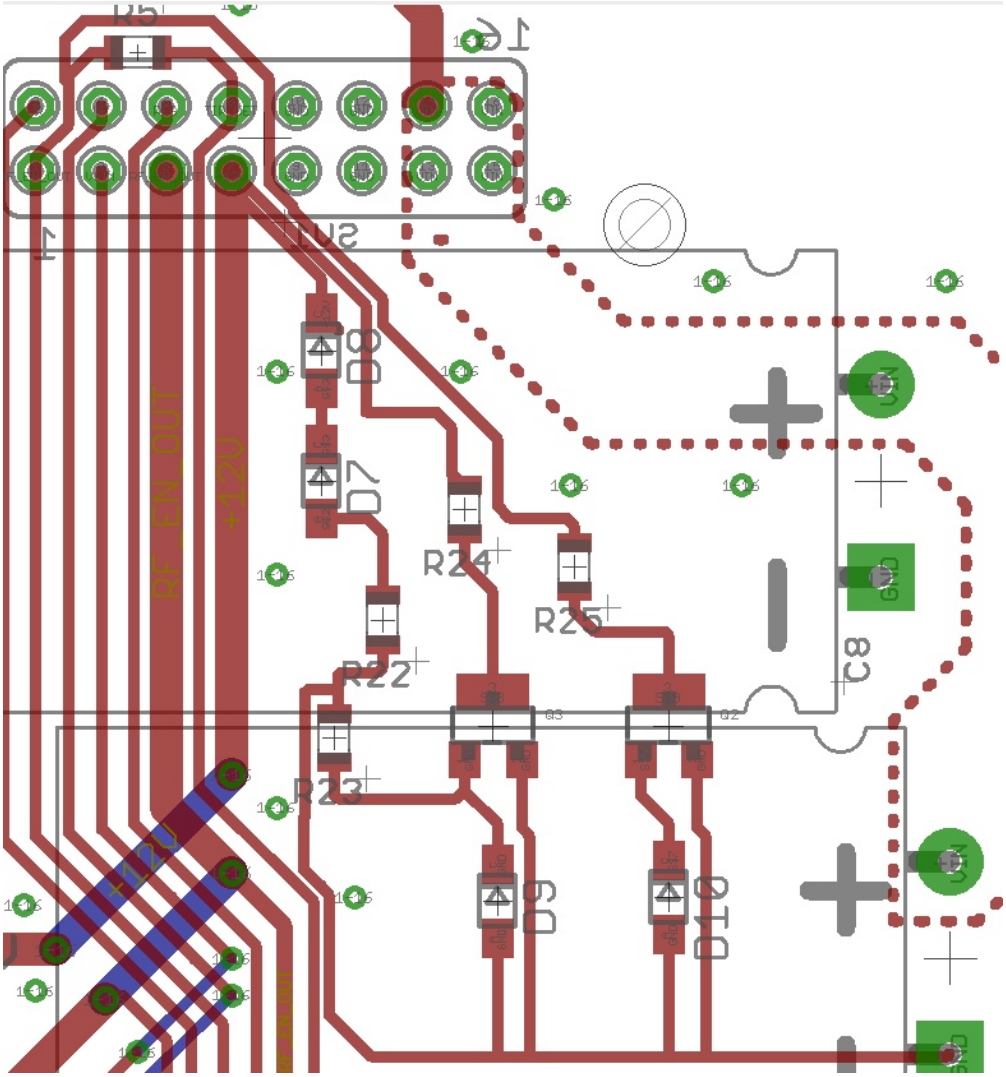
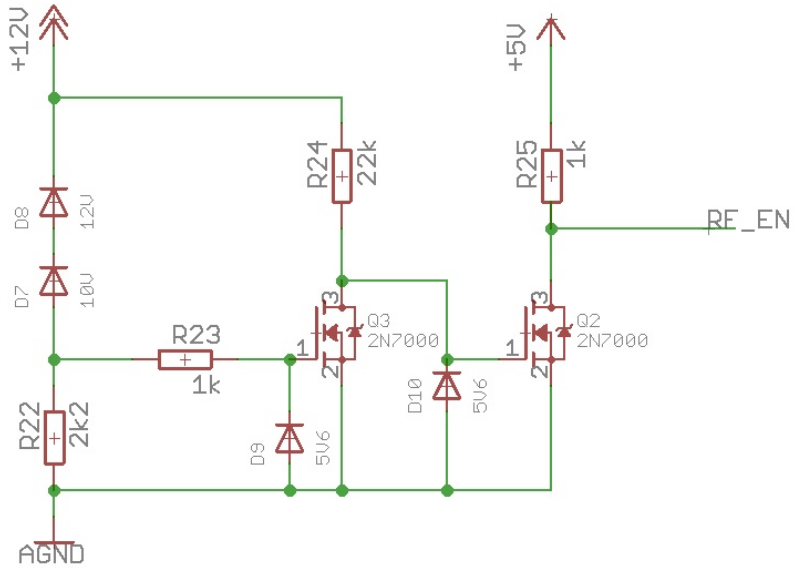


PCB_2.jpg (212.06 kB, 783x840 - viewed 559 times.)



SCHEM_1.jpg (54.01 kB, 903x625 - viewed 590 times.)

« *Last Edit: July 30, 2017, 08:40:20 pm by NavyBOFH* »

Report to moderator Logged

richard.cs

Re: DIY Metcal 13.56 MHz RF Supply

Frequent Contributor

Posts: 662
Country:

Electronics engineer from Southampton, UK.

« **Reply #466 on:** July 31, 2017, 12:01:51 pm » Say Thanks Reply Quote

Your undervoltage cutout seems to match my schematic, and I can confirm that a 2N7002 would be fine (or pretty much any other low power SMT MOSFET, it's not critical.

I don't remember the failure mechanism, but I remember several people reported blowing up the RF FETs, and Chris said cleanly shutting down the supply would always prevent it.

Report to moderator Logged

NavyBOFH

Contributor

Posts: 32
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #467 on:** July 31, 2017, 08:11:30 pm » Say Thanks Reply Quote

Quote from: richard.cs on July 31, 2017, 12:01:51 pm

> Your undervoltage cutout seems to match my schematic, and I can confirm that a 2N7002 would be fine (or pretty much any other low power SMT MOSFET, it's not critical.
>
> I don't remember the failure mechanism, but I remember several people reported blowing up the RF FETs, and Chris said cleanly shutting down the supply would always prevent it.

Thank you for getting back to me with that answer! I saw some people reporting it as well, and some of it had to do with the FET not being cleanly controlled, and others seem to have been from power supply issues.

I am glad that the 2N7002 will work, which makes life a little easier instead of making the board with through-hole components. I think next will still be to get both of the MOSFETs together onto an SOT23-6 package so it can limit some of the board space as well - if anyone can solder the PIC18 or ATMEGA168 to the board, then a SOT23-6 shouldn't be any worse.

My next move is probably going to be to see if I can design both the Arduino board with the same fix as the PIC board and give hobbyists an option between the two. To me, it seems like either processor works well and should have no bearing on the final product - but for experimentation sake and builders' preference I am hoping to update both.

I enjoy bringing this project back to life, considering Metcal and Hakko stations are STILL outside "hobbyist" price range... and all things willing if I can get enough bugs sorted out I would love to see this become a "finalized" hardware spec with the software being community-fixed via GitHub (which I will be setting up this week as well).

Report to moderator Logged

The following users thanked this post: Free_WiFi

NavyBOFH

Contributor

Posts: 32
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #468 on:** August 05, 2017, 12:37:56 am » Say Thanks Reply Quote

Quote from: Free_WiFi on August 05, 2017, 12:00:22 am

> **Quote from: NavyBOFH on July 31, 2017, 08:11:30 pm**
>
> > My next move is probably going to be to see if I can design both the Arduino board with the same fix as the PIC board and give hobbyists an option between the two. To me, it seems like either processor works well and should have no bearing on the final product - but for experimentation sake and builders' preference I am hoping to update both.
>
> In my personal opinion this seems to be pretty useless ,because i think the rf-stage has more priority for now.
> For example :
> You can check what you can tweak or optimize on the rf-stage to make it less hot,you can optimize swr parameters etc, etc, etc ..... so basically leave for now the work on mcu's to later
>
> Just my personal opinion .

I'd love any input on the RF stage. I plan on checking output power and SWR at some stage but it seems from previous posts that the system was decently SWR matched when it was designed. The IRF510 seems to run hot too but I can't find anything in that range that works any better without going up to another design.

Sent from my iPhone using Tapatalk

Report to moderator Logged

NavyBOFH

Contributor

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #469 on:** August 05, 2017, 03:02:11 pm » Say Thanks Reply Quote

Posts: 32
Country:

Further update: some messages and suggestions are that the IRF510 is not sufficient to drive the RF stage of the project and have been seeing either excessive heat and/or failures. I had to spend some time digging around to see that Metcal themselves (and not sure how Hakko or other "clones" engineered theirs) used an IRF640N for the driver and the IRF530 as the power amplifier.

The first suggestion I was given was to change the IRF510 to a IRF530 which can seemingly work and is rated for double the thermal dissipation the IRF510 offers. This sounds like the most interesting experiment to me since the design of the two is similar with slight changes in the characteristics of the MOSFET's input resistance and capacitance which would have to be double-checked through the actual MOSFET driver and circuit. Since this is where my experience is lacking, I would hope someone on here would know better how to go through this process versus a "trial and error" method I would end up going through. However, it is compelling to try since the IRF510's thermal dissipation is 43w while the 530's is 88w - that alone should lend to a cooler running and more efficient circuit - I would much rather run a MOSFET at 75% of its rated output than another at 100-105% output.

The other option was an IRF540 but that seems like too big of a step up and a complete re-design of the RF stage. It's thermal dissipation and power handling is up at 120w but has radically different characteristics to the FET itself.

I would love input on this... since my option at this point is to produce some boards with the over voltage fix and see what improvement can be made through trial and error which is hard to do on a hobbyist budget lol.

Report to moderator Logged

The following users thanked this post: Free_WiFi

richard.cs
Frequent Contributor
Posts: 662
Country:
Electronics engineer from Southampton, UK.

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #470 on:** August 05, 2017, 06:08:50 pm »
Say Thanks Reply Quote

Datasheets for convinience:

IRF510: https://www.vishay.com/docs/91015/sihf510.pdf

IRF530: https://www.vishay.com/docs/91019/91019.pdf

I haven't looked properly but I notice that the IRF530 has 3x more gate charge and all the switching parameters are slower. This is expected given you get the improved thermal performance by having a bigger die. It may well be a suitable MOSFET but I wouldn't just throw it in without re-examining the gate drive and testing on a prototype. If you unintentionally slow the switching then you will increase dissipation and it may very well run hotter despite the factor of two in $R_{th}JC$. Essentially the real figure to consider for thermal performance is the change in sum $R_{th}JC+R_{th}interface+R_{th}heatsink$ which is around a change of 6.5 C/W to 5 C/W with the 100x100mm heatsink and a greased mica insulator. Don't pay too much attention to the headline power figures in the datasheet, they're not really representative of real-world use (as in you can't usually get anywhere close).

I suspect the MOSFET-killing on switch-off relates unintended linear operation dissipating hundreds of Watts for milliseconds and taking it outside it's safe operating area. That should be fixed by the undervoltage lockout circuit.

I personally wouldn't change it, mine seems pretty robust and thermal performance seems sufficient with the 100x100mm heatsink everyone else has used. During testing I had it running continuously into a 50 Ohm load (equivalent of a cold tip that never warms up) for about half an hour and the MOSFET was only warm - maybe 40-50C.

If you do want to change it the datasheets offer hints but as they're not really specified for use as an RF power amplifier you will probably have to do it by experiment. I would stay away from the IRF540, as a minimum you would need to seriously beef up the gate drive (9x more charge needed, so 9x the current to do it in the same time), but the rise and fall times might still catch you out. Paralleled smaller MOSFETs might be simpler.

Report to moderator Logged

NavyBOFH
Contributor
Posts: 32
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #471 on:** August 05, 2017, 07:13:45 pm »
Say Thanks Reply Quote

Quote from: richard.cs on August 05, 2017, 06:08:50 pm

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You essentially read my mind on the issue. I think your protection circuit would fix most of the issues people were complaining about. At that point it would also be down to whoever used the Arduino vs PIC boards since I have a feeling there might be differences in how the controller handled heating and ramping down. My thought was the same as yours that at that point if there's still issues with the MOSFETs that having an IRF510 and an IRF9510 in push-pull configuration would probably be the way to handle that issue. I'm more inclined to test boards with your circuit and see if/when a failure occurs. I am pretty sure with my line of work if I passed around the unit to several of my coworkers they'll kill it in short time if given the opportunity for a failure to occur.

As for the 100x100 heatsink - part of my thought is (once validating everything in the two-board configuration), was to see if I could get everything stuffed into a 100x150 board or even smaller, with the ability to then add your input protection circuit and feed the entire setup off an external DC brick instead of stuffing a transformer inside the unit - like you ended up doing.

Have you continued working with your unit? It would be nice to have a long-term review of the setup since it seems most other people that made one have disappeared!

Report to moderator Logged

richard.cs
Frequent Contributor
Posts: 662
Country:
Electronics engineer from Southampton, UK.

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #472 on:** August 05, 2017, 07:35:30 pm » Say Thanks Reply Quote

All I can really say is that I use mine fairly regulary and I haven't blown it up yet. I haven't looked at the mosfet failure in detail and it's not happened to so I'm really just speculating about the cause. I have even misused it as a 13 MHz source for immunity testing with no harm done.

The only bug it has is sometimes the power metering seems off, reporting that it's finished heating before it really has, etc. It may be a software bug but probably I should find time to tweak the thresholds which Chris has made configurable from the UI before I complain about it.

What I haven't done is tried a wide selection of tips.

Report to moderator Logged

NavyBOFH
Contributor
Posts: 32
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #473 on:** August 05, 2017, 08:48:04 pm » Say Thanks Reply Quote

Quote from: richard.cs on August 05, 2017, 07:35:30 pm

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>
> What I haven't done is tried a wide selection of tips.

Luckily my workplace has a decent assortment of tips and a spare handle that I can use - though I'm tempted to buy a Hakko handle and stand to try out, and play with an assortment of tips to get the "best value" for the controller.

I'm glad yours has been standing up to the use! That to me says your over voltage fix has been the key part that was missing and these boards I eventually get made should be the "version 1.0" boards finally!

I sent you a PM regarding some component values on the controller board, once I get all that filled in I am going to try a prettier version of the over voltage circuit on the board, post the files/gerbers/BOM, and see if we can get a working setup!

Report to moderator Logged

NavyBOFH
Contributor
Posts: 32
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #474 on:** August 07, 2017, 02:24:39 pm » Say Thanks Reply Quote

Boards have been ordered! I ordered 10 sets which I will build one, keep one as a spare, and might have a friend interested in a set - which leaves 7-8 sets up for grabs when they come in! Anyone that is interested speak up!

I am thinking of doing what others did here and order the enamel wire and toroids for the inductors from the "preferred" source and sell the boards as "kits" with those hard-to-find pieces together. I don't know how much the toroids will cost, but right now I am assuming the boards plus toroids won't cost more than $10-15 (my cost), plus whatever shipping costs to you, which I will try my hardest to make it an inexpensive option!

I am also ordering up all the bits and pieces for my board and updating the BOM as I go - while all the parts are still the same, the example part numbers are to parts that have been marked obsolete so I am trying to find better options for them all. Right now DigiKey has all but 1 part in stock which I am sourcing a replacement.

Report to moderator Logged

The following users thanked this post: Free_WiFi

richard.cs
Frequent Contributor
Posts: 662
Country:
Electronics engineer from Southampton, UK.

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #475 on:** August 09, 2017, 11:46:52 am » Say Thanks Reply Quote

To me it's the power supply side that's most open to changes, if you're going to plan for an external DC supply (laptop brick or similar) then I suspect a little input protection and RF filtering may be in order.

A bigger step (which I remember a few people discussing earlier in the thread) would be to change the supply topology, perhaps making it buck-boost or SEPIC, so that it can operate from 12 V nominal (say 10-16 V) which makes it quite portable. I achieved the same thing in mine by using a separate boost converter, maybe the simplest approach there is to put an up-front boost onto the board in place of the 50 Hz rectifiers and smoothing. Mine now works off mains or on DC from 10 V to 32 V.

Report to moderator Logged

Monkeh
Super Contributor
Posts: 5894
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #476 on:** August 09, 2017, 03:10:38 pm » Say Thanks Reply Quote

Quote from: Free_WiFi on August 09, 2017, 03:03:51 pm

> **Just hope to this awesome broject be finalized as best as possible ,so everybody can use it without any fear and problems.**
> **I live in italy and to buy an real brand new metcal station i need to spend over 799 euros,because of 22% of taxes .**

And yet, they're actually only €560..

Or you could obtain a new Thermaltronics, for about €400, or a second hand Metcal, for as little as €150 with some patience..

« *Last Edit: August 09, 2017, 03:14:50 pm by Monkeh* »

Report to moderator Logged

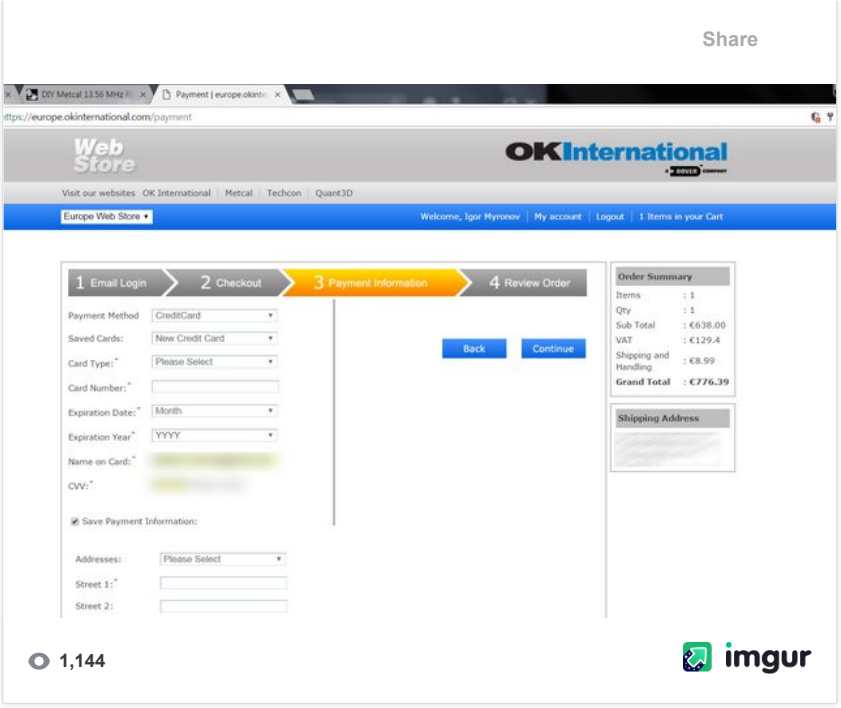
Monkeh
Super Contributor
Posts: 5894
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #477 on:** August 09, 2017, 03:20:37 pm » Say Thanks Reply Quote

Quote from: Free_WiFi on August 09, 2017, 03:17:12 pm

> and this is on the official webstore ,if i will go to another place the price will be higher .... so pleas shut down your ignorance.

Thanks



And this is Farnell Italy, where the price is lower: http://it.farnell.com/metcal/mx-500s/soldering-station-2-channel-40w/dp/2373305DM

Mind you, you haven't specified the package..

Report to moderator Logged

NavyBOFH
Contributor
Posts: 32
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #478 on:** August 09, 2017, 03:24:50 pm »

Say Thanks Reply Quote

Quote from: Monkeh on August 09, 2017, 03:10:38 pm

> And yet, they're actually only €560..
>
> Or you could obtain a new Thermaltronics, for about €400, or a second hand Metcal, for as little as €150 with some patience..

That isn't the reason for this project or why Chris spent the time on the initial design and firmware.

For one, almost every Metcal I've seen that's "cheap" is beat to snot and/or needing repairs of its own. Currently the only fully reverse engineered model is the initial MX-500 which doesn't have MCU control or display - which this has.

Next, the models you see are then $350-500 for a used model with still a closed-source schematic and design - and usually you still need to find a hand piece and stand.

Then, you come to this project. It's open-source, it works very well, and gives you the option of choosing whatever hand piece and tips you want to use that are RF induction. So you can choose Hakko, Metcal, Thermaltronics... etc.

I spent the money to have the first batch of revised boards printed. Assuming there were zero errors in the Gerbers, design, or manufacture, I still spent close to $60 just to try this myself. The fact I'll have spare boards to ship to others who want to donate shipping cost and a few dollars cash is a bonus to those that don't want to spend $60 when I can send a set of boards for $10-15. The total for parts to complete the boards? My DigiKey cart sits at $107 and the only things missing are the LCD and the rotary encoder for the board - and a case. Put all that together, with some patience, and even buying a brand new Hakko hand piece and stand... I made a complete, brand new, open source and community supported station for less than I can find a "good" used Metcal power supply.

The choice is yours in the end - but you came to the projects section to tell us that we are better off buying something used - not much in the spirit of projects.

Sent from my iPhone using Tapatalk

Report to moderator Logged

The following users thanked this post: Free_WiFi

NavyBOFH
Contributor
Posts: 32
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #479 on:** August 09, 2017, 03:32:25 pm »

Say Thanks Reply Quote

●●●○○ T-Mobile LTE VPN 11:27 AM 79%
ebay.com

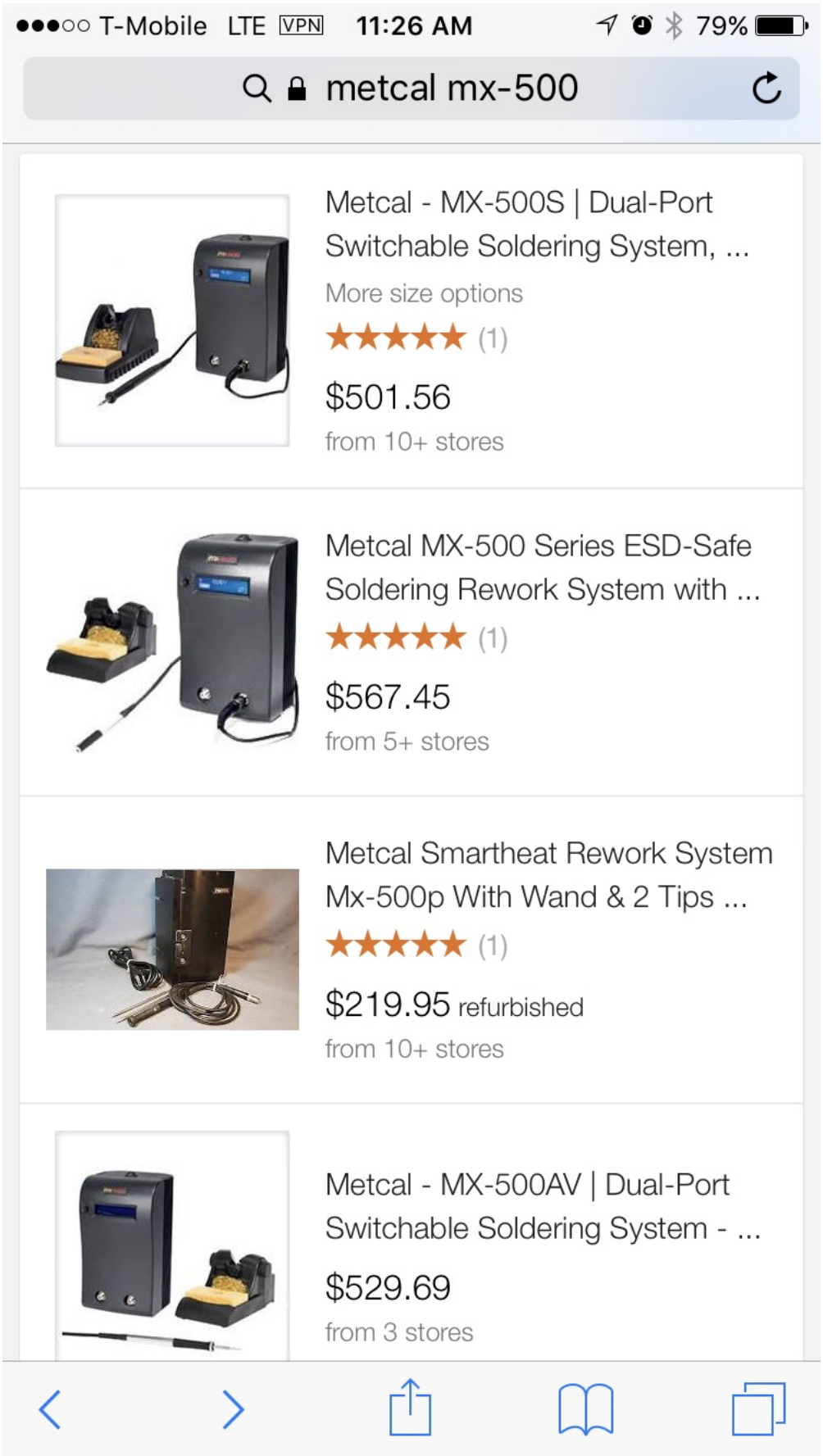
Metcal Smartheat Rework System MX-500P-11 Power Supply - Tested & Working Great
Pre-Owned · Metcal
$74.99
+$17.59 shipping
3 Watching

New Easybraid Shp-1 , Replaces Metcal Mx-Rm3E Or Mx-H1-Av Mx500 Mx5000
Brand New
$77.00
or Best Offer
FAST 'N FREE
2 Watching

METCAL MX-500P-11 SMARTHEAT REWORK SYSTEM
Pre-Owned · Metcal
★★★★★ (7)
$108.00
FAST 'N FREE

Metcal MX-500P-11 soldering iron
Pre-Owned · Metcal
$71.17
0 bids · 6d 18h
Buy It Now
+$31.70 shipping

These are your "cheap" models I mentioned. Not microprocessor controlled, not firmware updatable, and many come with questionable reliability and background.



These are my options for new. In US Dollars. And they are the base model with hand piece, no tips, and "on sale". The project even with me considering the full cost to PCBs is still going to cost me $250 less. That's a LOT of tips and maybe even a spare handle or some tweezers.

Now - let's get back on track about the project and not about the trolling of what's considered a useful project to someone or not. Again, you came to the project section to pretty much say "why bother?". Good for you. Point noted. Now we will continue with the project just like you can continue browsing

other topics since this is your "sore spot".

Sent from my iPhone using Tapatalk

Report to moderator Logged

Monkeh
Super Contributor
Posts: 5894
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #480 on:** August 09, 2017, 03:36:06 pm »
Say Thanks Reply Quote

Quote from: NavyBOFH on August 09, 2017, 03:24:50 pm

Quote from: Monkeh on August 09, 2017, 03:10:38 pm

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I'm aware of that, but I'm not attacking this project - only his whining about the price of buying one.

Quote

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Which are all interchangable on the existing stations anyway.

Quote

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No, I came to counter the bold claim of a member who I'm pretty sure has been banned twice that it's impossible to get a Metcal for under €800.

I actually really like this project, and I'd love to see a nice, portable 12V version I could use on the move. Not here to knock, I've been watching this thread for a while now to see how it goes. You'll note that nowhere have I said it's a bad idea and that you should just buy a second hand one - I simply said that you don't have to pay that much for a new station, let alone a used one.

ps. my Metcal predates the 'initial' MX-500 by over a decade and it's not the first model - it cost about $100 and had no damage but some corrosion on the stand - add in a transformer for a proper supply voltage (off the shelf part still!) and some tips, and I have a very nice station (which needs no display or MCU - not that those are bad). I just had to make room in the suitcase..

Quote from: Free_WiFi on August 09, 2017, 03:27:59 pm

Lol if you really think that also this package is really affordable ,then pls send me € 460,85 to my paypal and i will be happy

I think considering you get the power supply, iron, and stand, it's not an awful price for a brand new, warrantied product. I also think **it's less than the €799+ you claim you must pay to get a Metcal**.

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Stop putting words in my mouth, please. Again, like this project, watching closely. I'd chip in on it but I do not have the funds and spare parts to play with it.

« Last Edit: August 09, 2017, 03:38:31 pm by Monkeh »

Report to moderator Logged

NavyBOFH

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #481 on:** August 09, 2017, 03:43:06 pm »
Say Thanks Reply Quote

Contributor

Posts: 32
Country:

Quote from: Monkeh on August 09, 2017, 03:36:06 pm

Quote from: NavyBOFH on August 09, 2017, 03:24:50 pm

Quote from: Monkeh on August 09, 2017, 03:10:38 pm

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Stop putting words in my mouth, please. Again, like this project, watching closely.

Thank you for clarifying. My intention was not to attack just to defend open source hardware like all projects on this site. I work on closed source hardware for a living and spend my days trying to fix things that aren't supported anymore but also no schematics available or replacements are too expensive. Broadcasting equipment is planned to be obsolete quickly and leave engineers suffering. And that's my work. So these projects are a breath of fresh air and I am a strong supporter of open source.

The MX-500 is the first Metcal I've ever touched and we have 4 of them at our stations to do repairs. We also have some Hakko and Weller stations for basic work, and one Pace MBT250 that hasn't died no matter if lightning hits it. I enjoy these pieces of equipment but I cannot afford to put a "new model" Metcal in my house - and I know others would rather work on this project than buy a used station as well which is where my "defensiveness" takes place.

As for the planned future - I too would like to find a way to make it more portable, efficient, cool running, and accepting of more power sources. I work throughout the state and cannot take a full station with me so my end goal is to make a bench quality system as portable as possible so I can still have it in my trunk with the tons of parts and test equipment I need as well.

Just another day getting ready to use one here lol

Sent from my iPhone using Tapatalk

Report to moderator Logged

Monkeh
Super Contributor
Posts: 5894
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #482 on:** August 09, 2017, 05:06:51 pm »

Say Thanks Reply Quote

Quote from: NavyBOFH on August 09, 2017, 03:43:06 pm

> Just another day getting ready to use one here lol

Are the strain reliefs on the handpieces still taking a 'set' from sitting like that? Mine's never coming out.. but it's been in there for 20 years.

Quote from: Free_WiFi on August 09, 2017, 04:34:53 pm

> **Quote from: Monkeh on August 09, 2017, 03:36:06 pm**

> No, I came to counter the bold claim of a member who I'm pretty sure has been banned twice that it's impossible to get a Metcal for under €800.
>
> Are you just pretty sure or you have some kind of proof ?

Nope! Not that it matters to you:

> **Quote**
>
> And yes ,here in Italy it's impossible to get a Metcal for under €800

As I proved that it is possible, and you ignored it.

« *Last Edit: August 09, 2017, 05:08:37 pm by Monkeh* »

Report to moderator Logged

NavyBOFH
Contributor
Posts: 32
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #483 on:** August 09, 2017, 05:11:05 pm »

Say Thanks Reply Quote

These Metcal stations are only 2 years old but the cables and strain reliefs still flex like they are new. I hope they stay that way because I can't stand stiff cords or strain reliefs!

Sent from my iPhone using Tapatalk

Report to moderator Logged

Simon
Global Moderator
Posts: 13571
Country:
Did that just blow up? No? might work after all !!

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #484 on:** October 22, 2017, 02:08:46 pm »

Say Thanks Reply Quote

> **Quote from: Free_WiFi on August 09, 2017, 05:29:30 pm**
>
> > **Quote from: Monkeh on August 09, 2017, 05:06:51 pm**
> >
> > > **Quote from: NavyBOFH on August 09, 2017, 03:43:06 pm**
> > >
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> > > **Quote from: Free_WiFi on August 09, 2017, 04:34:53 pm**
> > >
> > > > **Quote from: Monkeh on August 09, 2017, 03:36:06 pm**
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> > > **Quote**
> > >
> > > And yes ,here in Italy it's impossible to get a Metcal for under €800
> >
> > As I proved that it is possible, and you ignored it.
>
> You are such a dumb-ass,you didn't yet realize that also 400,00 euros are very expensive here in Italy .....
> Also if i could get an complete metcal system (1tip,handpiece,stand,power supply) for 600,00 euros it would be always too much expensive with the average salary of 1200.00 shekels..... think about that Monkeh.

So you are aguing about €800 and now you are disproved you decide your argusing about €400? I know things in italy are hard but there is no need to be abusive, if your on 1200€ maybe I should come back! try living in the UK

Logged

https://www.simonselectronics.co.uk/shop
Varied stock of test instruments and components including EEVblog gear and Wurth Elektronik Books.
Also, if you want to get ripped off: https://www.ebay.co.uk/usr/simons_electronics?_trksid=p2047675.l2559

Neganur
Supporter

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #485 on:** October 22, 2017, 08:02:59 pm »

Say Thanks Reply Quote

Posts: 1114
Country:

Actually, I sold an MX500 station for 80 EUR here, it is definitely not impossible to get them.
The only problem is they are bloody heavy and so shipping can be really expensive (from Finland anyway).

https://www.eevblog.com/forum/buysellwanted/fs-(eu)-metcal-mx500p-solder-station-power-supply/msg1067739/#msg1067739

Report to moderator Logged

Nuno_pt
Frequent Contributor
Posts: 373
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #486 on:** October 23, 2017, 10:31:27 am » Say Thanks Reply Quote

I don't know what is the problem, I recently have bought an MX500p for 100€ shipped from UK, and around 130€ for the sleep stand and RM3 iron, plus a bunch of tips from Israel.

With maybe 200€ I put up a good soldering system, and by the way the average salary in Portugal are around 750€, the minimum salary here is 575€ month.

Report to moderator Logged

Nuno
CT2IRY

NavyBOFH
Contributor
Posts: 32
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #487 on:** November 22, 2017, 03:08:43 am » Say Thanks Reply Quote

Quote from: Free_WiFi on November 21, 2017, 10:19:44 pm

> someone can explain me pls ,why i can't find the new pcb gerber from mr. NavyBOFH ?

I apologize for falling off the map for a while. My health has declined pretty badly over the past handful of months and I have been struggling to catch up my health along with work, school, and personal life.

Long story short: The PCBs came in and looked good - not spectacular but good. I started ordering some components and left the PCBs and components in a box on my repair bench at work. I ended up out of work for the better part of a month - and when I came back the box had grown legs and I haven't seen it since... so I lost the PCBs and a good $350 of components I bought.

I will double-check my Google Drive, but I thought the PCB Gerber files were uploaded there and the link shared in this thread. I will double-check them and upload newer versions if necessary and link it here.

Report to moderator Logged

The following users thanked this post: Free_WiFi

CM800
Frequent Contributor

Posts: 880
Country: 00

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #488 on:** February 02, 2018, 05:31:16 pm » Say Thanks Reply Quote

Curious: How much do we know about how the soldering tips are designed?

How feasable would it be to make your own soldering tip from scratch.

Ignore the cost factor etc. Say this is for a different application no standard tip would do?

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Cerebus
Super Contributor

Posts: 3396
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #489 on:** February 02, 2018, 05:43:27 pm » Say Thanks Reply Quote

Quote from: CM800 on February 02, 2018, 05:31:16 pm

> Curious: How much do we know about how the soldering tips are designed?
>
> How feasable would it be to make your own soldering tip from scratch.
>
> Ignore the cost factor etc. Say this is for a different application no standard tip would do?

Dig back in the thread and you'll find references to the patents for the tips. Those should give you some idea.

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Anybody got a syringe I can use to squeeze the magic smoke back into this?

David Hess
Super Contributor
Posts: 9902
Country:
DavidH

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #490 on:** February 05, 2018, 03:57:41 pm »
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> **Quote from: Free_WiFi on February 05, 2018, 02:37:27 pm**
>
> Since the ordinary transistors like the IRF510 can't solve the common problems of this RF power supply,then,can we go with an dedicated Rf Fet like this?

An RF power MOSFET could be used but they are expensive and at only 13.56MHz, not required. Redesigning the circuit to use a more modern TO-220 part would be much easier and less expensive.

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SergeyMax
Newbie
Posts: 1
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #491 on:** February 10, 2018, 07:12:39 am »
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> **Quote from: Free_WiFi on February 05, 2018, 02:37:27 pm**
>
> Since the ordinary transistors like the IRF510 can't solve the common problems of this RF power supply,then,can we go with an dedicated Rf Fet like this?
> **SD1902**

RF fets usually have low Vds voltage, SD1902 has 65V only. It is too low for this application. I would recommend you to completely redesign output schematics to make two-stage output amplifier, as it was made in the original Metcal stations. They use such solution to avoid Vds overstress. For example, in the new MX5000 output transistor has 500V Vds! But of course it has very large input capacitance, so it can't be driven directly at 13,6 MHz by the tiny standard driver.

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The following users thanked this post: Free_WiFi

affinekinetic
Newbie
Posts: 2
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #492 on:** March 19, 2018, 10:39:11 pm »
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> **Quote from: Free_WiFi on February 19, 2018, 07:16:55 pm**
>
> Mr.NavyBOFH,is also out from this project,he promised pcb gerber files ,but none yet.....

The Google Drive folder, posted by NavyBOFH in reply #473, includes Gerber files.

Which Gerber files are you missing?

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The following users thanked this post: Free_WiFi

mamalala
Supporter

Posts: 777
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #493 on:** March 31, 2018, 09:38:00 pm »
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Yikes, i almost forgot about all this. Damn real life and work stuff always getting in the way of the fun things

Anyways, to (re-)clarify a few things:

- I'm not an RF engineer. It all was mostly trial-and-error, as well as simulations. So there sure is some room for improvement in that section.

- I never spent much time figuring out why the output FET dies sometimes for some people. It usually only happens when powering off the system. However, i found that not all IRF510's are the same. They vary between manufacturers.

- Yes, the RF stage isn't incredibly powerfull, using large Talon tips means slower heatup. However, it shouldn't be noticably slower than on a RFG-30 supply. At least it never was for me.

- The whole design was done to be as simple as possible, with mostly cheap off-the-shelf parts. Especially the driver chip is a big point that could be improved, i think. It just can't handle really large FET's. More powerful drivers usually have slower rise/fall times. I guess the only way to reliably get more power with a larger output FET would be to build a discrete driver stage instead of using a simple driver IC.

- This thing was never meant to be a "final" version of anything. It was just meant to get things started, to get to a usable stage, so that other can jump in and improve on that. As said, i'm not a RF guy, so i'm sure that a lot can be improved there.

- Yes, the cores in the RF transfomer and filters are important. Different manufacturers seem to have wildly different real-world parameters, although the spec sheets suggest otherwise. At least that is what i observed back then.

- The IRF510 is pretty much at it's limit in this application. However, i think it would be somewhat trivial to increase the power with a little re-design of the circuit. Right now the primary side of the RF transformer is single ended, since there is only one FET driving it. One could make that a "real" transformer with a center-tapped primary instead, the center at the +24V supply. Then just use a second driver chip and IRF510, connected to the second leg of the primary, and drive it with an inverted signal. Unless i'm thinking wrong, that should increase the overall power output. This would also mean that the main supply voltage to the RF stage can be a bit lower, decreasing the stress on the FETs. The following output filtering stages (caps and inductors) probably need some beefing-up then as well to handle the increased power. Using proper RF litz wire may be useful as well, instead of solid core copper wire.

- Regarding the RF transformer and filtering stages in general: Those were also mostly done by trial-and-error (again, because i'm not a RF guy). I tweaked things so that i got the most output power into a 50 ohms RF dummy load. That obviously does not mean that everything is tuned as good as it can. It's possible that at some point there is a big mismatch and/or power loss, just covered up by having a better tuning at a different stage. I simply lack the tools required to make useful meassurements when it comes to RF power and matching.

Having said that, it's something that someone else has to pick up. As far as i am concerned, i got that initial experiment to work, that is, to come up with something that works and is usable, and that others can take as a starting point for further development. Sorry that i couldn't solve the issue with the output FET sometimes blowing up when switching the unit off hard. Since i only ever encountered that when powering it off by switching off the supply, and never had that issue when first doing a soft "power off" through the user interface, i would guess that this could be fixed in firmware (or hardware).

Take a small recitifier, hook it up to the AC input. Or "isolate" the DC by a big diode before it goes into the smoothing caps. The idea is to get a voltage that goes away as soon as the input voltage is powered off, and not being held up by the filtering caps. Feed that though a resistor+zener combination to give a +5V signal. Put that into a free pin on the microcontroller. Then all thats left is to just hack the firmware so that it disables the driver as soon as that signal goes away (or use some logic gate to combine that with the RF_EN signal). The basic idea being that RF_EN gets de-asserted as soon as the input supply voltage is turned off, even though the input filtering caps are still charged.

Oh, and i won't be making any new batches of boards. If anyone wants boards for the current design, they have to get to Seed, iTead, or similar, and have a batch made for themselves, and then hand out the excess boards to whoever wants some.

Greetings,

Chris

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The following users thanked this post: 3roomlab, affinekinetic, Free_WiFi

CM800

Frequent Contributor

Posts: 880
Country: 00

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #494 on:** May 09, 2018, 11:41:48 am »

Say Thanks Reply Quote

Quote from: Free_WiFi on May 08, 2018, 11:15:03 pm

> Im selling my old Metcal Diy Pcb's board if you are interested ,then please write me in private
> Thanks you very much.

Are you still continuing this project or has this been abandoned now?

I'm really interested in seeing where this project could go.

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prusony

Newbie

Posts: 2
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #495 on:** May 16, 2018, 05:34:18 pm »

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Huge thanks to Christian for project!! HUGE!!
I bought PCB and started to do.
Thanks again from Belarus.)

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The following users thanked this post: 1707

prusony
Newbie
Posts: 2
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #496 on:** May 17, 2018, 08:58:43 pm »
Say Thanks Reply Quote

Quote from: Free_WiFi on May 17, 2018, 08:34:08 pm

Quote from: prusony on May 16, 2018, 05:34:18 pm

Huge thanks to Christian for project!! HUGE!!
I bought PCB and started to do.
Thanks again from Belarus.)

Привет JustNote

Привет! HI , Ciao !)

Report to moderator Logged

zmetzing
Contributor
Posts: 10
Country:

Re: DIY Metcal 13.56 MHz RF Supply
« **Reply #497 on:** January 03, 2019, 05:20:51 pm »
Say Thanks Reply Quote

Quote from: NavyBOFH on July 29, 2017, 06:59:22 pm

This is what I have come up with so far: I have zipped each functional section into its own ZIP. One is the RF board, which seems to be the latest as of June 2013. The BOM is from zoltan and seems to be what Chris references as the "best list" available.

https://drive.google.com/open?id=0B9MnfIuHNf_INFlZaEwzbXdwOGc

Are these still the definitive latest sources for this project?

Thanks!

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