Ideas @ Projects

for QRP

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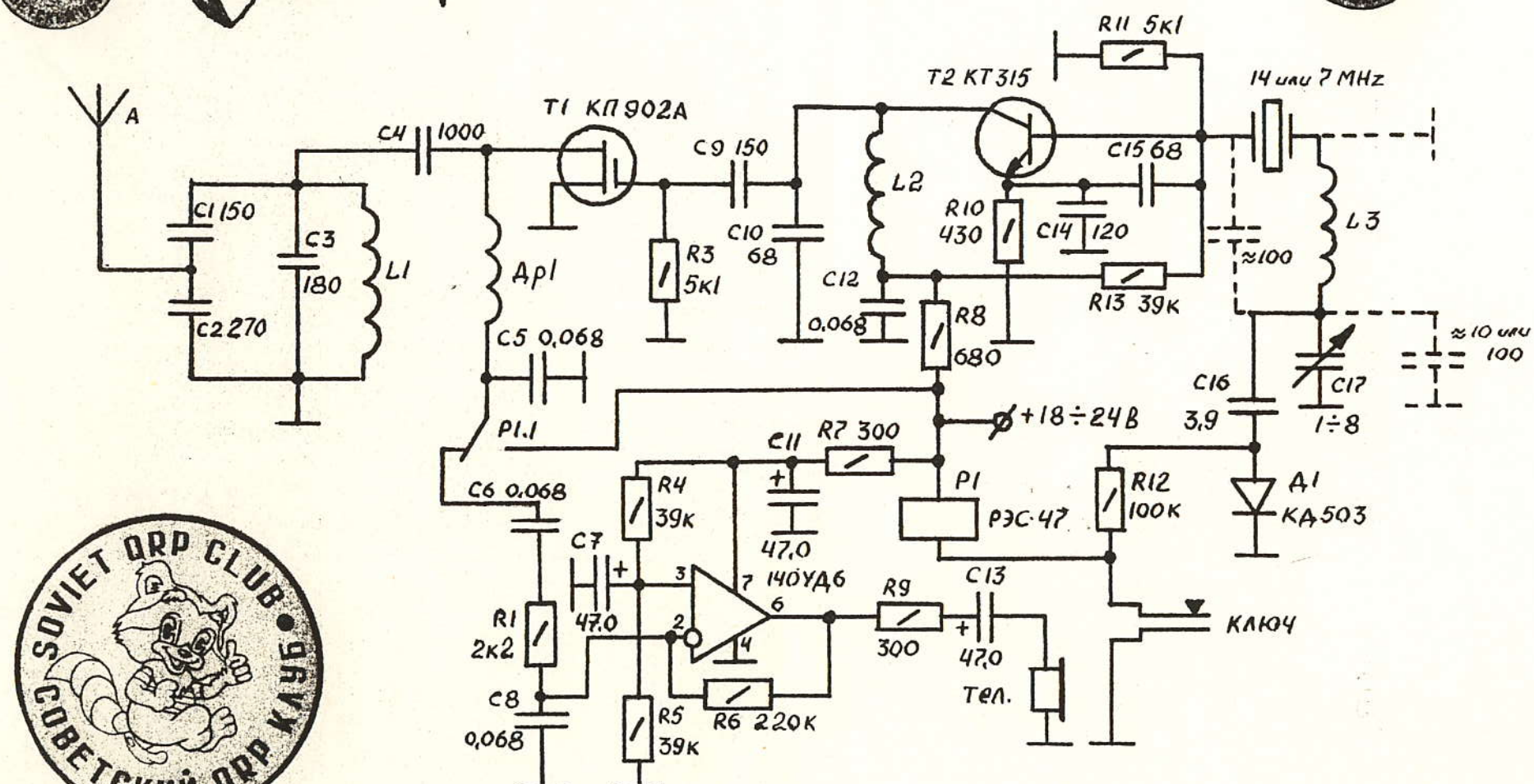


SOVIET QRP CLUB • СОВЕТСКИЙ QRP КЛУБ

A SIMPLE SSB TRANSCEIVER

Credit Line:

http://farhan.net.co.nr/

by Ashhar Farhan
computercorp@hotmail.com

A dual-band transceiver with a crisp receiver and a clean SSB signal is described. It started its life as an investigation of the excellent S7C receiver described in EMRFD. This transceiver was specifically designed to use components that are easily available in TV and Radio spares shops. The receiver sports an above average dynamic range, very clean signal and noiseless performance. Although the components are easily available, and every detail about making it is covered here, this is not a weekend project. The design is elaborate and invites improvisation.

We decided to pursue the following rules in designing this transceiver:

► Use what is easily available. Very often, we find designs that look good but they use exotic parts like TUF-1 mixers that are simply impossible to get hold of in India and other countries. Instead, we have tried using those spares that are universally available.

► Keep impedances and gain low: Often, we try coaxing maximum gain out of a stage making it difficult to duplicate and stabilize. We chose to take only modest gain out of each stage, using extensive feedback to make the circuit stable. Most of the interconnections between modules are for 50 ohms termination. In fact, the rig was a number of discrete board connected using RCA audio cables and sockets before we hooked it all up together to work.

► No PCB. We directly solder the components over a plain copper clad board (un-etched PCB). It is an excellent way to experiment, physically robust and has a quick and dirty appeal. You can usually solder up a whole circuit as you think it out in a few minutes. See the pictures.

► Broadband. We wanted to be able to use broadband design where applicable. We have found that the television balun cores are an excellent and very cheap (about Rs. 2 per balun, that is 5 cents) way of making broadband transformers.

► Modest cost. While we didn't want to use very expensive components. We didn't want to compromise the performance either. You will see that we have used 2N3866 exclusively. This was because we found that the BF195/BF194/2N2222 series transistors available in the market were consistently inferior in the HF range and performed below their stated specs. The 2N3866 is commonly used in cable TV equipment and has a good HF performance: both as a low noise small signal transistor as well as driver up to 1 watt level. 2N3866 is expensive (about Rs.20 each, but well worth the expense). It is used in a number of critical places.

► Measure what you have built. We used a 12 volt 1.5A power supply, a frequency counter, a test oscillator (to measure the crystals and coils) and a high impedance voltmeter with an RF probe to test and measure the design. All these test equipment were homemade. The transmitter design did require a PC-based oscilloscope. It helped us identify the spurs and harmonics using the in-built FFT functionality. But now that the design is complete, just an RF probe and a 14MHz receiver are enough to align the rig.

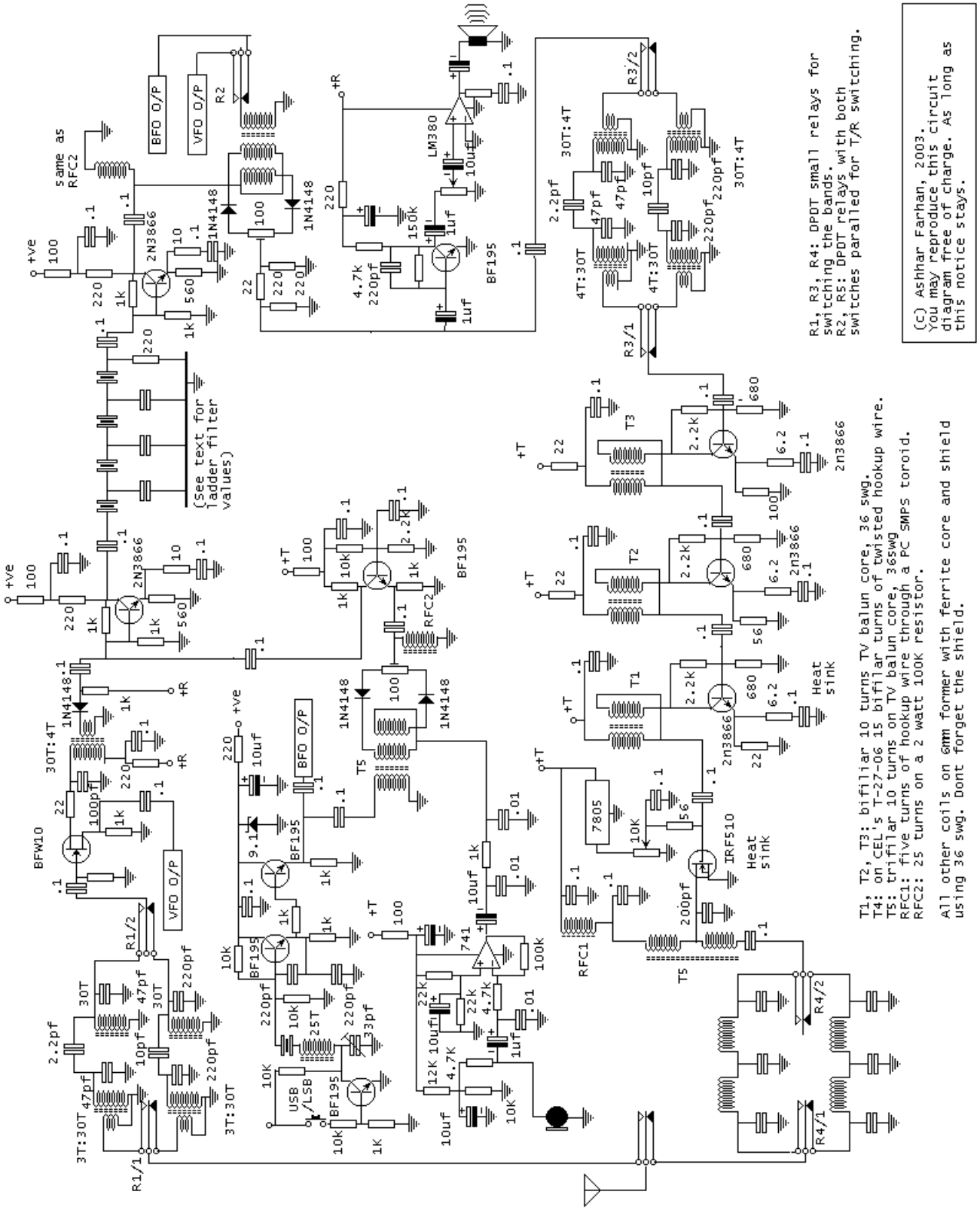
► Quality over quantity. A better signal is preferred to a bigger signal. This is a 6 watt design that will work off a simple 12V, 1.5A supply (using a single 7812).

The ladder crystal filter

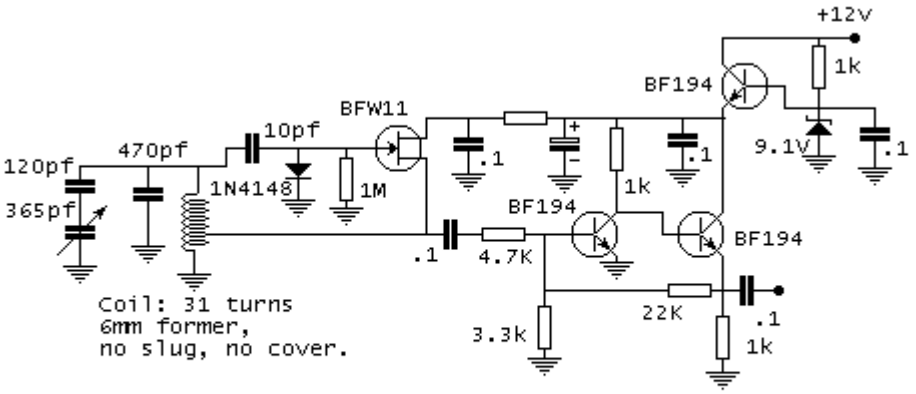
A good filter is central to the crispness of a receiver and the quality of the transmitter. There are two types of crystal filters possible, the lattice filter and the ladder filter. The lattice filter requires ordering crystals with 1.5 KHz frequency difference between them. This was ruled out, also procuring readymade filters from BEL India and other sources was ruled out as it is too expensive to do that. Instead, a ladder filter was chosen. The ladder filter offers results as good if not better than a lattice filter. However, the design is crucially dependent upon internal parameters of the crystals used. It is not possible to suggest any generic values for the capacitors to be used in the ladder filter. Rather, a method to measure each of the crystals and calculate the capacitor values has been worked out. We present this here. This design procedure will work only for 10 MHz crystals. 10Mhz is the chosen IF of our filter as the crystals are easily available and it sits comfortably between 7 and 14 MHz amateur bands. We have followed the Butterworth design methodology given in the new ARRL book 'Experimental Methods in RF Design'.

The circuit centers around a four crystal ladder filter. Each lot of crystals from each manufacturer differs from the others. We will describe a way to experimentally calculate the values of the capacitors for the filter. You should probably buy 10 crystals and select 5 of them.

Circuit of the transceiver



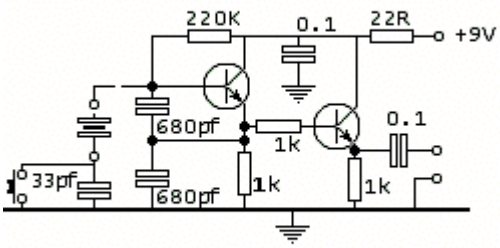
VFO of the transceiver



VFO: Use two identical VFOs using two sections of the broadcast gang, switch power suppy for each VFO. The 470Pf should be a polystrene or a 'Styroflex' cap. The 14 Mhz VFO tunes from 4 to 4.4Mzh.

For this purpose, construct the test circuit of **figure 1**. This is a simple Hartley-style crystal oscillator. You will require access to either a frequency counter or a general coverage receiver (ask a neighborhood ham to allow you to bring over your crystals to his shack and test them for few minutes). Mark each crystal with a number and solder it into the circuit (don't use a crystal socket). Connect the 9 volt battery and measure the frequency. If you are using a receiver, find out the frequency on which the crystal is absolutely zero. Note the frequencies with the 33 pf capacitor in series and shorted. You will have a pair of frequencies for each crystal. Select four crystals with pairs of frequencies that match within 50-40 Hz of each other. A fifth (for the carrier) oscillator crystal should be within 100 hz of the other four selected.

Fig1.
Test Oscillator for Fitler Design



Note: Don't use a switch across the 33 pf, use a small component lead to short the capacitor.

Calculate the value of the capacitors of **Fig.2** like this:

1. Calculate the average frequency shift of the four chosen crystals as F (in KHz).

2. C1 = 21 * F, C2 = 40 * F. Choose the nearest available fixed capacitor. If you can't find a fixed capacitor within 10% of this value, then parallel two capacitors to achieve the capacitance.

For instance, in the case of the first prototype, we measure an average of 5KHz of shift. Thus, the capacitors calculated were 107pf and 200pf. We used 100pf and two parallel 100pfs as a substitute for 200pf capacitors. These calculations are for 200 Ohms termination. For a complete discussion of this design method, you are referred to the excellent paper by Craver in the Communications Quarterly of 1993, Winter.

Broad-band design without Toroids

It was decided to use broad-band techniques where suitable and keep the circuit free of too many critically tuned circuits. We decided to investigate the TV baluns as cores for broadband transformers. The TV baluns as small ferrites as shown in the picture.

Almost all the broadband transformers are bifilar. Two (the modulator and the transmit mixer cum product detector) are trifilarly wound. They are simple to produce. Making a bifilar transformer:

► Take two lengths of 36 swg copper enameled wire.

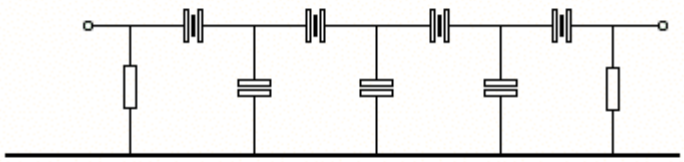
►Hold them together. Tie one end to a nail.

► Twist the wires together so that they cleanly have about 8-10 turns per inch.

► Check that the wires are evenly twisted (although there will be more twists towards the ends).

► If the balun core is mounted on a PCB, cut it out with a cutter and remove all the original windings.

Designing a 10Mhz SSB ladder filter.



Frequency shift in circuit of Fig 1 was 5KHz
C1, C3 = 5 * 21 = 105 pf
C2 = 5 * 40 = 200 pf.

We used 100 pf at c1, C3 and 200 pf at C2

► Pass the twisted pair through one hole to the other side, bend the wire back and pass it back through the other hole (like a U turn). This is one turn, like this, make similar 10 turns.

► Cut out the remaining ends of the windings leaving about half an inch of the twisted pair on each end.

► Scrap the enamel off to about quarter inch, and tin the leads.

► Using a VOM at low ohms setting, identify the two separate windings of the twisted pair. If we call the two wires X and Y, each will have two ends A and B. This you will have four ends AX, BX, AY and BY. Short AX and BY together and use this as the center point of the transformer in the circuits. Use AY and BX as the two opposite ends of the transformers.

Making a trifilar transformer is similar, except that you have to use three wires twisted together. Separate out the three wires as before, use the first two as described above, and the third winding as the secondary.

IF sub-system

The crystal filter and its associated IF circuitry is shared between the receiver and transmitter. Although the crystals are inexpensive enough to be able to afford separate filters for the transmitter and the receiver, we noted that each filter would have a different center frequency. This would make zero-tuning difficult for SSB operation. Therefore, it was decided to share the same crystal filter, carrier oscillator and the VFO between transmit and receive functions.

The crystal filter requires 200 ohms impedance matching at both ends to provide the correct bandwidth and low ripple. A regular practice among hams is to strap a resistor of approximately the same value as the terminating filter impedance across the input and output ends of the filter. This is incorrect. This looks like a resistor that is paralleled with a reactive impedance of the rest of the circuitry attached to the filter. When the crystal filter is not properly terminated and sees reactive termination, ripple and ringing are introduced. This will spoil the crispness of the receiver and spoil your on-the-air quality.

The crystal filter is terminated on both sides by ‘strong’ RC coupled amplifiers based on 2N3866. This is slightly unusual. The 2N3866 is used mostly as a VHF power amplifier. It has excellent low-noise characteristics, good gain and using it as a small signal device is now an established practice. The 2N3866 is an expensive transistor. It costs about Rs.20 in the open market. We think it is a good investment.

Using RC coupled broadband amplifiers makes the IF system a ‘no-tune’ affair. The output of the post-filter amplifier is coupled to a two diode mixer. The two-diode mixer uses a broadband bifilar wound transformer. It is next to impossible to get toroids in India. We have evaluated using TV baluns as substitutes for toroids. These baluns are available at most TV spare shops.

Most designs we have studied couple the RF input to the diode detector through the transformer and inject the BFO at the center of the transformer. This is a wrong practice. The diode mixer requires a minimum of 5mW of energy from the transformer input to operate properly. There should be enough energy to switch on both the diodes. This means about 1.2 v peak voltage. The received signals are rarely this level. As a result, the product detector operates like a regular envelope detector and the diodes act as distortion devices to mix the BFO with the signal. The correct configuration is to inject the BFO across the transformer

An unusual approach is taken here. The IF amplification gain is just enough to maintain good noise figure and recover the losses in the ladder filter. We measured almost 10 dB loss in the filter.

The Receiver

The receiver is minimal. By keeping the number of active devices low (3 devices between the antenna and the audio amplifier), very good fidelity is achieved. The circuit is kept at a low impedance and broadband everywhere except the front-end. This helps in stability.

The front-end uses a low-noise FET. We have used a BFW11 (because the local component shop ran out of BFW10). They have slightly different characteristics. Almost any FET can be used if it is biased properly. The FET should be biased for exactly half the pinch-off voltage. Wes Hayward (W7ZOI) has described the proper way to bias a FET Mixer for proper operation:

► Short gate and source and measure the current that flows through a 560 ohms resister connected to +12V through the drain. This gives the exact Idss.

► Place a 10K resistor between the source and the ground. Keeping the gate grounded and the drain still connected through the 560 ohms resister, measure the voltage between the source and the ground. This gives you the pinch-off voltage.

► The FET has to be biased such that the voltage on the source is exactly half the pinch-off voltage and there is half of Idss current flowing through the FET. Such a scheme assures you that the FET is driven between pinch-off and maximum drain by the VFO injected at the source. This gives the proper switching action for the mixer to operate as well as maximum gain. We measured the pinch-off voltage for BFW11s as 2.1 volts and Idss as 5mA. A standard 1K resistor at the source gives the proper bias.

It should be noted here that we first tried a double balanced diode ring mixer at the front-end. It has a number of spurious responses that literally made it impossible to use the receiver. We tried to properly terminate the diode ring mixer by inserting attenuators between the mixer and the Ladder filter's pre-amp. It didn't cure the problem. When we changed to the FET mixer, the noise figure improved, the receiver's dynamic range, while unmeasured, was never found lacking in the last one month of extensive usage at VU2PEP.

The output of the IF amplifier is detected in a balanced detector using just two diodes. Here gain, we break a common myth. You will see most of the HF receivers employing a two diode balanced detector with the BFO fed to the center tap and the incoming signal applied through the primary winding of the detector transformer. This is wrong. The signal applied through the primary winding should strong enough to switch the diodes on and off (requiring about 0.6 across each diode, that is, 1.2 volts across the winding). This roughly translates to about 5 mW power. The diodes switch the low level signal coupled at the center-tap of the coil to the detector output. Therefore, in our design we have applied the local oscillator through the primary of the transformer and the incoming signal from the IF stage to the center tap.

There is a 100 ohms preset used to null the local oscillator from appearing at the output. This is of importance during transmit where the balanced detector also doubles up as the transmitting mixer.
An audio pre-amplifier follows the detector. The capacitor of 220 pf between the base and the collector ensures that the 'hiss' is kept down. The audio amplifier used is an LM380. Almost any audio amplifier can be used. We have tried everything from the PC's ampli-speakers to a Sony amplifier to a TBA810 amplifier. We would recommend using a high fidelity, low cost amplifier like the TBA810 if you plan using a speaker. If most of your work is with headphones (to save your companion from the late night QRM), we recommend the LM386.

The Transmitter

The transmitter starts with the modulator using a 741. There is a three resistor network that biases the electret microphones. We use a Phillips 'walkman' style headphone with built-in microphone for our work. The electret microphone requires a bias that provides 5V as given by the circuit.

The balanced modulator also had two 22pf trimming capacitors for nulling the carrier. They were later found unnecessary (as long as both the diodes are purchased from the same roll) and removed. If you do find balance a bother, feel free to add a 22 pf trimmer to one side and a 10 pf fixed to the other side as indicated in the schematic.

The output of the balanced modulator is routed to the common IF amplifier through a buffer amplifier using a BF195. This serves to keep the carrier leak from the modulator out of the IF string during the reception mode.

The balanced detector of the receiver also doubles up as a mixer during transmit. It is important to balance out the VFO energy at the output by setting the 100 ohms trimmer properly. We noticed a 50mW residual out-of-band output from the transmitter when the VFO is unbalanced. The power chain is an interesting broad-band amplifier. You can use this in virtually any transmitter of up to 7 watts (and higher with more than 12 volts supply to the final stage). Three stages of broadband amplifiers feed an IRF510 PA. It is an interesting twist that the driver 2N3866 transistors cost more than the IRF510! The IRF510 should be biased for 80mA of standing current during transmit with the microphone disconnected (no modulation) and carrier nulled by the trimpot of the balanced modulator.

Construction

We heavily recommend constructing over pieces of un-etched PCBs. They are cheaply available everywhere. See the pictures as a guide to component layout. We recommend the following rules:

► Keep your leads short. Short connections are more important than components that are at right angles to each other. What might look neat to you might look unstable to the RF design.
► Keep the outputs and inputs isolated from each other. We have taken care to keep the high impedance points down to a minimum. But still, maintain design hygiene.
► Make one module at a time, test it completely, then move to the next one. Construct the transceiver in the following steps:
► Make the VFO. Check the RF output using an RF probe. Check the stability on a regular receiver or a frequency counter. With the tuning capacitor fully closed (the plates inside each other), set the trimmer so that the VF0 frequency is exactly 3.9995 MHz (keep 5 KHz margin at the band end)
► Make the BFO. Check the output on the RF probe.
► Calculate the ladder filter values and make the IF strip along with the audio preamplifier.
► Connect the BFO, VFO, IF strip and an external audio amplifier together. When you power on and attach a piece of 2-3 meter long wire to the input of the IF amplifier you should be able to hear the atmospheric noise. Tune the BFO coil by fully screwing the slug in and then slowly tuning it out until the IF noise sounds right (not too shrill and not too muffled).
► Wire up the receiver mixer, connect the VFO. Peak the mixer output and the RF input coils for maximum output. Then tune to a weak signal on the band and tune for the best signal. Be careful to tune for best quality of signal and not for maximum loudness. Take a break, spend a day or two listening to the band with your receiver. Nothing is more enjoyable than using a crisp receiver that you have homebrewed.
► Wire up the modulator. If you have an oscilloscope, you can check the modulation. The modulated output will be too low for you to be able to measure on the RF probe.
► Wire up the linear chain. DON'T solder the IRF510 yet.
► Put the transceiver in transmit mode. Whistle into the microphone and peak the transmit mixer output coils for about 6 volts peak RF voltage on the probe at the 56 ohms resistor where the gate of the IRF510 would be.
► Solder in the IRF510. ATTACH A DUMMY LOAD. We used four 220 ohms two watts resistors paralleled together.
► Keep the bias trimmer totally down towards zero. Attach VOM in series with point X in the power amplifier. Apply power in transmit mode and slow increase the bias until you have 80mA flowing through the IRF510.
► Connect the RF probe across the dummy load.
► As you whistle, You should get about 20-24volts of peak RF on the probe. When you pull out the microphone from the jack, the RF output should drop to complete zero. What if your transmitter is unstable?

- Don't curse your fate. All transmitters start out as unstable beasts. Relax.
- Start disconnecting power from the stages starting from final IRF510 and working backwards. When you have located the unstable stage, there are a number of things you can do to fix it.
- Try increasing the value of the 10 ohms resistor used in the emitter degeneration OR
- Strap a resistor of about 1K across the output transformer of the unstable stage to 'load' it.
- Move the linear amplifier away from the rest of the circuitry.
- Redo the board. This time spread the stages out. We guess that the linear chain should occupy about 6 inches of space, all laid out in one line.

Substitutions

The BF195 transistors can be substituted with any other HF transistor like 2N2222 etc. The 2N3866s are best not substituted. The circuit works with slight increase in the noise figure if BF195 or equivalents are used in place of 2N3866s in the IF stages. The output power on the transmitter absolutely needs the 2N3866s. Substituting them with other switching transistors didn't give good performance.

The IRF510 should not be substituted with any other transistor. The other IRFs, though rated higher, have higher input capacitance which makes them a bad choice for 14MHz operation.

The LM380/LM386 can be substituted with almost any other audio amplifier. Our first amplifier was Cambridge SoundWorks Sound System. If you turn down the bass, they are an excellent system for the shack. We have tried a TBA180, an LM386, an LM380 and even a glow-bug guitar amp. Feel free to experiment.

Final Notes

The first contact we made using this rig was DF6PW. He reported us 57. Within the first evening we had worked four continents. The rig is regularly used at VU2PEP. People are often surprised at how the transmitter quality is 'just like a commercial rig'. Many refused to believe that it is a seven watt rig.

72/73!

CHAPTER 7

QRP TX

80/40 meter CW Transmitter with 6BM8/ECL82

by Jan, SM5GNN

Credit Line:
http://www.algonet.se/~janax/ecl82bug.htm

This is my own variation of the triode/pentode family of glowbug transmitters. It features a Pierce oscillator which runs continously during transmit to avoid chirp. The PA is grid block keyed and since the negative is there, fixed bias. The bias setting is not critical, grid rectification will provide additional bias and form a sort of regulation network. The PA is biased into class C, adjust bias for about -24V at keydown, measured at the junction of the 3 resistors. Plate current should be around 35-40 mA when fully loaded, depending on crystal activity. Power output is 5 to 8W at 12W input which is a healty 66% efficiency (not counting the screen current) and a nice blue glow comes from the innards following the keying. My original plan was to use a Pi-L tank to meet the modern demand of spectral purity but with loaded Q higher than normal, not really needed in this power class. The idea with grid blocking was to enable me to use my keyer without any relay in between. It has a negative keying line with a 250V filledstate device behind.

When tuning up, mesh the loading condenser C2 fully and dip the plate with the tuning condenser C1, quickly! Plate current should dip down to around 20 mA. Unmesh tle loading condenser C2 until the current just stops rising or maximum 40 mA. Redip the plate. Repeat until the dip is shallow, a few mA. Do not tune for maximum output, the PA is not neutralized and will run beyond maximum tube ratings if this is done. If maximum output goes over 9W or loaded plate current over 40 mA, lower the plate supply or back off the grid condenser a little or mesh the loading condenser a little. The plate current should not exceed 40 mA fully loaded (ah, well, the tube is still available from Russia :^), maximum allowed cathode current is 50 mA for this tube. I have installed a 100 mA meter in the wire going to the plate of the PA. The glowbug is free from chirp and runs smooth. Keyline filtering seems to be unnecessary but check the envelope if you are driving a power amplifier with it. I have found that the grid condenser could be replaced with a 47 pF fixed for FT243 rocks and 15-22 pF for modern tin can rocks.

T/R switch? I use a rotating switch with 3 poles, one for switching the antenna, one for+300V on/off and one for the receiver mute. If you use a regenerative tube receiver, antenna switching isn't really necessary, use a separate short wire as RX antenna or couple lightly to the TX tank. The regen grid leak and coupling condenser should be adjusted for proper recovery between the code elements (full QSK) or perhaps between words. Only a simple rocker for the +300V is needed.

Spotting? Well, my Heath SB301 gives this away for free. Set the RX in receive mode and engage the T/R switch without keying. You will hear the triode oscillating in the receiver. Tune it in and reset the RX in standby mode again. Advantage, gridblock!

Sidetone? Many ideas here. I use my new keyer's sidetone. My previous keyer did not have sidetone, instead I used my TS-830 as a growler, he, he... Or use a small 50 mA lamp in series with the PA plate as a sidelight :-), at least at QRS speeds.

Circuit layout? Not very critical. Only one tuned element except the rock is present. As a starter, keep the triode circuit on one side of the tube socket and the PA section on the other. Use the middle stud on the tube socket as a common grounding point if there is one. Keep the rock at least 2 inches away from the tube envelope to avoid heating it. The schematic does not show the heater, ground one side and decouple the other side at the socket with a 0.01 ceramic condenser. Heater voltage is 6.3V. If it exceeds 6.6V when loaded by the tube, add series resistance until below for maximum tube life. My own is built in a aluminum cast box with all circuitry inside it except L1, C2 and the output choke. If you use loads other than 50 ohms, some fiddlin' with the tank may be called for. You can also replace the pi tank with a link coupled parallel tank. For data and pinout on the tube, see ECL82 tube data (http://www.algonet.se/~janax/secl82.htm)

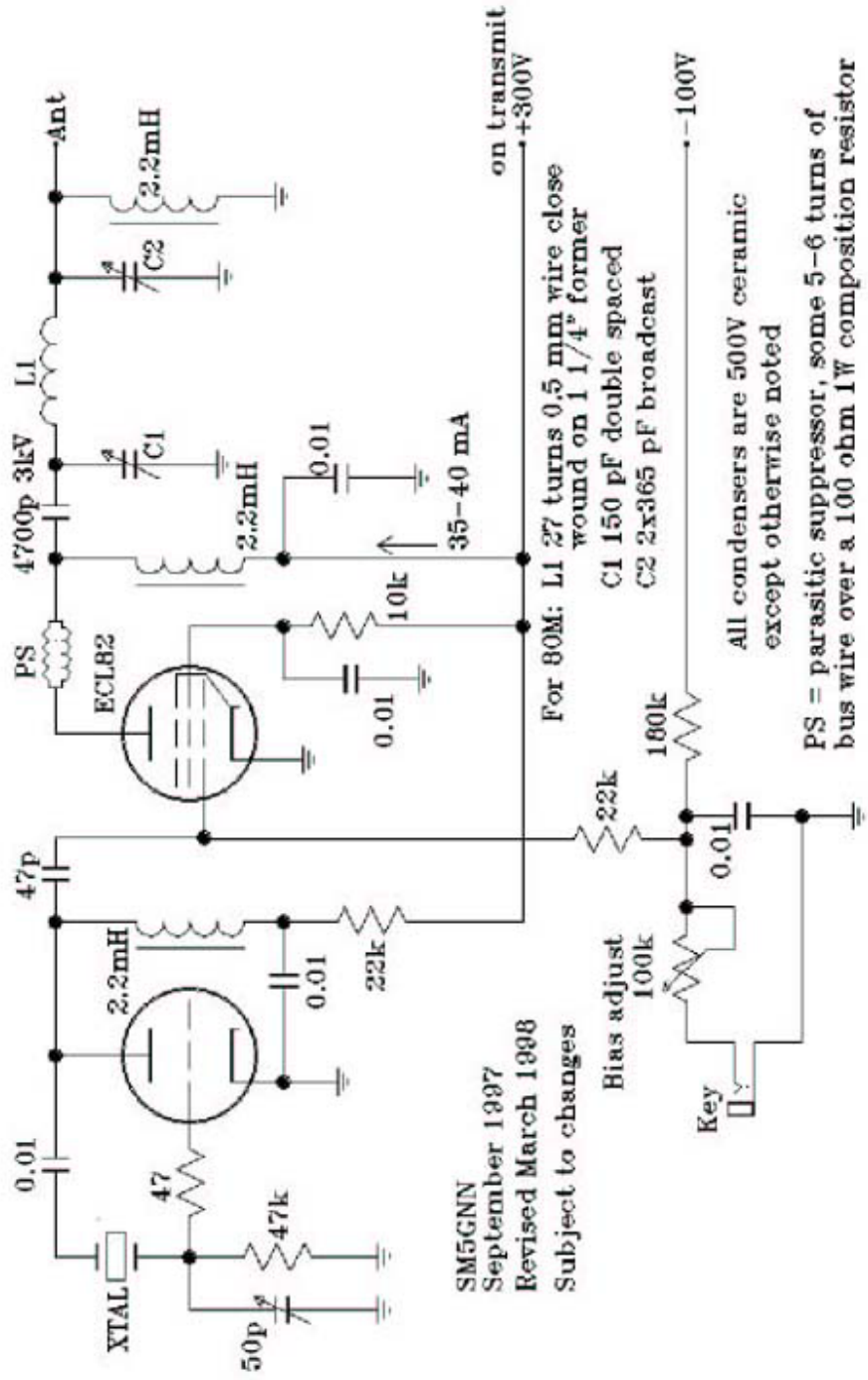
Running rock bound? Not easy. You call CQ. Don't wait on the rock QRG for others unless others knows about you. Sometimes you hear another station calling CQ near your rock QRG. Give him a try, he may hear you. It might be easier to use the QRP QRG 3560 kHz. In US, 3579 kHz is a common rock QRG. Use a 3579R545 kHz color burstie rubbed down a tad. In EU at night, most glowbugs seem to stay around 3560-3565 kHz.

AM? Well, I have not tried. You gotta reduce input power a lot. 2-3W carrier output would be appropiate. Feed plate and screen through a modulation iron of around 7-8 kohms secondary impedance. Avoid AM on 80M during dark hours in EU, there ain't room enuff.

A little warning: Lethal voltages are present in this circuit. Be careful. Do not omit the output-to-ground choke. The -100V present at the key is not dangerous if the resistor values in the schematics are used and are of adequate quality and voltage rating.

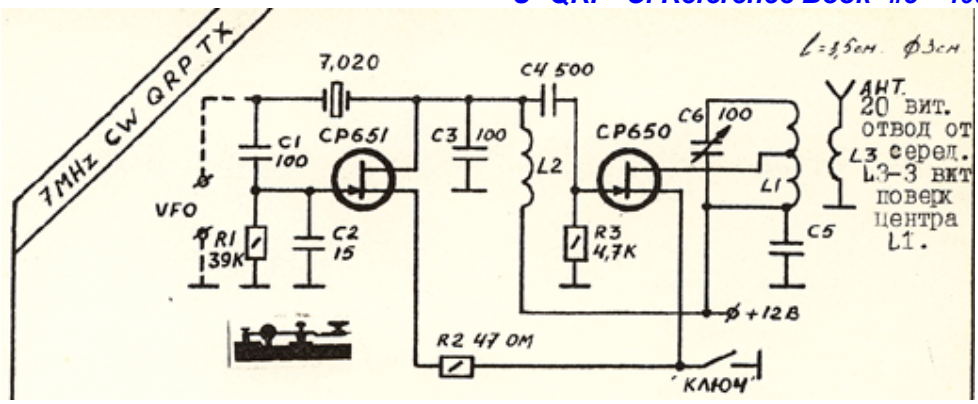
The circuit could use a 6GW8/ECL86 but the high mu triode section is a tad hard to tame. It requires less bias voltage. I'll try another glowbug with this tube but with a Colpitts oscillator instead. Stay tuned, I will make a 6GW8/ECL86 bug also, perhaps after I have finished the Eurobug (EL83+EL34).

This glowbug has been on air for some time now and the reports are good, no chirp and no clicks. "Very good sound" is the normal report.



Simple QRP TX for the 40 meters

Credit Line:
"U- QRP- C. Reference Book- #3" 1991 year.



At QRP rubric at Antentop 01- 2005 I use stuff from old Soviet QRP magazine published by the U- QRP- C at 1991. It was named "U- QRP- C. Reference Book- #3," you can see its cover at the right. The schematics, which were published there, are very interesting till now.

The simple QRP TX used two FETs was published at "U- QRP- C. Reference Book- #3," page 4. I have done the TX, it worked pretty well! I have tried it in several ways. Pair low power FETs (300 MHz, 300 mWt) did very good job, near 200- 300 mWts output without problem. I put in parallel up to 5 the same transistors (instead output transistor), it gives near 1 watts, the transistors were without a heat sink. Of course, goog results were obtained at first FET (300 mWt, 300 MHz), second MOS, 300 MHz, 3 watts. I have near 2 watts at 24 Volts.

If instead C2 you use a variable capacitor, you can use quartz for 3500 or 1750 kHz. Of course, the transmitter works good at another bands, for 30, 20, 15 and 10 meters, however, the power is dropped. At 80 and 160 meters the TX has good power and clean tone. I did experiments with the TX and RF- generator, I removed the quartz, and put output of the generator to clips 'VFO.' So, I have got very nice small TX, that worked very good.

Data: L1= L2: diameter 30 mm, winding length 35 55, 15 turns, L2 tap from middle, L3 3 turns above center L2.

I strongly recommend you try the simple TX.
73/72! I. G.

First page of the
"U- QRP- C. Reference Book- #3'

Figures of the TX are reproduced from "U- QRP- C. Reference Book- #3.'

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CHAPTER 8

QRP RX

A Regenerative Receiver with 6SN7GT

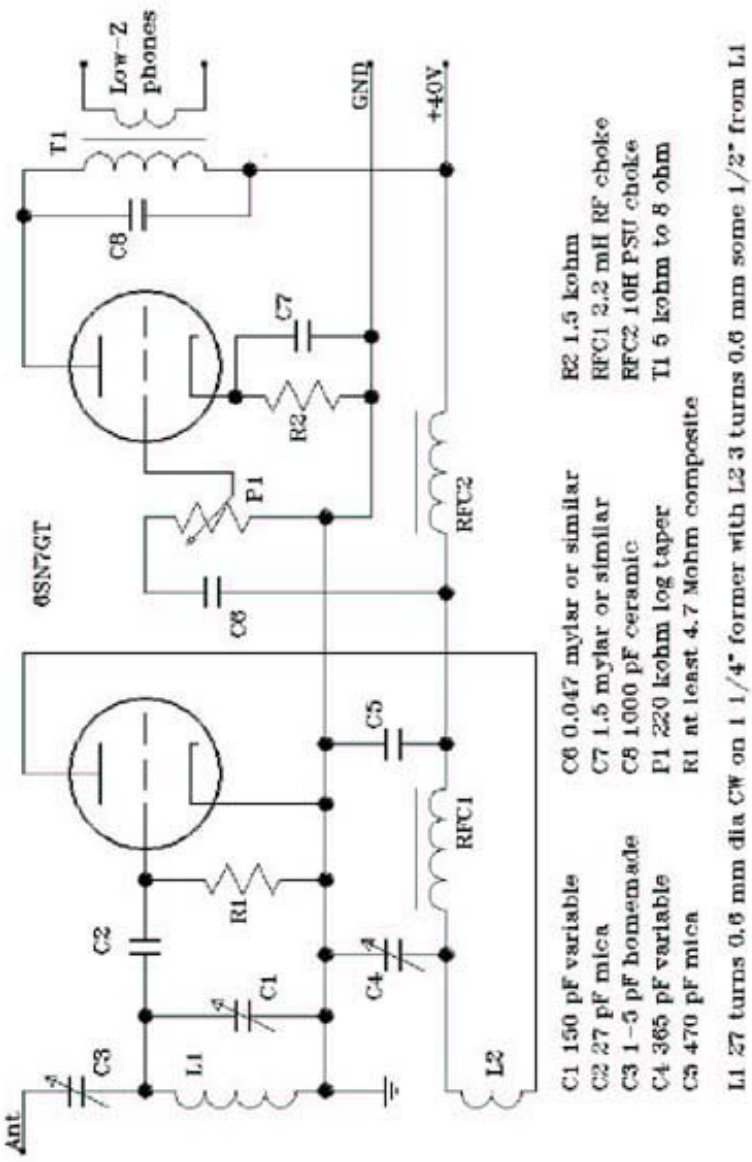
by Jan, SM5GNN

Credit Line:
http://www.algonet.se/~janax/myregen.htm

This is my October regenny as it looks right now. It works but more adjustements must be done before I'm happy with it. It's based on the 1950 ARRL handbook design. The original had plate voltage regeneration control but I found out quickly that the throttle condenser approach is the correct way to go. I did not have an interstage transformer so I took a small power supply choke instead.

I also added a volume control, at 40 plate volts, the output transformer into 16 ohms headphones, my ears nearly blew off.

First I heard nothing, then I got Deutsche Welle in on the 41 meter band. After that I found that I had the dummy load connected...

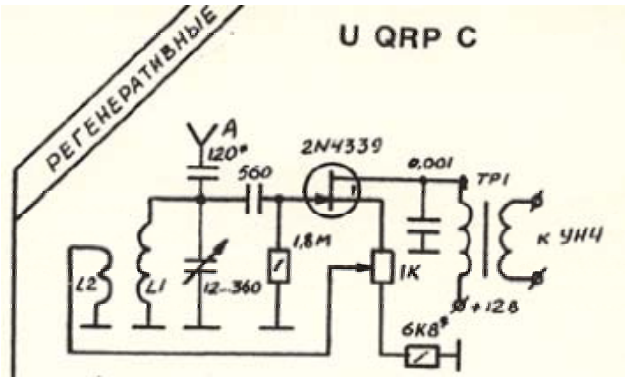


Simple Regenerative Receivers

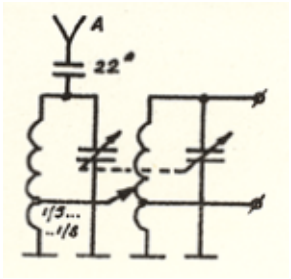
The simple regenerative receivers were published at "U- QRP- C. Reference Book- #3," page 6. I have done the receivers, they work pretty well!
73/72! I. G.

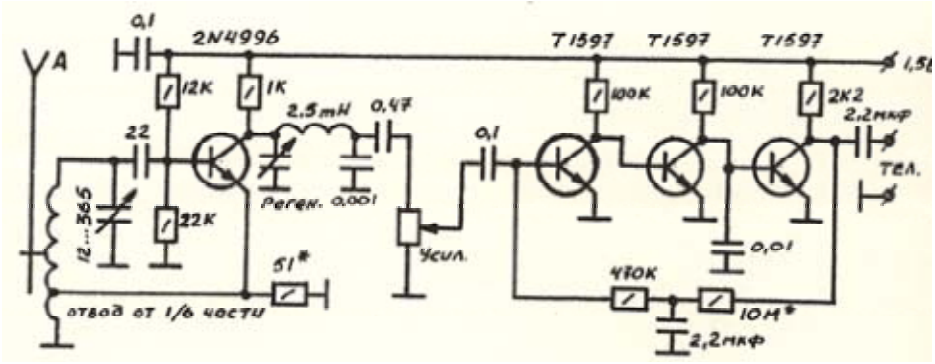
Credit Line:
"U- QRP- C. Reference Book- #3" 1991 year.

DATA:
Transistor can be any RF FET. Output transformer can be any output transformer from a transistor radio. L1 depends on used band. I used collections inductors wired at form diameter 20 mm with wiring length 25 mm. For 10- 20 meters, L1 contains 9 turns, L2 contains 2 turns near cold end L1. For 20- 40 meters L1 contains 15 turns, L2 contains 3 turns near cold end L1. For 80- 160 meters L1 contains 45 turns, L2 contains 10 turns near cold end L1. Antenna capacitor 120-pF may be 2- 120-pF in value.



Use the two- tank circuit at input clips of the receivers. It gives you cleaning from unwanted stations and provides your thin Air.





Data for L the same as for above receiver. Tap made from 1/6 parts of the L. Resistor on *51 Ohm should be pickup for used band (or, the same, used L). Inductor for 2.5 mH is home brew, it contains 200 turns onto a ferrite ring 20x12x4 mm, permeability 600. Transistor used in regenerative stage should be good RF transistor with f = 300 MHz, and gain =100 and more. Any audio transistors can be used in audio amplifier.

Hope, you will have fun with the receivers!
73! Igor, VA3ZNW

Figures of the receivers are reproduced from "U- QRP- C. Reference Book- #3.'

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CHAPTER 9

QRP PA

QRP PA for the 10 meters

The QRP PA was published at "U- QRP- C. Reference Book- #3," page 3. I have done the PA as well as for 10 meters as well as for others high (20-12 meters) amateurs bands. It works well! It gives near 1 watts to 50(75) Ohm load.
73/72! I. G.

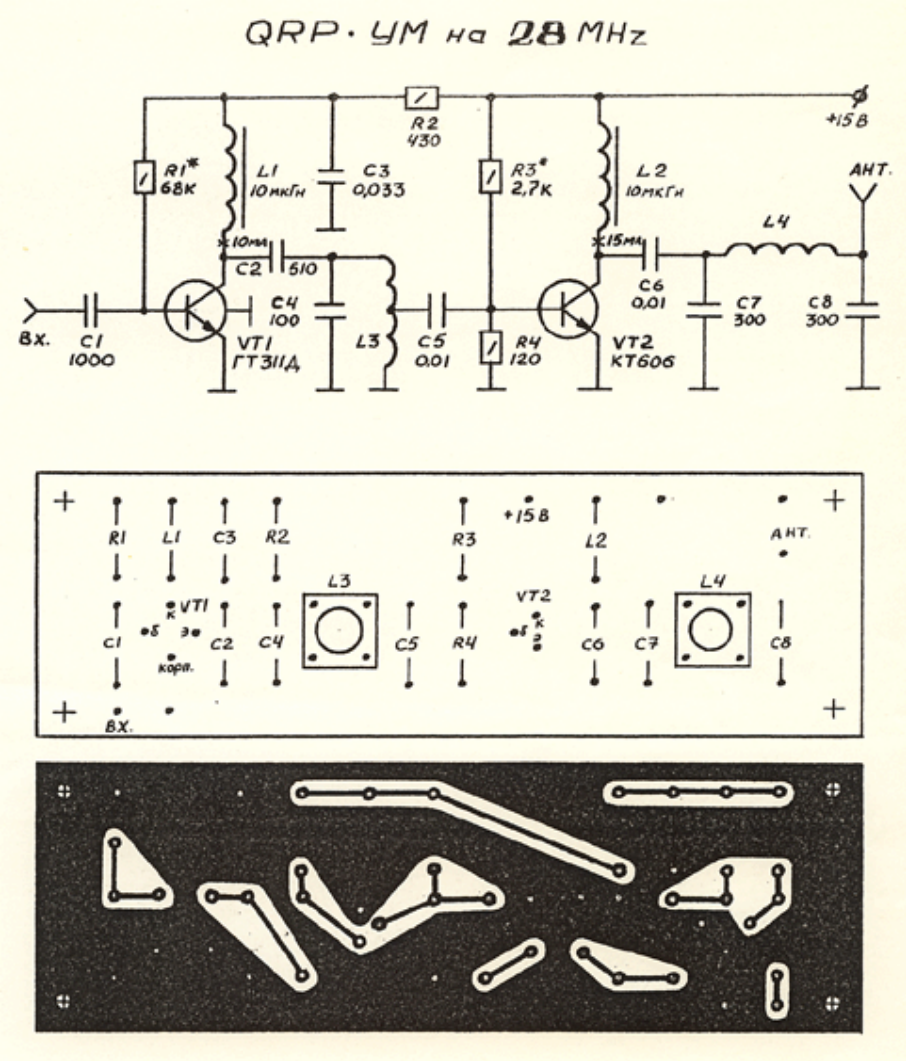
DATA (for 10 meters):

L1, L2- RFC, 10 micro Henry.
L3- 7 turns, wire diameter is 0.7 mm (21 AWG), form diameter is 7 mm (used old inductor from IF tract of tube TV, the inductor has a ferrite core), tap from 2 turn from cold end;
L4- 5 turns wire diameter is 0.7 mm (21 AWG), form diameter is 7 mm (used old inductor from IF tract of tube TV, the inductor has a ferrite core);
T1- f= 300 MHz, gain 100
T2- f= 600 MHz, gain 50, 3 watts output. Need be installed at a small heat sink.

Figure PA is reproduced at "U- QRP- C. Reference Book- #3.'

Early 1991 the PA with some modifications was published at different References, one of them:

Polyakov V.T. : To the Ham about the DC Technique. Moscow, 1990.



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CHAPTER 10

KEYS for QRP

Keys for QRP- expeditions

by Igor Grigorov, RK3ZK

G-QRP-C # 6363

The two articles were published at SPRAT, the journal of the G- QRP – C # 114 and # 115 accordingly. However, I think, the keys will be interesting for all amateurs.

Telegraph key for a QRP-expedition

It is a problem what a key to use in a QRP-expedition, hand or electronic. An electronic key does not provide a good operation at a QRP-expedition for the following reason. At first, it need in an external feeding for it, at second, as rule an electronic key made on the CMOS (Complementary Metal Oxide Semiconductor) chips is undergo of dampness. From dampness it would leave out of operation in the most improper moment. A standard telegraph key, usual for routine radio amateur activity, is complicated in application in field conditions because the key should be reliably fixed to any fixed base. The matter is not always possible in a field QRP-expedition. Often expedition key is keeping in one hand (or even on a knee) and by other hand working on it. Certainly, it is very inconveniently for job in the ether and rate of transmission is very low in that case. My special self-made a hand telegraph key has no the defects. **Fig. 1** shows drawing for the key.

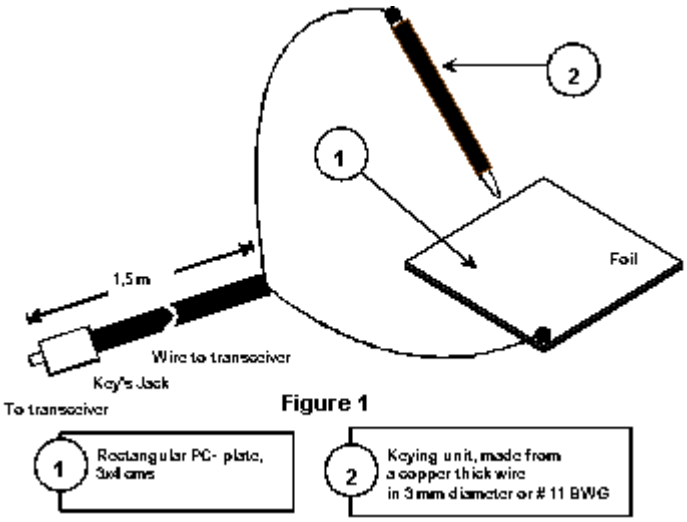


Figure 1

It consists of from a rectangular part of PC- board (item 1), which is connected to “ground” of a transceiver and a keying unit (item 2), made from a copper thick wire in 3 mm diameter or #11 BWG, or # 9 AWG.

At operating in the ether the rectangular part places in a hand, on a knee or on any fixed basis. The other arm does keying. Ever it is possible to paste this slice of PC – board with help of an adhesive tape to a transceiver case or to floor of a tent. This key was used at operation from any possible most inconvenient positions. For example, laying in a tent, and even laying in a sleeping bag. Certainly, the keying rate is not so high, up to 60 symbols per one minute. But it is quite sufficient for operation from a QRP expedition, where the high speed do not use usually.

Electronic keying for an electronic key

When I used an electronic telegraph key made on CMOS chips during my QRP- expedition, I found out that the key is very sensitive to dampness. Even when I covered a PC- board of the key by paraffin (it is possible easily to delete paraffin with the help of hot water and after that with petrol, if a repair is necessary), the failures in activity of the key continued.

Also I found out that small drops of water influenced on key operation, i.e. the drops covered contacts of the key’s manipulator and go to false operation.

Only reed relays (magnetically operated with hermetically sealed contacts) helped me to solve that problem and make reliable work of the electronic key in field operation.

Only reed relays (magnetically operated with hermetically sealed contacts) helped me to solve that problem and make reliable work of the electronic key in field operation.

The reed relays were placed on the PC- board of the automatic electronic key, near keying “dot” – “dash” chip. I used old reed relays, taken from burned old relay of a telephone station. **Fig. 1** shows the scheme of the unit. The PC- board of the automatic electronic key with the reed relays was covered with paraffin. Manipulator of the key was placed outside the key’s body. The reed relays had a self-made windings. Each winding contained several thousands turns, coiled by copper wire 0.1 mm in diameter or #36 BWG.

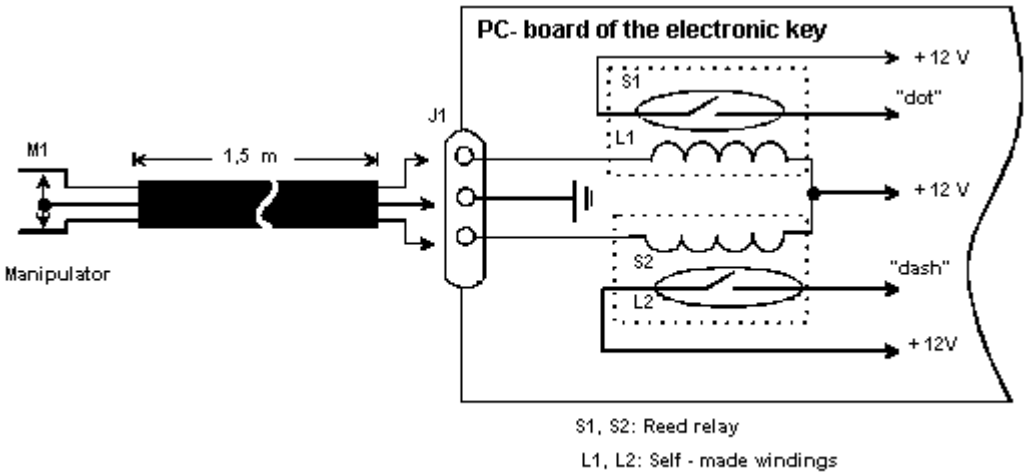


Figure 1

Winding of reed relay consumed current near 3- 4 mA at 12 volts of key power voltage. Such small current did not load much key battery.

The electronic telegraph key, consisted of such electronic keying unit and PC- board covered with paraffin, reliably works even while raining. Also the key was serviceable in the morning when both key PC-board and manipulator were covered with dew.

Home Made Key for FT- 817

Yuri Murashev, RX3AEW

Sorry for pictures' quality – they were taken by my cell-phone. The design of the key is simple, see **Figure 1**. Three copper areas are cut on a small PC-board. Two upper ones are for 'dot- dash,' rest below is 'ground.' Copper strips with thickness in 0.5 mm are soldered to each dot- dash area, a metal end from a glass fuse is soldered to the ground area. Plastic buttons (special dash pots used at furniture) are glued to the copper strips. The PC board is placed to a little nice black box made from a metal.

The box with key board inside the one is fastened by a screw to transceiver's push-to-talk switch. The screw is screwed instead a screw (too much 'screws in one sentence!) that early was hold a clip. The push-to-talk switch has not flat surface, so a pillow made of polyurethane is placed under the 'black box.' Key wires are into push-to-talk switch cable.

While QSO the push-to-talk switch is in the left hand, by the hand do turn RX/TX, keying do by the right hand.

73/72!

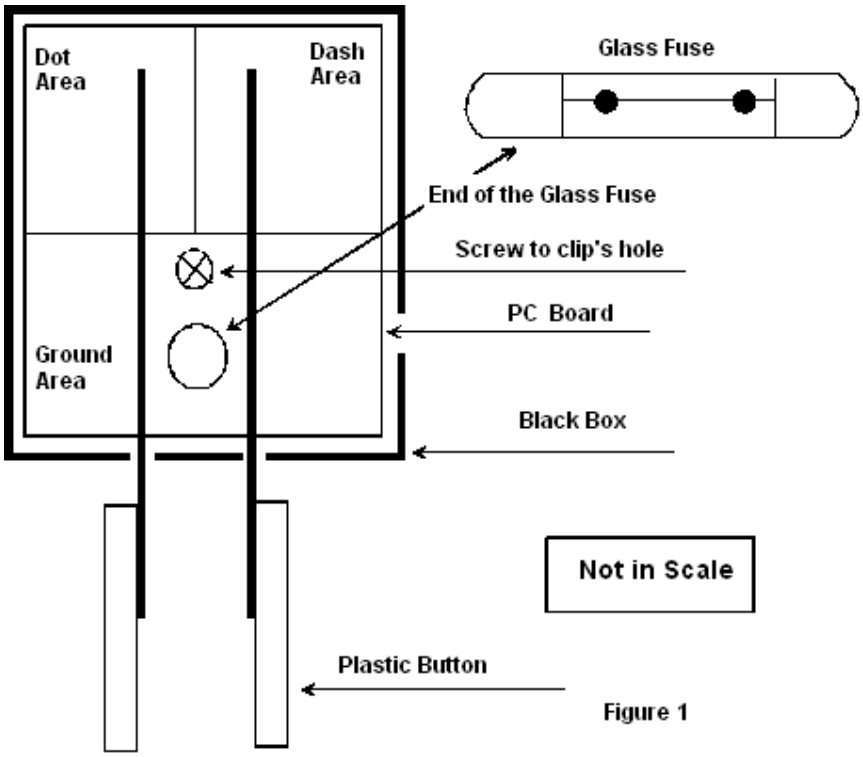


Figure 1

CHAPTER 11

QRP STORY

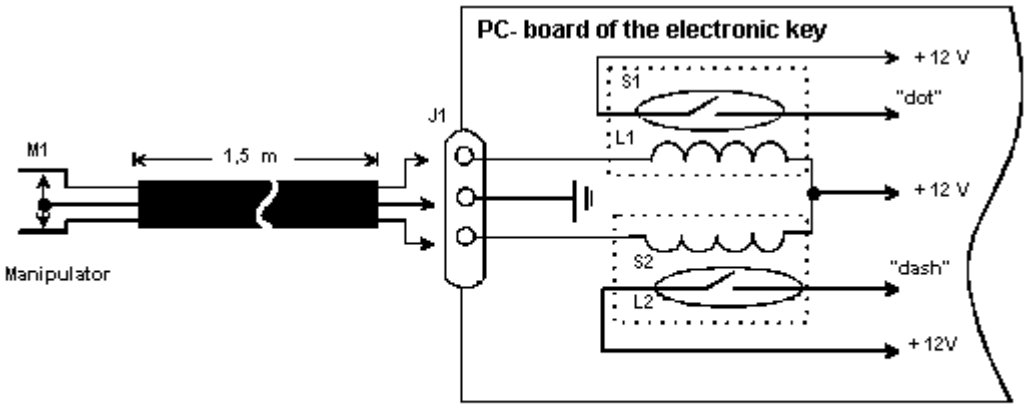


Figure 1

QRP beyond belief

by Igor Grigorov / RK3ZK

G-QRP-C # 6363

The article was published at SPRAT, the journal of the G- QRP – C # 114. However, I think, the keys will be interesting for all amateurs.

Work on QRP is wonderful when with only several watts of power to do a DX QSO. But the surprise is especially great if a radio amateur does not know that he works on QRP... later he looks into his log and does not belief it! About such improbable work on QRP I want to tell.

It took place on the 10th of December 2001, during the QRP expedition on Ai - Petri plateau. This expedition was held in honor of the centenary of Marconi's First Transoceanic radio contact. The UR-QRP Club arranged the expedition. The call EN100GM was used. We used an old military Russian made radio R - 143. It provided 8 watts RF- power at 1.8 to 18 MHz. An ATU (Antenna Tuning Unit) (see reference [1]) was used with the military transceiver. **Fig. 1** shows the scheme for the ATU.

By mistake, one of the operators connected our transmitting antenna to jack J4 instead of jack J2. In other words, our antenna was connected to R4, the dummy load, installed inside the ATU. The dummy helped to do right matching a transmitter with the ATU.

So, during several hours we worked in the Air with the antenna, connected to R4, not to the transceiver. It is beyond belief, but we made 21 QSOs! One QSO was made on a range of 40-m, three QSOs were made on a range of 17-m and the others 17 QSOs were made on a range of 20-m. Only casually the mistaken connection was detected when we could not make QSOs on a range of 80-m... **Tab. 1** shows the page from EN100GM log with the QRPP QSOs..

Photo: December 10, 2002

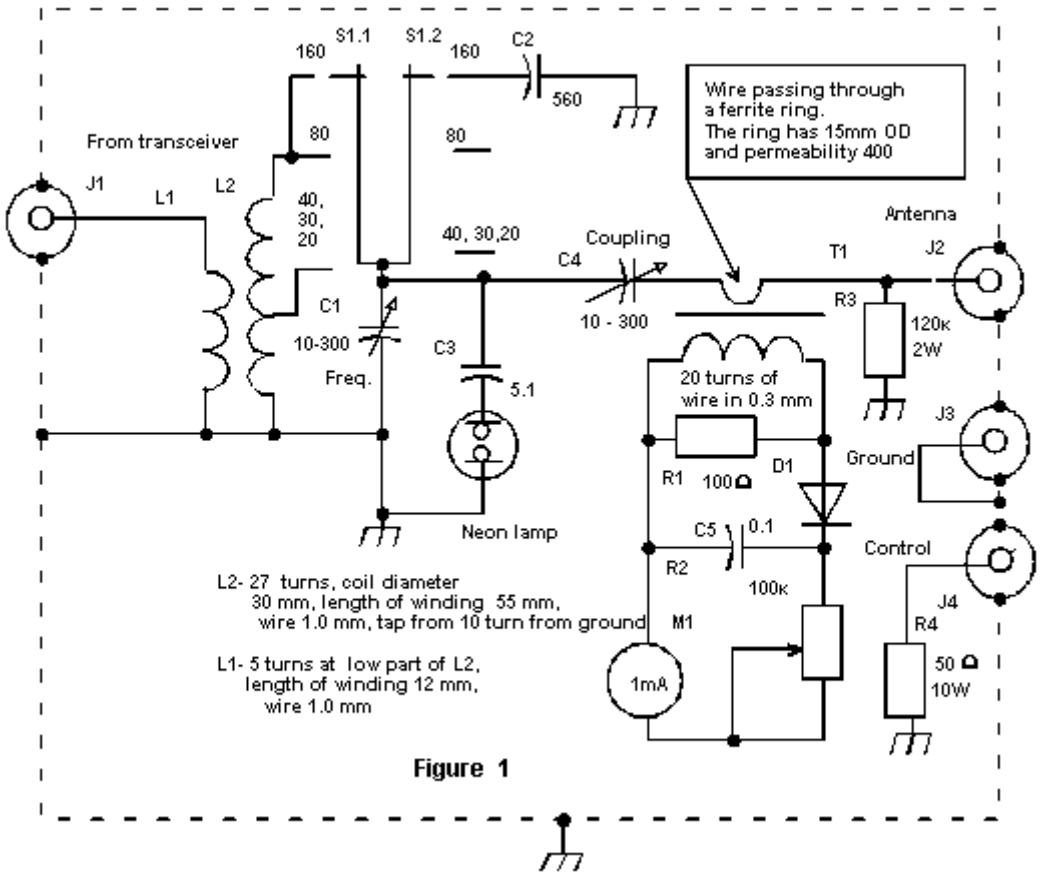


Figure 1

Certainly, when tank L2C1 (see **Fig.1**) is tuned in resonance with the input frequency, a high RF voltage is on the tank, and a little part of the RF energy from the tank L2C1 is induced on the dummy load R4. Hence, a small RF voltage is presence on R4, and a very little power goes in the antenna. Off course, a little RF energy also is induced on current transformer

T1 (see **Fig. 1**). So, the RF- transformer shows a RF current.

When we stayed on receiving, I think a little part of RF energy from R4 was induced to L2C1, and from L2C1 goes to input of P-143. This military radio station could provide quite a good reception even at very poor radio signals.

After our expedition, when I have arrived home, I have measured the level of the RF power what could be induced on the dummy load, R4.

When I run 10 watts in to the unloaded ATU, I obtained, that it was 0.5 – 0.8-V RF across the dummy load. Hence 5 -15 milliwatts were dissipated by the dummy load. When an antenna was connected to the dummy load the induced RF power shares with the antenna.

Table 1

# QSO	Call	Time, GMT	Band, MHz	RS
1	RK4LXD	14.20	14	59\59
2	UA1UPC	14.21	14	59\59
3	RV9MM/9	14.25	14	59\59
4	UA3BT	14.30	14	59\59
5	RA3DCU	14.31	14	59\58
6	RK4CXK	14.32	14	59\59
7	RW9AS	14.33	14	58\59
8	UA0AX	14.38	14	58\58
9	UA1NCX	14.39	14	59\57
10	UA9FLD	14.45	14	58\59
11	RW4UU	14.49	14	59\59
12	UA4SX	14.56	14	59\55
13	RX3AX	15.00	14	59\59
14	RX3FZ	15.04	14	58\59
15	RK4YWK	15.07	14	58\58
16	RV3DNT	15.12	14	58\58
17	4Z5AF	15.41	14	58\58
18	UR4QI/M	15.53	7	59\56
19	IK4WKU	16.15	18	59\54
20	ON4LAN	16.33	18	59\53
21	PA3DUV/M	16.36	18	59\59

Ooops, we worked while several hours with several milliwatts in our antenna! Four hams, UU4JCQ, US1REO, USIRCH, RK3ZK, observed the wonderful work.

Reference

1. Grigorov I.N.: Antennas: Adjustment and Tuning. Moscow, RadioSoft, 2002, ISBN: 5- 93037-087-7 (in Russian)

QRP- TALES

By Alexei Rusakov, UA4ARL/qrp (RU-QRP # 005) ua4arl@vistcom.ru

September 13, 2002.

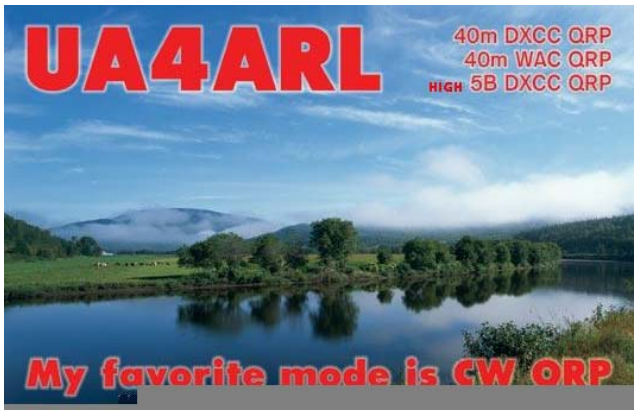
The day before yesterday I decided to hang my ZL-antenna for 20m in another direction - and so sad it was for me, fixing the last point I broke director wire. My antenna made of D6mm antenna-rope had been already used for 2 years and I had no any desire to prolong it's term

Yesterday I switched to two alternative dipoles instead.

Today in the morning I started tuning my new 2-el Beam of D3mm bi-metall directed North-South strictly. On 20m SWR that's 1point2. And just after it I tried SWR on other high bands. On 10m band the SWR was 1point4. And on 15m band [CW] SWR surprised me with 1point1. I'd just only checked SWR not changing tuning from the middle of [CW] on 15m and switched on my soldering iron on in order to changeall temporary contacts for cable [SO-239]s. Frequency, once established, was the same.

Early morning. The band's not opened yet. The sweet noise sound pouring from speaker-phone. I've switched off one of the dipoles and the other was still wired to transceiver. Still soldering. And just that time I'm hearing on that frequency someone asks for "QRL?" and in a half a minutel hear "CQ CQ de 9U0X".

I switch to another antenna - that was [Delta for 40m] and lost him, and while immediately returning to the dipole I have RST 539. I'm hurring to cacth my



luck, trying to repair my hand-made connections, but wires were already cut for soldering and so it's a great deal to screw them all once again. I have two bulks of wire under my legs, and on my knees, so hard to screw because the coax-cable is so thick and hard. So I connect the antenna cables together manually using the newspaper as isolator!!

When the second dipole added the signal up tp 559. I ask him at QRP, he doesn't reply, and QRO I don't use [interestingy].

Three minutes after other HAM's came and one Italian station invites me SKED 18.085 kHz. My [delta-loop] hear nothing and Beam SWR - unlimited. I used my 20m Beam and received RST 559 in answer!!!! And that pal from Italy asked SKED 24 MHz once more. I follow them. Delta-loop is empty and Beam SWR the same as on 18MHz. I call and have 559 in answer!!!! QSO at 08.35z и 08.38z.

9U - Burundi - my new country reached on QRP (204).

Credit Line: : http://rugrp.narod.ru

International QRP frequencies:

Band	Frequency, kHz
160	CW - 1843
80	CW - 3560 SSB - 3690
40	CW - 7030 SSB - 7090
30	CW - 10106
20	CW - 14060 SSB - 14285
17	CW - 18096
15	CW - 21060 SSB - 21285
12	CW – 24906
10	CW - 28060 SSB - 28360

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QRP- TALES

By Alexei Rusakov, UA4ARL/qrp (RU-QRP # 005) ua4arl@vistcom.ru

Continued from ANTENTOP- 02-2003

On 25 May 2003 I worked the WPX-CW contest. I started calling CQ-WPX at 0000Z but was only answered about every fifth time. After about an hour I had only 18 QSOs on 80 meters. I started calling CQ just to see how the propagation was. At 0120Z TO5AA was 559. Finally I was able to work Europe a bit.

Yesterday, before the WPX-CW contest I heard someone call CQ. The signal was right at the noise level, so it was impossible to copy. Even my 500MHz filter didn't improve the signal. I fine tuned and the RST finally got up to 339 and I recognized

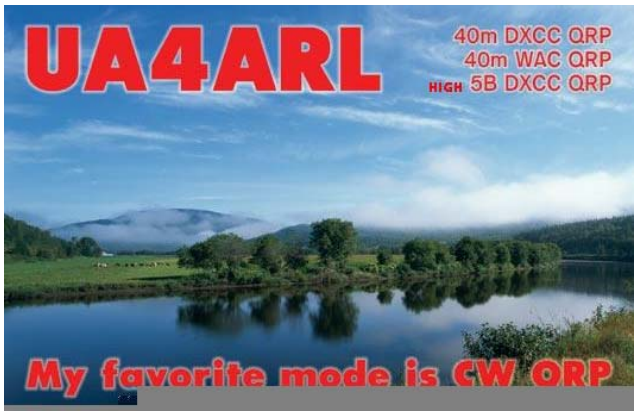
part of his call sign, 3?2N?, but with QSB. He continued to call CQ but had no response. The RST got up to 559. The call sign was 3D2NC. I gave him a call. No answer. I called again. He said RPT AGN, but there was a European station calling him and he went back the European. On my third attempt he finally came back to me. Sadly he gave me the standard RST 559 for my QRP signal.

At 1101Z I heard no body calling. . I waited for a few minutes more. Then a few sations from Siberia and Europe started calling. They probably heard the pile-up for 3D2NC, whose signal peaked at 569. After about 30 contacts his signal dropped and I couldn't hear him any more. I was interested in how well he was heard in Siberia so I sent an e-mail to UA0_____ asking how well the European station was heard there.

On 20 meters signals from far Europe were 559 and on 15 meters they were 579. The frequency of 3D2 is free now. Is somebody calling QRL ? I waited and heard CQ CQ de A3JJ A3JJ K. Immediately a few stations called him. A3JJ answered a Dutch station and giving "... de EA3JJ". After first QSO the pile-up disappeared.

Today I heard RZ6HX/QRP on 21 MHz.

72! Alexei, UA4ARL/qrp



The RCC had a contest on 26 April 2003. Propagation was poor for both short and long skip, but I did make 150 QSOs. However not many contacts were QRP. After the contest I listened to the upper bands without luck. 15 meters was dead as well as 10 meters. I listened to HF in the evening and it was dead also.

The weather in Volgograd is very unstable now. Friday the high was +19 C, Saturday it was only +5 C.

Victor, RZ4AA, shares QRP experiences with me. He said "After every contest I always hear HF. Usually propagation is better than before the contests. The contesters have gone back to their other rigs and then it is possible to work 5 watts QRP DX without any problems." Last weekend he had about 20 QRP QSOs into South America (LU, CX and PY) using 5 watts and dipole antenna up about 5 meters. He worked one LU station who was also running QRP and they both exchanged RST of 579!

I next listened to 21.00 MSK. I heard the Switzerland contest. The propagation was improving some now. I tuned to the DX window and heard someone transmitting "...ON /QRP. His RST here was 589 and he was talking to Belgium, but I couldn't hear the Belgian station. He told the Belgian station that he was usng a K2 txcvr. When he said 73 and gave his call sign, I was surprised to hear VK9XK! I gave him a call and he came back to me on the first try. He gave my RST as 599. His QTH was Christmas Island. Grear FUN!

72! UA4ARL/qrp Alexei Rusakov

Credit Line: : http://ruqrp.narod.ru

QRP- TALES

By Alexei Rusakov, UA4ARL/qrp (RU-QRP # 005) ua4arl@vistcom.ru

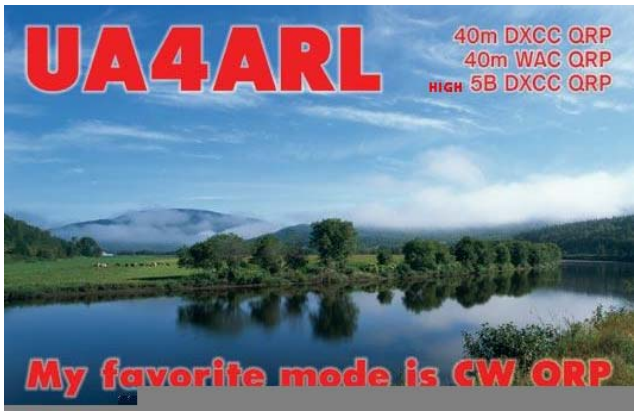
Continued from ANTENTOP- 03-2003

1'st March, 2003

The ARRL phone contest was today but propagation was bad into Volgograd. Even the CW portions were quiet. I checked all the CW portions of the bands this morning and figured that everyone was on SSB. In the evening I went back to check the condition of the bands but 21.060, 24.900 and 28.060 were already gone. While in 15 meters I slid down the band and heard some Europeans. LP's were 549 - 559 while HP's were no louder than 589 here in Volgograd. Around 21.006 there was someone that had a 559 signal with 3 or 4 stations calling him. However, he

didn't give his call sign while I was listening.

I changed antennas from a North delta to an Africa oriented 2 element and the signal went to 579. That is a good sign, I thought. Suddenly DX starting sending CQ CQ C98RF UP. I tuned the signal in with anticipation. I went up 1.5 kHz and called, but without the /QRP. I must have been the only one that answered him because he came back to me on the first try! I then told him that I was running QRP.



After our QSO was over sounded the orchestra of calling stations on the same frequency. I sat and enjoyed listening to the pile-up of DXers. Easy propagation for about an hour and a half then the signals went down to 459.

72! UA4ARL/qrp Alexei Rusakov

Credit Line : http://ruqrp.narod.ru

A QRP-QSO WITHOUT AN ANTENNA

October 5, 2003. Robin, M5AEF, had an unique CW QSO with RX3BO from Moscow at 17 meters using only 1 watt output. You say 'it is nothing especial for 17 meters', but what do you say, if you know that Robin did not use any antenna?

Yes, Robin was doing a calibration for his FT- 757, and this one was connected to a dummy load. An antenna did not connected to the transceiver at this time, the antenna was connected to monitoring receiver, that does control for quality of the output signal from FT- 757. So, Robin heard Anatoly, RX3BO, from Moscow and they had QSO with each other. Robin had received 559 from Anatoly for his dummy- load antenna!

Dear Friends,

you can read about a QRP- QSO without antenna also at ANTENTOP – 01-2003.

72/73! I.G,

Some minutes later Robin connected his usual 1,5 lambda antenna to the FT – 757 and did QSO with RX3BO. Robin had received 579!

Don't say me that there are no miracles!

With the best regards!

Oleg ("Master-72") V.Borodin

72! de RV3GM (UE3QRP)

Credit Line:

http://groups.yahoo.com/group/ruqrp/

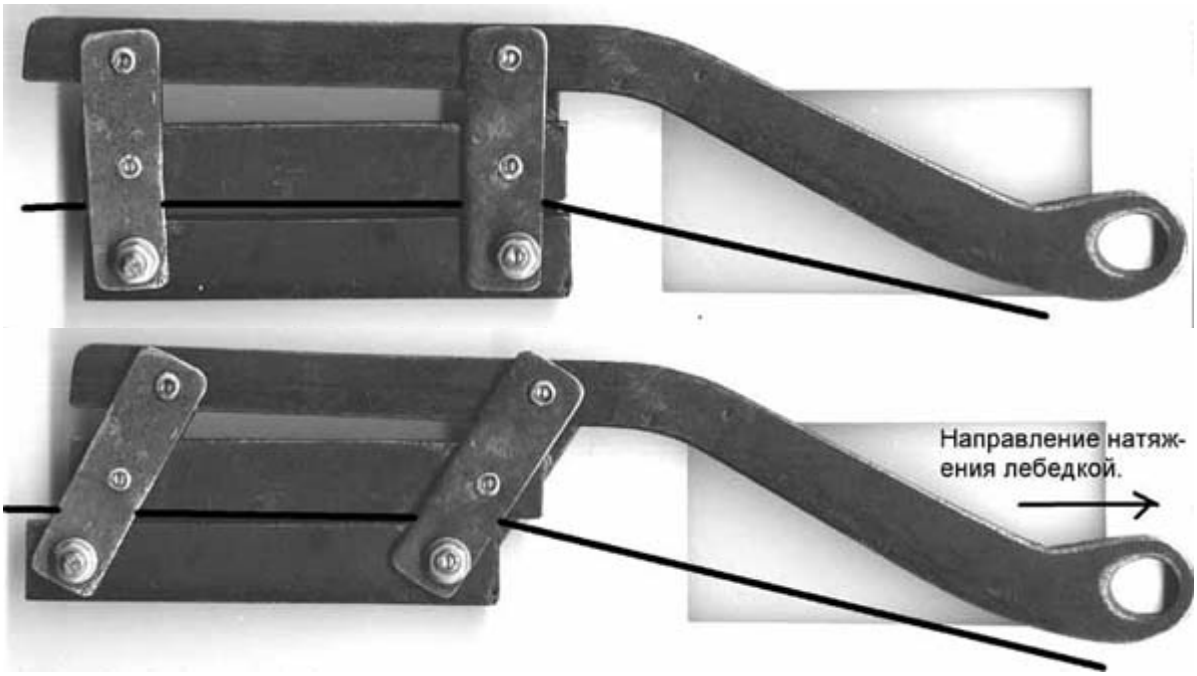
CHAPTER 12

ANTENNA TOOLS

TOOL FOR PULLING GUYS

by Victor. RN9FAB viacon@permonline.ru

For several years I use to a home-brew tool, that I made by myself, for puling guys. I made it of 8 mm of steel plate. The tool holds any guys, for example, bimetal of diameter of 4-6 mm, steel rope, wire rope. Picture shows how the tool holds the guy.



A winch is attached to the hole in the tool and placed by the place where the guy is fastened.

You can very easy move the tool onto a guy. The tool does not bite a guy at pulling. When a guy has been pulled, the tool removed by unscrewing the bottom plate.

Everyone can design the tool to needed sizes, proceeding from own needs. Force of capture is defined by a difference of shoulders of cross levers to which fasten plates. Plates have longitudinal gnowing -through at the place where it hold a guy.

RECYCLING CHOKES FOR THE LF-BAND

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When experimenting on the LF-band chokes with inductances of some mH are often needed. They are not so easy to get in these days. Those in the junk-box from the tube era are often quite big.

Do you have low-energy lamps that are not working any more ? Before giving them away to recycling do the following:

Carefully disassemble the electronic part with a screwdriver. Inside there (among some other things) is a choke with an inductance of 1.8-17mH (depending of the power and the make of the lamp). They chokes are very small, approximately 12x12x15mm. I have measured the Q of some of them and it was between 10 and 25.

Caution: Yes, of course you have to be careful not to apply any force on the glass part of the lamp. I have taken between 5 and 10 lamps apart and used the method of holding the socket with a glove firmly against a piece of wood. Then using a small screwdriver to carefully bend the socket into two parts. By doing in this way no force is applied to the glass. When the socket is divided into two parts it is an easy matter with a small sidecutter to cut the wires going to the filaments.

Happy recycling !

FASTENING OF GUYS

*by **Nick V. Derenko**, **US8AR***

Made in Ukraine

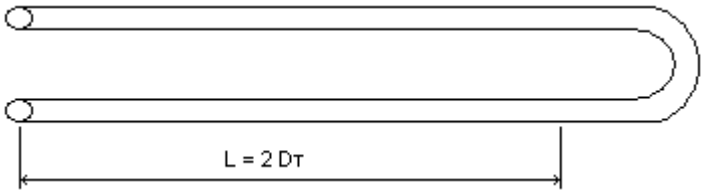
ex UB5AEO, UB4AR *mailto:us8ar@qsl.net*
http://www.qsl.net/us8ar
http://us8ar.narod.ru

Different ways apply for fastening guys to a mast or to antenna elements. The common way is to drill holes in the tips. It, undoubtedly, results to easing of rigidity of towers and antennas both. At the same time it is possible to apply "sparing" method of fastening of guys.

Takes a kapron cord. From this one do loops for fastening guys, as it is shown at **Figure 1**. (where Dt is - diameter of a tube).

Several loops is put to the chosen place on a mast or on antenna elements and attached to these ones by usual threads. Here we do attach a binding cord as it is shown in **Figure 2**.

***Figure 1**. Loop for fastening guys*



Further, using cordlike binding, we adhere loops to a tube as it is shown in **Figure 3**.

Figure 2. Preparing loops for fastening guys

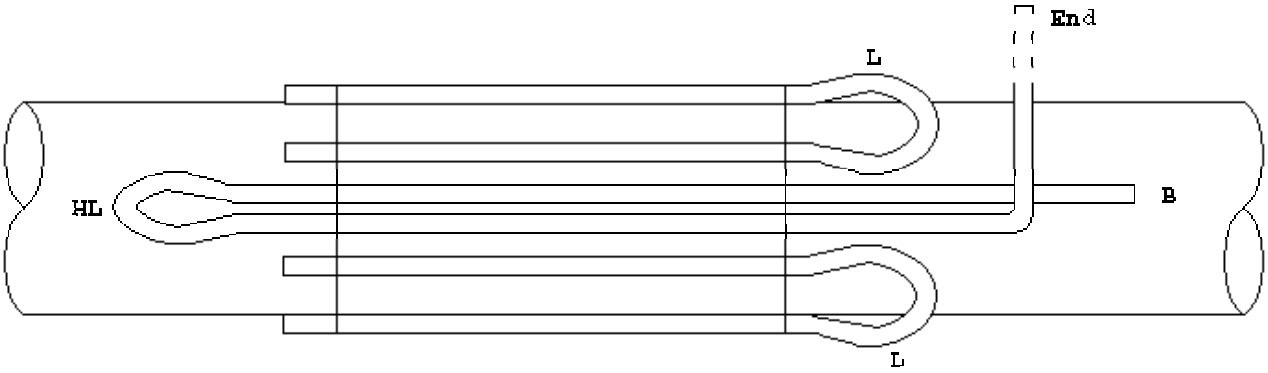
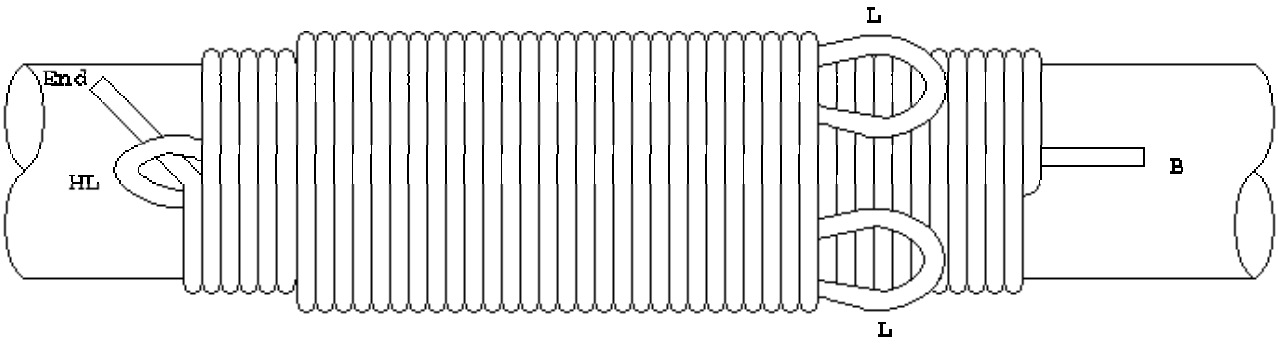


Figure 3. How to bind



At the figures are designated: L - Loop for fastening, B - Beginning of binding cord, End - End of binding ord, HL – Helping Loop.

After the ending of binding we pass the end of binding cord in Helping Loop and strongly pull for the beginning of binding cord. After that do melt of the Beginning and the End the binding rope, and that is all.

WOODEN STRUTS

By Igor Grigorov, RK3ZK
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Made in the USSR

In the far eightieth years of 20 century, on to one of Russian radio transmitting radio center I saw a self-made opened transmission line that fed a transmitting antenna. Struts of the line were made of oak tree. What is wonder at that? These struts were about some tens years old. They were made at the end of 40 years, during restoring of the USSR after World War-II. The struts had been thoroughly boiled in paraffin before installation. Till now these wooden struts, made in great quantity, lie in a tub filled with paraffin. At repair of transmission lines the paraffin is kindled, the insulators are got and used. The wooden struts, despite of their "antiquity", looked rather 'fresh' and had sufficient mechanical and electric strength.

***Figure 1** Wooden compression strut*

Figure 1

***Figure 2** Two -wire line with usage of wooden compression struts*

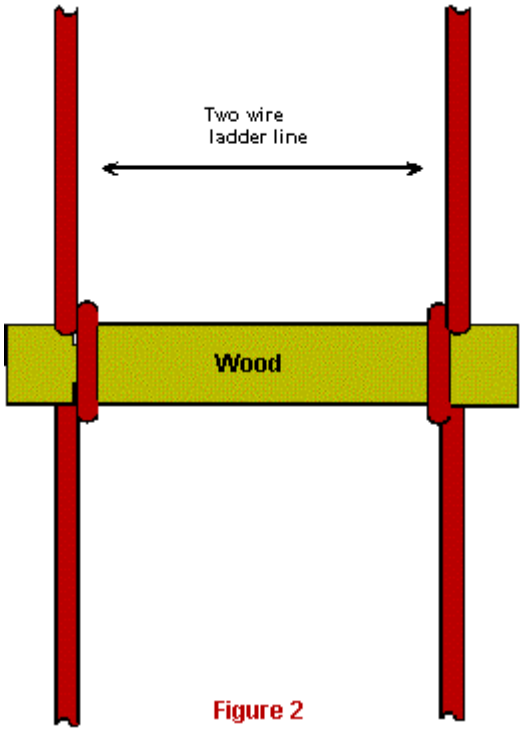

Figure 2

The struts had length 12-15 centimeters, and width about 2 centimeters. Kerfs were made at a small distance from ends of the struts. **Figure 1** shows the wooden strut. Wires of the ladder line were wound around of struts and kept on kerfs. **Figure 2** shows the two-wire line with usage of wooden struts.

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PARAMETERS OF COAXIAL CABLES

Credit Line: http://radioteh.nm.ru/

Coax no	Diameter, mm	Losses (db/100m) at frequency (MHz)					Price (US $) and producer
		100	200	400	900	1800	
PK 50-17-51	27,5	1,4	2,1	3,1	5,1	7,7	8,0 RU
RFC LCF 7/8	28	1,16	1,69	2,53	4	6,1	15 GM
NOKIA RF 7/8	27,5	1,2	1,8	2,6	4,1	6,2	15 FN
NOKIA RF 1/2	16	2,2	3,2	4,6	7,3	11	10 FN
RFC LCF 1/2	16	2,13	3,1	4,6	6,9	10,3	10 GM
ANDREW LDF4-50A	16	-	-	4,6	7,3	11	10
RFC LCF 3/8	12,1	3,1	4,4	6,6	9,8	14,4	7,0 GM
PK50-7-58	12,1	3,4	4,9	7,1	11,2	17	4,0 RU
12D-SFB-NL	15,6	-	-	5,4	8,7	13,1	8,0 JP
10D-SFB-NL	13	-	-	6,5	10,3	16,4	6,0 JP
8D-SFB-NL	11,1	-	-	8,2	12,9	19,2	4,0 JP
8D-SFAE	11,1	-	-	7	11	16,5	6,0 JP
10D-FB	13	3,2	4,8	7	11,3	17,2	3,5 TW
8D-FB	11,1	4,3	7	10,5	16	24	2,0 TW
8D-FB-LL	11,1	-	-	9,5	14,7	-	2,5 TW
POPE H 100	9,8	4,1	-	8,5	13,2	19,2	2,0 NL
CUSHCRAFT TL93605	11,1	-	-	8,2	12,4	19	3,0 US
BELDEN 9913	11,1	-	-	8,8	14	-	3
SIVA RH 100	9,7	-	5,2	8,2	13	18,5	2,0 IT
LMR-400	11,1	-	-	10,6	16	-	1,5
5D-FB	7,4	6,5	9,6	14,4	21	32	1,0 TW
RG-8/U;	6,0	-	9.0	-	13,5	-	-
RG-8A/U	10,3	-7,0	-10,5	-15,75	24	38	1,5 TW
PK 50-11-31	13	3,8	6,6	9,5?	15	-	4,0 RU
PK 50-11-11	13	4,5	8,5	14,0?	24	-	1,5 RU
PK 50-7-312	11,3	8,5	14	22	36	-	1,0 RU
PK 50-7-11	11,3	8,5	14	22	36	-	1,0 RU
PK 50-7-32	11,3	6,8	11,8	18	-	-	-
RG8-LRP	10,4	-	9	13,5	24	38	1,5
RG-8x	6,15	12,1	17,7	26,5	-	-	1,0 TW, ,5RU
RG213/U, RG213BX	10,3	7	10,5	15,75	27	40,5	1,5 TW
3D-FB	5,3	8,3	12	24	-	-	1,0 TW
RG-58/U	5	14	20	33	-	-	0,3
RG-58A/U	5,03	13,1	18,7	31	-	-	0,3
RG-58C/U	4,95	16	23	35	-	-	0,3
RG-174/U, RG-174A/U	2,8	26	38	57	-	-	0,25

Producer:: RU- Russia; IT- Italy,; GM- Germany, NL-Netherlands; US- USA; JP-Japan ; TW- Taiwan.

SUPPLEMENTARY

The hAmTX Power Supplay

by Paulo Ferreira CT2ILQ
paf@dei.isep.ipp.pt

The need for a power supply

When a ham buys (or makes) a radio he usually needs a power supply for it. A cheap alternative to buy one is to adapt a computer power supply. I just said the magic word, cheap. Hams like cheap things because that way they can buy more radios, or wire for antennas, or CW keys, or any other things they like. And a computer power supply can be bought in many places of the world, where one cannot find other radio related items. But a computer power supply is very different from a radio power supply, so we need to check the differences and see what can be done.

The Normal and the modified PSU

A typical PC compatible power supply is usually a switch-mode power supply with at least one fan. So one can expect RF noise and some acoustic noise. The RF noise can be ignored if the objective is to feed a VHF/UHF FM rig, and (some) modern PC power supplies have reasonably quiet fans.

Moving Closer

There are several documents on the internet that give information about transforming one PC PSU in one radio PSU. They have several shortcomings, they are for older AT style PSUs, they usually need changes in the internal circuit of power supply, or in alternative they can supply only small currents.

But, in the recent times there is a new kind of PC power supplies called ATX12V and they are interesting, very interesting. In a simple way, old style AT PSUs had a strong +5V output, and a reasonable +12V output. The ATX standard brought different connectors and a +3.3V output. The ATX12V standard comes from the need of low voltages and strong currents for the actual processors. The motherboard manufacturers place voltage converters on the motherboard and feed the voltage converters at +12V. So its easy to find PSUs with a capacity of between 15 and 25 Ampéres on the +12V line (without circuit changes).

The minimum

The trouble is not the maximum current, but the minimum current because switch-mode PSUs have a minimum current limit, if their load is lower than the minimum, they can be damaged (or they shutdown if they are protected).

But the resolution of this problem is simple, we just need to place some resistors on the outputs that have a minimum current requirement. Usually the +3.3v, +5V and +12V outputs have a minimum current requirement. The resistors must have the correct wattage, preferably with a safe margin. Some of the more recent power supplies only have a minimum current requirement on the +12V line, so they are very nice for our needs.

How to proceed

1) Get the ATX12V power supply design guide.

2) Choose the ATX power supply to buy.
Items to check:

The PSU must have a power switch.

The manufacturer has a page on the Internet?

Does the page has the full specifications?

Is the PSU a "big fan" (120 mm) type PSU?

What are the maximum currents?

What are the minimum currents?

What are the outputs with a minimum current requirements?

Calculations

So lets suppose we have a power supply with a minimum current of 0.5 A on the +12Volts output only. So we need a resistor of 12/0.5= 24 Ohms maximum. A good approximation would be a 22 Ohm resistor. The power dissipated would be 12V*0.5A= 6 Watts so a good compromise would be a 22 Ohm resistor of 15 Watt at least.

If the power supply has a minimum current on other outputs we need to calculate the resistors for the other outputs using the same method.

Opening the power supply

You may get an electrical shock even if the PSU is disconnected from the mains, so be careful, or you may not need to follow the next steps. One measure of caution that may not work, but may diminish the danger, is to leave the PSU disconnected one full day before opening it.

List of wires and colors

Black Wires - Ground - connect to ground (Ground Output)

Green Wire - Connect to one black (to place the power supply always on)

Grey - Power Ok - unconnected

Purple - +5V standby - unconnected

White - -5v (not used in recent motherboards) unconnected

Blue - -12V unconnected

Orange Wires (+3.3v) - leave opened (no connection)

Red Wires (+5v) - leave opened (no connection)

Yellow Wires (+12Volts) - connect to Positive Output

Resistors to connect

As only the +12V output has a minimum current requirement we only place one load resistor (previously calculated) between the yellow and black wires. The resistor (or resistors) should be placed inside the PSU to benefit from the PSU fan.

Practical resume:

Black = Ground = Connect to Black wire of the radio

Yellow = 12 Volts = Connect to Red wire of the radio

Place the Resistor between Yellow and Black

Orange = +3.3V = Leave open (unconnected)

(Place a resistor between Orange and Black if needed, if the +3.3V Output has a minimum current requirement)

Red = +5V = Leave open (unconnected)

(Place a resistor between Red and Black if needed, if the +5V Output has a minimum current requirement)

Green = connect to Black

All the other wires are unconnected

Practical experience:

I got one power supply (460W nominal with a big 120mm fan) and modified it. Acoustically it is very quiet. Electrically with a VHF/UHF FM rig the RF noise is not detectable. So to operate a VHF rig the PSU is suitable.

One good thing about it (and many others) is an adjustable resistor inside to control the output voltage and that way I could adjust the output voltage up to 13.5 Volts instead of usual 12Volts (with a lot of care because of the deadly voltages inside of the power supply).

To test the RF noise I compared the PSU with a linear PSU, and with a Gel-Cell battery, using one hf radio on several amateur bands, and a 20 meter horizontal long wire antenna.

On the first test, inside the house, the PC modified PSU was a noisier than the linear PSU but not much worse, and the battery was comparable to the linear supply.

Then outside, I placed the radio under the antenna and yes, the "computer" PSU, is usable on VHF and UHF FM, but on HF gives a lot of noise. Surprise, the linear PSU also makes noise, and the battery is very quiet, because almost all the QRM I hear is from the coaxial cable routing from the inside to the outside of the house.

ANTENTOP Free e-magazine edited by hams for hams www.antentop.org

It runs parallel to the satellite receiver cables and that should be the cause of all that QRM... So I need to reroute the antenna cables.

Meanwhile I have a good PSU to use with a typical 50W FM VHF/UHF radio.

Things to try in the future:

The PSU is not suitable for HF use. Could the PSU be improved with additional filters? I have not placed any filter on the output but there is space for the filter inside the PSU box if the fan is moved to the outside.
Links and documentation:

Atx12V Specification:

http://www.enhanceusa.com/documents/ATX12V_v2.01.pdf

Other specifications:

http://www.enhanceusa.com/support_tech.htm

Basic Modification Examples:
http://www.antennex.com/preview/archive3/powers.htm

http://www.qsl.net/aa3sj/Pages/PC-Supply.html

http://www.mattsrcstuff.com/PCPS.htm

http://www.qsl.net/vk2ep/news/dec2001.doc

St. Louis switcher

http://www2.arrl.org/members-only/tis/info/pdf/0205035.pdf

http://www.qsl.net/wj5o/project.htm

http://www.njqrp.org/qhbextra/6/6d.html

http://207.195.94.13/sart/radio_library/switcher-supply.pdf

Advanced ones:
Very complete:
http://www.qrp4u.de/docs/en/powersupply/index.htm

Nice modification
http://www.qsl.net/vk4ba/projects/index.html

ATX power supply example
http://pavouk.comp.cz/hw/en_atxps.html

Changing an ATX PSU to 12-24V input (input!):
http://www.acs.comcen.com.au/atxps.html

Data sheets and tech pubs:
http://www.fairchildsemi.com/ds/TL/TL494.pdf

http://www.fairchildsemi.com/ds/KA/KA7500B.pdf

http://focus.ti.com/docs/prod/folders/print/tl494.html

Nice Articles about switched power supply repair
(on a slot machine tech magazine !!)

http://slot-tech-ftp.serveftp.com:8080/magazine/february02.pdf

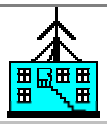
http://slot-tech-ftp.serveftp.com:8080/magazine/march02.pdf

Modifing a PC power Supply for Lab use:
http://web2.murraystate.edu/andy.batts/ps/powersupply.htm

Final version (for now) with fan outside of the box

Inside View

HAND-HELD/CAR/TRUCK/HOUSE 27 AND 145 MHZ COMMUNICATION

CB- 27-MHz (distance in kilometers)				
				40-50
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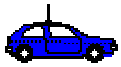
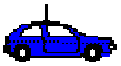
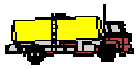
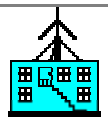
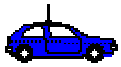
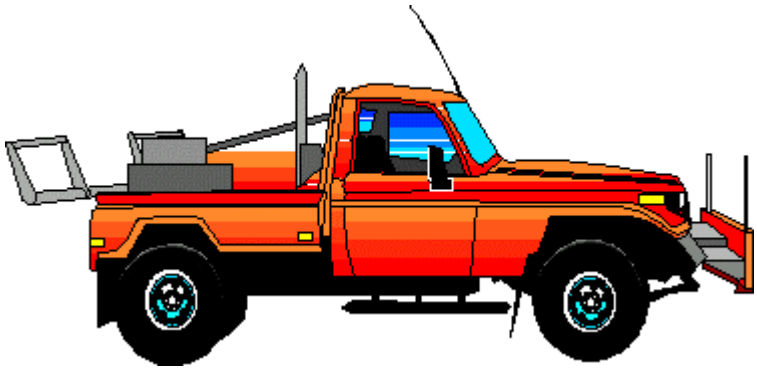
		8-15	10-20	15-25
	2.5-6	4-10	5-12	8-16
				
	5-12	7-15	8-16	10-18
		12-25	15-30	25-40
			20-35	35-50
				60-80
VHF- 145-MHz (distance in kilometers)				



WIRE METRIC DIAMETER/GAUGE STANDARD

Number #		0000	000	00	0	1	2	3	4	5	6	7
Diameter in mm	SWG	10.16	9.45	8.84	8.23	7.62	7.01	6.40	5.89	5.38	4.88	4.47
	AWG	11.68	10.41	9.27	8.25	7.35	6.54	5.83	5.19	4.62	4.11	3.66
	BWG	11.53	10.80	9.65	8.64	7.62	7.21	6.58	6.05	5.59	5.16	4.57

Number #		8	9	10	11	12	13	14	15	16	17	18
Diameter in mm	SWG	4.08	3.68	3.25	2.95	2.64	2.34	2.03	1.83	1.63	1.42	1.22
	AWG	3.25	2.90	2.59	2.30	2.05	1.83	1.63	1.45	1.29	1.15	1.02
	BWG	4.19	3.76	3.40	3.05	2.77	2.41	2.11	1.83	1.65	1.47	1.24

Number #		19	20	21	22	23	24	25	26	27	28	29
Diameter in mm	SWG	1.02	0.92	0.81	0.71	0.61	0.56	0.51	0.46	0.41	0.38	0.35
	AWG	0.91	0.81	0.72	0.64	0.57	0.51	0.45	0.40	0.36	0.32	0.29
	BWG	1.07	0.89	0.81	0.71	0.64	0.56	0.51	0.46	0.41	0.35	0.33

Number #		30	31	32	33	34	35	36	37	38	39
Diameter in mm	SWG	0.30	0.29	0.27	0.254	0.229	0.203	0.178	0.17	0.15	0.127
	AWG	0.25	0.23	0.20	0.18	0.16	0.14	0.13	0.11	0.10	0.08
	BWG	0.30	0.25	0.229	0.203	0.178	0.127	0.102			

Color Code for Resistors and Capacitors

Resistor color code

As usual a resistor is marked by four or five ring strips. Since you can find out the value of the resistors at any installation of this one on a printed-circuit-board. Read value of the resistor from the end with a narrow strip in Ohms. Read a wide strip the last. **Table 1** shows the decoding of the color marks for resistors. Up to multiplier marks are given in Ohms.

Table 1 Resistor color code

Mark color	1 mark	2 mark	3 mark	Multiplier	Tolerance, %
silver	-	-	-	10^{-2}	10
gold	-	-	-	10^{-1}	5
black	-	0	-	1	-
brawn	1	1	1	10	1
red	2	2	2	10^{2}	2
orange	3	3	3	10^{3}	-
yellow	4	4	4	10^{4}	-
green	5	5	5	10^{5}	0,5
blue	6	6	6	10^{6}	0,25
violet	7	7	7	10^{7}	0,1
grey	8	8	8	10^{8}	0,05
white	9	9	9	10^{9}	-

Capacitor color code

Recently capacitors as well as resistors have color marks. However different types of capacitors can have different color strips or points at the body. **Figure 1** shows examples of color marks for several types of modern capacitors.

Capacity is specified by two first colors (strip or points) in pF. After that the multiplier shows value of the capacitor. Tolerance, working voltage and also can be specified if it is necessary. **Table 2** shows capacitor color marks. **Table 3** shows lighting calculator for capacitors

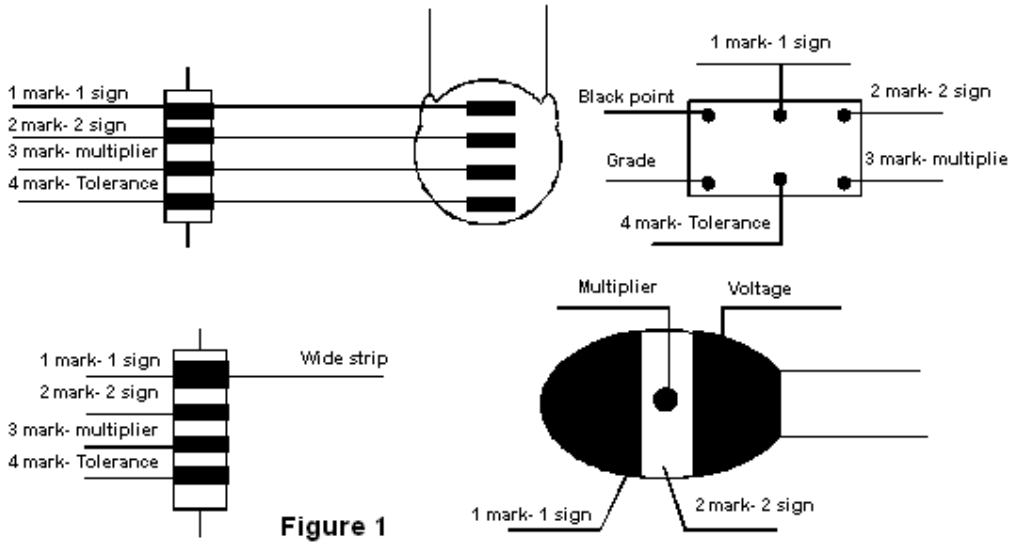


Figure 1

Table 2 Capacitor color mark

Mark color	1 mark	2 mark	Multiplier	Tolerance, %	Voltage, V
black	0	0	1	20	4
brawn	1	1	10	1	6,3
red	2	2	10^2	2	10
orange	3	3	10^3	0,25	16
yellow	4	4	10^4	0,5	40
green	4	5	10^5	5	20
blue	6	6	10^6	-	30
violet	7	7	10^7	+50/-20	50
grey	8	8	10^8	+80/-20	3,2
white	9	9	-	-	63
silver	-	-	-	-	2,5
gold	-	-	-	-	1,6

Table 3 lighting calculator for capacitors

Value of capacity (μF)	1 mark	2 mark	3 mark (Multiplier)
0,010	brawn	black	orange
0,015	brawn	green	orange
0,022	red	red	orange
0,033	orange	orange	orange
0,047	yellow	violet	orange
0,068	blue	grey	orange
0,10	brawn	black	yellow
0,15	brawn	green	yellow
0,22	red	red	yellow
0,33	orange	orange	yellow
0,47	yellow	violet	yellow
0,68	blue	grey	yellow
1,0	brown	black	green
2,2	red	red	green

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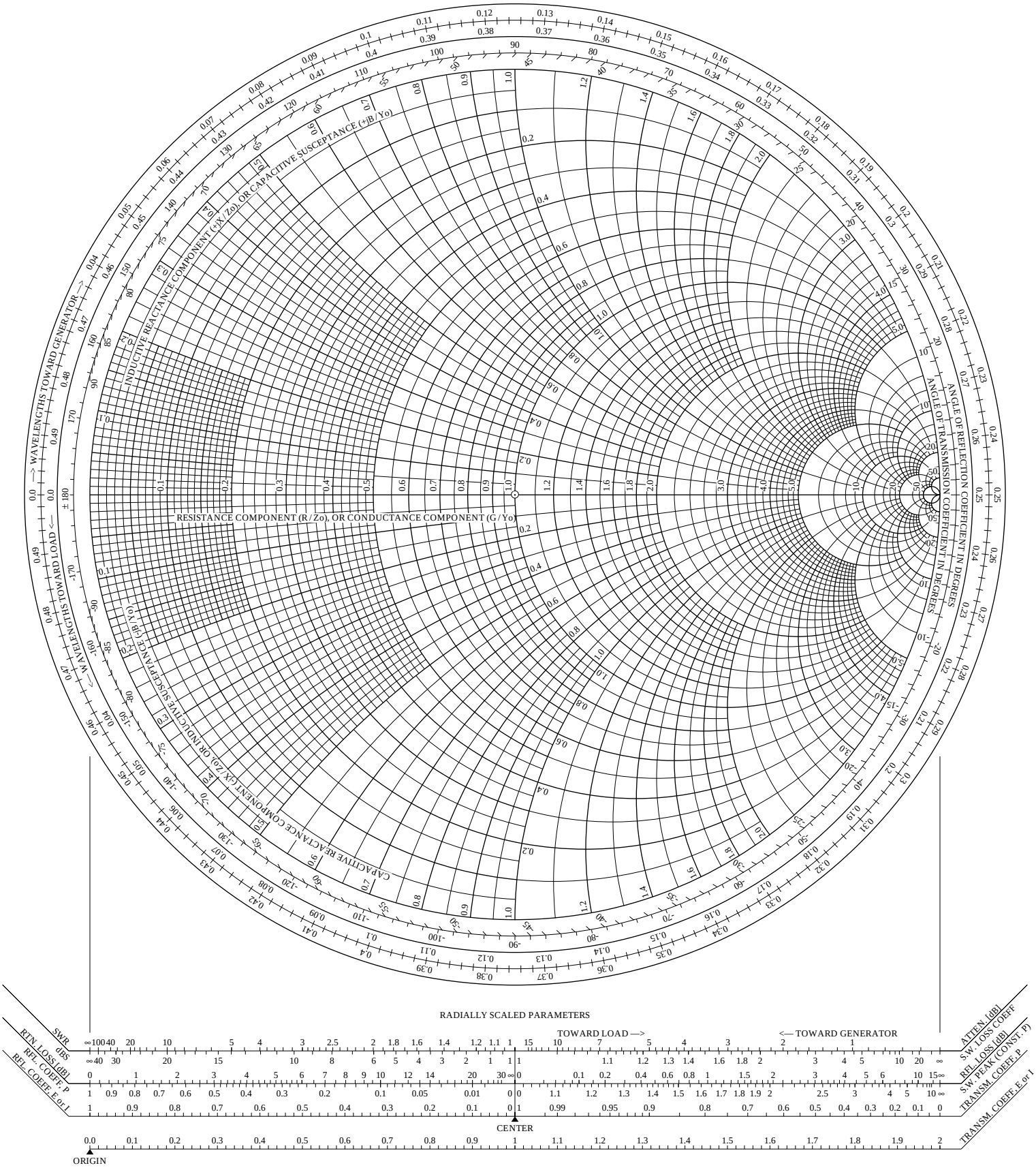
The Complete Smith Chart

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