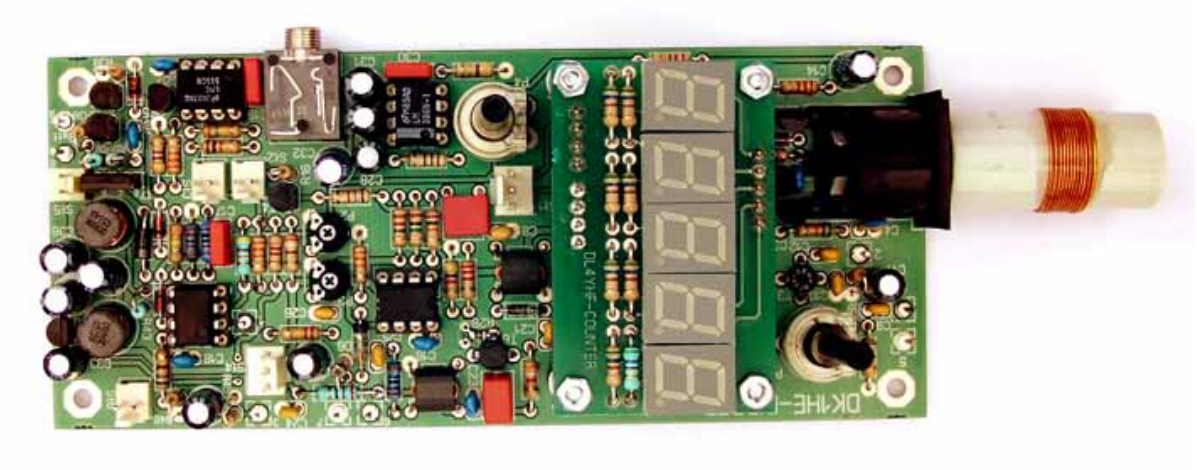
HAM-Radio IS alive!
Ham Radio is Homebrew Radio

Welcome in the World of QRP and Homebrew HAM Radio of Peter, DL2FI and Nikolai, DL7NIK
QRP Made in Germany and more

DipIt, the revolutionary Dipmeter of the German QRP Club

DL-QRP-AG.



Idea and Design by Peter Solf, DK1HE

Project Coordination by Peter, DL2FI

Kit Realisation by Nikolai, DL7NIK

Thanks to the help of Pete, WK8S the english manual is now available. Download here

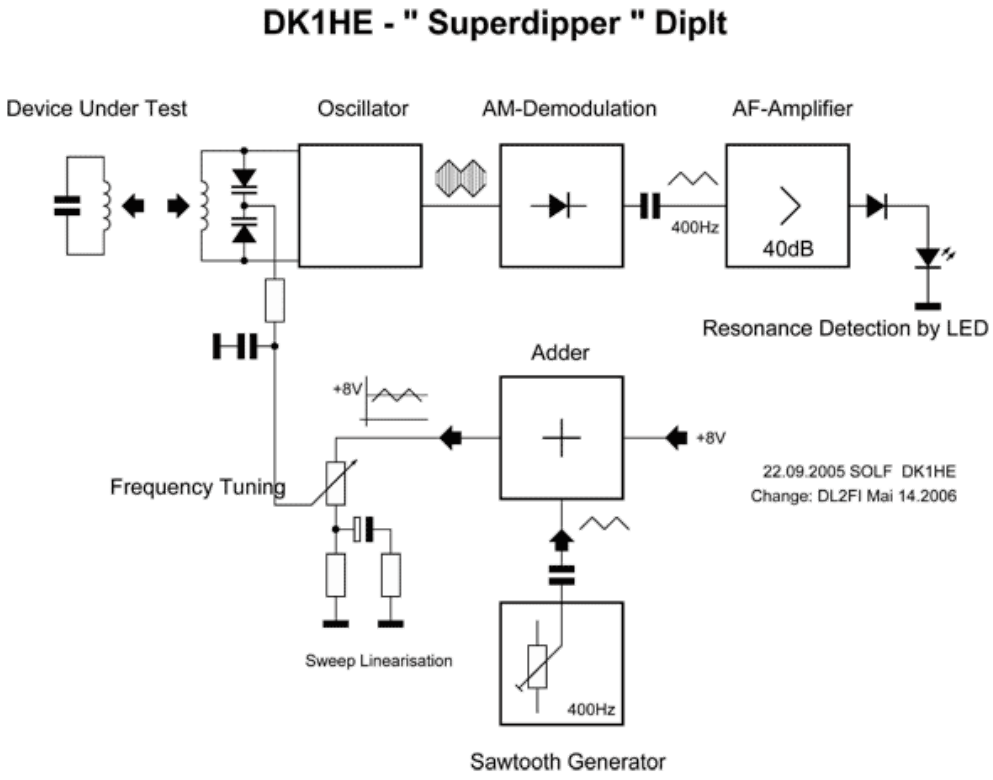
The DL-QRP-AG DipIt works in a complete other way:

The heart of the circuit is the varicap tuned variable oscillator with a tuning range of about one octave. The Tuning-Voltage is overlaid by a small sawtooth voltage which causes a symmetrical frequency modulation (sweeping) of the VFO. The chosen frequency sweep is approximately +/- 0.2% of the current oscillator frequency. The sweep frequency is approximately 400 Hz. If DipIt is coupled to a device, DipIt´s frequency will sweep over the resonance curve of the Device Under Test (DUT). This is the same what a user normally does with a conventional Dipmeter by sweeping the Main Tune Knob for a little amount to find the Dip.

Sweeping the VFO by 400 Hz over the resonant curve of the DUT results in an Amplitude Modulation (AM) of the VFO. Why? The DUT will absorb energy of the VFO if it is on the same frequency as the Dipmeter. Because the Dipmeters frequency is swept by 400 Hz, the Amplitude of the VFO will go up and down by 400 Hz - this is what we all know as Amplitude-Modulation (AM). The degree of modulation is greater the more exact DUT and Dipmeter are tuned to the same frequency and the harder the coupling between both is. A following AM demodulation stage separates the 400 Hz AC tone. The display part of DipIt is a simple 40dB AF Amplifier, a rectifier and a superbright LED. Using this method, the only criteria of detecting resonant devices is the AM-Modulation so the different Amplitude height of the VFO

depending on its frequency is no longer a problem. That fact, that an AM signal can be amplified very easy increases the sensitivity of the dipper dramatically.

- Coupling between DipIt and DUT can be much looser then with any conventional dipmeter, the dip is absolutely clearly.
- DipIt works as a Direct Conversion Mode Frequency Meter. To make DipIt more flexible, we added a Direct Conversion Frequency Meter.
- With a simple probe made from a piece of coax cable and a capacitor we can connect DipIt via its built in Cinch connector to any RF signal source.
- With its Attenuator, Mixer and separate AF Amplifier DipIt becomes a complete Direct Conversion Receiver working over the same range as it does in Dipper mode. This makes DipIt ideal to measure the output of TX-Mixers, output of bandpassfilters in a TX chain and others. Both DipIt modes together plus the standard Absorption Mode make DipIt a tiny and cheap replacement for a (much more comfortable) Spectrum Analyser.



The Circuit:

The VFO is a Hartley Oscillator with a JFET T1 (BF2456B). It consists of the plug in coil L1 and the two anti serial Diodes D1/D2. A 10 turn Pot enables a smooth tuning range of 1 octave. By using 5 different plug in coils, DipIt has a complete range from about 1 to 42 MHz. Because in our opinion its not a good idea to use the same oscillator design for a range from 1 MHZ up to the VHF area, we decided to develop separate plug in Oscillators later for UHF and VHF use. Diode D3 automatically generates the negative Gate Voltage and acts as an AM demodulator the same time. The R/C circuit R2/C2 is a lowpass Filter with an upper border of about 4 kHz. At C2 the demodulated 400 Hz signal is taken and connected via S1 to the following Amplifier.

The Sweep Generator

IC3 acts as an R/C oscillator and produces a symmetrically sawtooth of about 400Hz. The Voltage divider R19/R20 reduce the Amplitude of the sawtooth to the value we need. IC2a is working as an adder that adds the sawtooth to the DC-Voltage from R18. At the output of IC2a we find 8V DC plus symmetrically overlaid sawtooth of some 60-80mV. R45 defines the Tuning range. The R/C combination plus Pot P5 form a Voltage divider for the sawtooth part and they linearize the typically S-shaped curve of D1-D2. So the sweep range is nearly constant over the whole VFO range.

Display Amplifier

The 400Hz AC Signal is amplified in IC1a, amplification ratio is 40dB. C15 decouples the AC signal from it's DC part. By P2 the quiescent level can be adjusted so that the LED outside of a resonant situation is just glowing a little bit. At this point the LED additional acts as a rectifier. If there is an AC signal, the positive half-waves let a current flow through the LED. The brightness is direct proportional to the amplitude of the signal. Transistor T4 serves as current source for the LED, R15 limits the If a user likes to use a needle instrument (Voltmeter) this one can be added parallel to the LED.

Buffer, Power Amplifier and ALC

By C3 the VFO Signal is coupled to a FET Buffer T2. The frequency counter is low impedance coupled at the source of the buffer by BU3. The buffered VFO Signal also is used as Local Oscillator Signal (LO) for the integrated Direct Conversion Frequency Meter. By transformer TR1 the buffered signal is coupled to the power amplifier T6. Amplification is adjusted by R28 to 20dB. Transformer TR2 transforms the dynamic collector resistance of T6 to the system impedance of 50 Ohm. This amplified RF Signal can be taken from DipIt at the Signal Generator Output Jack BU 6. To get a constant level of +7dBm independent from the actual frequency, the circuit around T6 is designed as VCA, Voltage controlled Amplifier. The actual output is decoupled by R29 and rectified by D6/D7. The resulting Voltage is feed as an "IS" Voltage to the inverting input of IC1b. The Output is controlled by the "To BE" Voltage at the non inverting input of IC1b. PIN Diode D5 together with R23 act as a RF Voltage divider. So if the Actual rectified RF Voltage is lower at PIN 6 of IC1b is lower then the control Voltage at PIN 5 IC1b, the output of IC1B gets positive causing a higher current in D5 which makes it's dynamic resistance lower. The RF Input at the Base of T6 increases until the rectified RF output Voltage has the same value as the control voltage.

Direct conversion Frequency Meter

We integrated an instrument into DipIt which was an absolutely "MUST HAVE" for long times but has been nearly forgotten the last years: the Direct Conversion Frequency Meter or Zero beat Frequency Meter because it extreme useful to have it when building Amateur Radio Kits without access to other frequency selective metering devices like Spectrum Analysers. We use a MOS Tetrode as Direct Conversion Mixer. Gate 1 is coupled to the input Jack Bu5 by a variable attenuator P1, Gate 2 gets the LO signal from the Buffer Circuit. The output of the mixer T3 is coupled to the Display by switch S1 and amplified by IC4 to control it by headphones. If DUT frequency and VFO frequency are nearly the same, the conversion tone will be heard in the headphones. If the VFO is tuned to "ZEROBEAT" , that is the frequency where the tone just disappears, the frequency-counter will show the exact frequency of the measured DUT signal. The Sweeper must be shut off during this measurement!

Absorption Frequency Meter

If Switch S1 is switched to Absorption, the input of the Display Amplifier is coupled to the direct conversion Mixer. Now additional to the acoustic control DipIt offers an optical control which gives us some quantitative meaning. This can be used to find a maximum of an Bandfilter per example. The strength of the RF at BU5 will be displayed by the LED, its brightness is direct proportional to the strength of the signal. BU5 can be coupled to a DUT by a coaxial cable and a small Cap. Attenuator P1 shout be adjusted to hold the brightness of the LED much below its maximum to make it possible to see small differences in signal level. This Method is a very sensitive variant of the classical Absorbtion measurement. It is extreme useful while optimising / maximizing TX stages. If the frequency of the DUT is not stable, the sweeper can be switched on. In this case the frequency modulated VFO detects the DUT signal which now can be detected and adjusted if the drift is not more then about 8kHz.

Voltage Control

Because a Dipmeter is used periodically, we decided to use Alkaline AA cells instead of accumulators because due to the self-unloading of NiMH cells we assume that DipIt has no power every time you will use it. The 4 Alkaline AA cells give us a Voltage of 6V. Because we need an internal Voltage of 10 Volt, DipIt uses a Voltage converter. T7, T9 and DR8 form the Current Converter, C37/R38 determine the switch frequency. The converter output voltage loads the capacitor C35 via a Schottky–Diod D8. Zener

Diode D8 and Transistor T8 clamp the output to 10 Volt. The minimum Input Voltage for the converter is about 4 Volt which gives a ood utilization of the batteries.

Batteries control

To control the status of the batteries, an optical control has been integrated into DipIt. Comparator IC2b compares the divided Voltage (R40/R41) of the regulated 8V output with the voltage of the batteries. If Battery voltage drops below 4,4 Volt, the control LED goes to ON state which indicates that the Batteries are next to die.

Frequency read out

DipIt uses a well known counter which was designed by our friend DL4YHF. Resolution below 10 MHz is 100Hz and above 10 MHz 1kHz which is much better then any other Dipmeter can do. The counter has been designed as a plug in module to make it available for other QRP projects. Because it has an easy programmable additive / subtractive part it can be used for small transceivers with Superhet RX as well.

It's A kit

As all other Designs of the German QRP Club, a kit is available from QRPproject. http://www.qrpproject.de/ QRPproject started shipment of kits on May 15. 2006. Because the extreme high number of orders, from the very beginning the waiting time is about 4-5 weeks. We hope to decrease waiting times soon.

Download the complete Dipper-Schematic here.

Download the englis manual here

Manual addon: Wirinig of the switches:

The DipIt-Kit comes complete with double sided industrial PCB, all parts, an Industrie made Alu Enclosure, all cuts and drills already done. The Counter is included. English manual.

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Webmaster and QRPproject Support
Impressum:
This homepage is owned by:
QRPproject Hildegard Zenker QRP and Homebrew International

Molchstr. 15
12524 Berlin
Tel: +49(30)85961323
Fax: +49(30)85961324
Contact email

Bank: Berliner Sparkasse BLZ 10050000 Konto 1120048733
VAT- ID according to German Law §27 a Umsatzsteuergesetz :DE813395325

IBAN Number: DE83100500001120048733

SWIFT/BIC: BELADEBE

Responsible according to German Law § 6 MDStV: Peter Zenker, Molchstr. 15
12524 Berlin

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