

Details

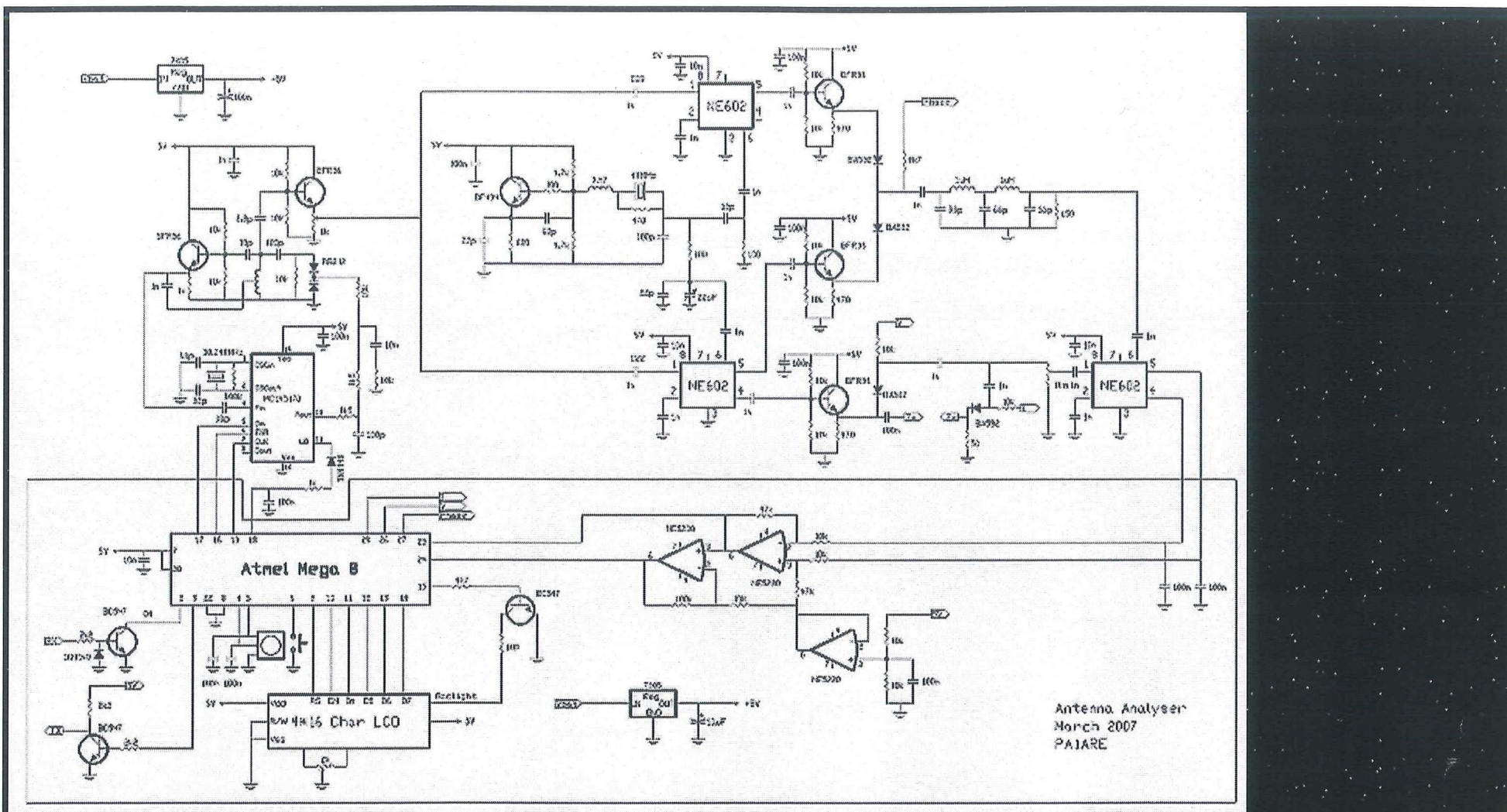
The information provided here is primarily intended for home brewers that want to build the analyzer or want to design their own based on the principles of the design. **It is not intended for use in commercial applications !**

If you want to build the analyser a warning is in order: First make sure you can get hold of all the components. One of the design objectives was to use easily obtainable components. Well I must admit I failed miserably because I used components I had in stock and did not check for their availability. It turns out that some of the key components are obsolete and hard to get. The table below may help you find equivalents and/or possible sources.

Component	Equivalent	Supplier	Comment
MC145170		Barend Hendriksen	
NE5230	LTC1152CN8	Conrad	Not tested, should be OK
BA592		Conrad	
Display AV1640		Conrad	Use type with ILED (white light) back light
Rotary encoder		Voti	SW-ROT-01

You also need to understand how the analyzer works and having some experience with building HF circuits is a benefit. During testing and alignment (and maybe troubleshooting) you would probably need an oscilloscope.

Detailed circuit description



The VCO is a Hartley oscillator tuned by a BB212 varicap. Its frequency is controlled by a MC145170 synthesizer. The clock frequency of the synthesizer is 10.240 MHz. It is divided by 1024 to produce a 10 kHz reference frequency. So the VCO is tuned in increments of 10 kHz. The controller software allows you to select the actual step size from a 10,20,100,200,500,1000 kHz sequence. The VCO signal is fed to two NE602 mixers. The LO signal for the mixers is generated by a Colpitts X-tal oscillator at 48 MHz. Two RC combinations of 100Ω || 33pF provide the +45° and -45° phase shift. The output of each mixer is buffered by an emitter-follower. The second mixer also provides the measurement signal.

(the NE602 outputs are used as single ended outputs)

Either I or Q is selected by a diode switch and fed to a fifth order LPF at the LO input of the synchronous detector. This is also a NE602. Another diode switch selects either Voltage or Current to be connected to the input of the detector. The differential output of the detector is fed to a differential amplifier on the controller board. The output is connected to one of the ADC inputs of the controller. The first amplifier is followed by a second one with a gain of 11. Its output is connected to a second ADC input. The controller uses the second 11* signal to achieve a simple way of auto scaling. A rotary encoder is used to set the frequency. A pushbutton acts as a Function key. When pressed and hold down the encoder selects the step size. When released it will control the frequency. Pressing and releasing the function key will select the menu items. The display mode allows the impedance to be represented in a series equivalent ($R_s + jX_s$) or parallel equivalent ($R_p // jX_p$). In addition to complex impedance the analyzer also calculates the equivalent Inductance (in μH) or capacitance (in pF) as well as the SWR.

```
Fr= 14.200 MHz
    313-j150Ω
    74.8pF s= 7.73
1000kHz SER 8.90
```

The bottom line of the display shows step size, display mode and battery Voltage.

The back light intensity is controlled by Pulse Width Modulation. The PWM signal is generated by one of the timers in the controller. Its a very efficient way to control the current supplied to the LED back light

The controllers build in UART is used to communicate with a PC. This function is used primarily to implement a frequency scan. The command send by the PC contains 3 numeric values; Start frequency, End frequency, step size all in units of 10 kHz. For example "400 900 10<CR>" tells the analyzer to perform a scan from 4 MHz to 9 MHz

in steps of 100kHz. The results are reported in the following format : Frequency in kHz, R in Ω and X in Ω (either in series or parallel representation, depending on the display mode) An example is shown here on the right. After a scan the frequency will return to its original setting. The controllers UART is designed to work with level shifters like the MAX232. Therefore the polarity of the in- and output is reversed compared to the polarity of the RS232 TX and RX lines. Simple transistor inverters will work well in most cases. The baud rate is fixed at 4800 bd. This is the highest rate that will work reliably with the internal RC clock generator.

```
9500 969 6<CR>
9600 976 9<CR>
9700 964 17<CR>
9800 969 16<CR>
9900 964 13<CR>
10000 964 16<CR>
10100 967 20<CR>
10200 964 15<CR>
```