THE WEST RAND AMATEUR RADIO CLUB

March 2004
Volume 4, Issue 8

ANODE

Inside this issue:

Special points of interest:

- Contact details on back page
- Boot Sale on the 6th of March. See page 2 for details

Editor's Comments

March 2004

Broken News
The West Rand Boot Sale will be held on the 27th March, not yesterday as reported in the last Anode. It will still take place at 12:00. And you are reminded of the requirement to park in the space outside the fence. Do not block the road access to the houses.

Anode is nearly 4 years old!
Yep, we are nearly 4! Something Philip said the other month has stuck with me; there's no text search on the Anode compendium. It's so useful that I thought I would look into ways of generating it. Also the Anode publisher or html files are now so numerous that I quite often have problems checking if an article has already appeared.

I recently wrote a utility to scan a series of folders (directories) and sub-folders for text files of various sorts. The usual .txt files as well as list (.lst) and ASCII (.asc) files are collected into a list. The program can then process the list of files by reading every file into a 'rich text file' (.rtf), This file which has every text file in it can be used to find any word in any file and provide a pointer to the actual file itself. Unfortunately this utility doesn't handle MS Publisher files (.PUB). Also MS Publisher files don't save the text parts in a logical manner. Any

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NJQRP Antenna Analyzer - II

collection and plotting, and numerous operating modes. Based on the HC908 Daughtercard, easy software upgradeability makes this design attractive for home brewers and antenna enthusiasts. George Heron, N2APB and Joe Everhart, N2CX

A low cost and portable microcontroller-based instrument that automatically measures network parameters to yield SWR and reactance characteristics of antennas and transmission lines. Includes advanced features of DDS frequency control, LCD tuning display, PC data

INTRODUCTION

As complementary halves of a design team working together in the NJQRP club

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suggestions?

The one-second power failures

Escom / Jhb. City claim that their power supply is over 99%. Yeah right! The one second power failure represents a much better 'up time'. But it either reboots or switches off personal computers, causing drives to fail or work to be lost. Roodekrans has been suffering these at all times of the day or night. Time to buy another UPS!

A MORSE CODE SYMBOL FOR THE "AT SIGN"

Computer fanatics who also like operating CW listen up. Radio Currents Online for February 16th says that the International Morse Code is being updated to include a new character for the "at sign". In December, the International Telecommunications Union voted to create the character, which will be known as a 'commat'. The 'commat' is made up of dot-dash for the letter A and dash-dot-dash-dot, which we all know, is the letter C. The two characters are combined with no space between them giving Morse code web surfers an easy way to send an e-mail address or the location of a web page. (CGC)

THE MIKE NEWBOLD, K0YO FUND [Not Just in SA!]

A fund to help 6 meter rover operator Mike Newbold, K0YO. It was set up by a group of hams who value Newbold's contributions by putting his life on-the-line to get rare grid squares on the air. And late last year it almost cost him his life. Bruce Tennant, K6PZW, has the rest of the story:

According to a posting on QRZ.com made for Phil Krichbaum, N0KE , Mike Newbold, K0YO, was vacationing in Baja Mexico just before Christmas 2003. He was savagely beaten with a pipe, robbed and left for dead. The same thugs also killed two Canadian surfers who were camping about 100 yards away from Newbold and threw their bodies and those of their dogs over a cliff.

Kirchbaum says that Newbold crawled 3 kilometres on his hands and knees through cactus and over rocks to a road where he had a better chance of being located. Some surfers from Los Angeles found him the next day. They took him to a medical facility and contacted the police. They then transported Newbold back to California for further medical treatment. Newbold then went back to Steamboat Springs, Colorado, where his son took him for additional medical care and then home for a Christmas eve dinner. Kirchbaum says he has since visited Newbold brought him a 2 meter F-M radio donated by Bob Ludtke, K9MWM. That's where he learned that the value of items lost and stolen in Baja easily exceeds $10,000.

To help defray the cost of replacing Newbold's pick-up truck, camper and ham radio gear that he and Gary Yantis, W0TM have established the Mike Newbold Fund. If anyone would care to make a donation to help get Newbold back on the road to rare grids, please contact W0TM or N0KE. Their respective e-mail addresses are gyantis@midtec.com and pfkski@vail.net.

For the Amateur Radio Newsline, I'm Bruce Tennant, K6PZW, in Los Angeles.

U-O-SAT AT AGE 20

Meantime, there's a big anniversary coming up for ham radio space operations. March 1st marks the 20th anniversary of the UO11 ham radio satellite on-orbit. We have more in this report:

On the 1st March the UO-11 ham radio satellite, which is also known as UOSAT 2 will have been in space for two decades. To mark the event, AMSAT-UK will be issuing a commemorative QSL card in exchange for listener reports from stations hearing the signals during the month of March. The reports must be made by way of the reporting page on the web site and the QSL card will be in the form of

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a downloadable "E-QSL".

By way of background, UO-11 was the second satellite to be launched by Martin Sweeting, G3YJO's group at the University of Surrey in here in England. Its telemetry beacon can still be heard on 145.825 MHz FM using nothing more than a handheld two metre rig. There is also a 2401.5 MHz beacon but signal is not very strong and represents quite a challenge.

Depending on the status of the satellite, it sometimes goes into 'safe' mode, and the beacon transmitters are not activated for days at a time. Because of this, University of Surrey ground station controllers will attempt to maximise the number of days the transmitters are active during the month of March.

For the Amateur Radio Newsline, Rick Johnson, KA9VZD reporting.

An article and pictures about U O11 and the rules for filing reports are available on the AMSAT-UK website. Its in cyberspace at **www.uk.amsat.org** (AMSAT-UK)

NJQRP Antenna Analyser - II

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over the past seven years, we've been fascinated with opportunities that digital computing technology can bring to the design of standard analogue and RF radio equipment, measurement fixtures and QRP accessories. Four years ago we created a prototype of an antenna analyzer – actually the predecessor of the one described here – using relatively state of the art components to create a very inexpensive piece of test equipment.

Since then technology has advanced in the microcontroller world as well as on the RF digital synthesis front. We've dusted off the designs we prototyped back in 1998 and augmented the approach with precision signal generation via a DDS integrated circuit, an LCD for the user display interface, and a much more flexible and powerful microcontroller unit for the computationally intense demands lying ahead.

In this website, we'll present the design and evolution of the Antenna Analyzer II. It is intended to be an extension of the principles, techniques and implementation we presented in a significant technical session at the FDIM 2002 QRP Forum. Our plans now are to finish the initial development over the coming summer months -- complete with pc board and beta trial -- and to offer the project in kit form during the summer of 2003. The target price for the kit is "under $100" ... we'll do our best to achieve this important goal.

Meanwhile, feel free to visit this site often to review the frequent updates that are planned at the project approaches production status. We have fairly thorough technical descriptions, accurate schematics, complete source code listings and application notes for those wishing to construct their own Antenna Analyzer. Many features of our approach will be of interest to QRPers, home brewers and hams all around the world. We hope you follow along in its evolution and provide feedback relative to what you think about it.

OVERVIEW

A good overview of the Antenna Analyzer II project can be seen in the slide presentation we made at the FDIM 2002 QRP Forum. The slides converted nicely to web format and you should get a good feel for the important points of the design. Please let us know if you have any problems viewing the slides.

View the Slides (requires browser ability to view frames, and it may be Internet Explorer-specific)

Download zip file of the original Powerpoint slides (it's big ... 2.6 MB)

http://www.njqrp.org/antanal/AntAnal%20FDIM%202002a.zip

Download PDF file of the original Powerpoint slides (it's bigger yet ... 10 MB)

http://www.njqrp.org/antanal/AntAnal%20FDIM%202002a.pdf

The Rainbow Antenna Analyzer is a small and inexpensive measurement device designed to determine antenna performance across the amateur bands through use of automatically collected SWR and complex impedance readings. The figure below shows the block diagram of the Antenna Analyzer.

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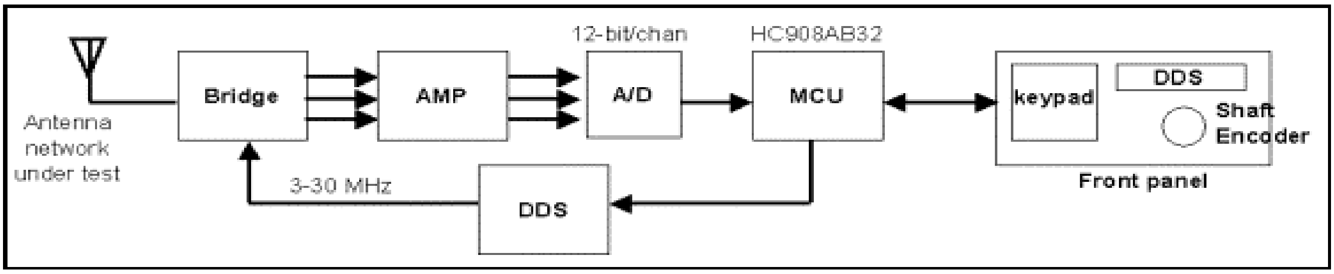

Block diagram of the Antenna Analyzer II

A very low power transmitter is swept across selected frequencies by a microcontroller, and the transmitter's signal is routed through an absorptive SWR bridge to an antenna system – for example, a feed line and radiator. These match indications are input to the microcontroller, which retains the corresponding frequency and SWR readings throughout the measurement period.

During this measurement period, the microcontroller rapidly displays the individual frequency and SWR values on an LCD mounted on the front panel. When all data are collected, the microcontroller statically displays selected frequencies and the associated SWR readings.

The frequency and SWR data may also be downloaded to a PC attached to the Antenna Analyzer via a serial cable. A special software program for the PC collects the data pairs and displays a graphic representation of the antenna performance. This plot clearly shows the resonant frequencies of the antenna system under test. The PC may also be used to remotely control the Analyzer for manual selection of frequencies of interest.

Thus, with a press of a button, the Antenna Analyzer is able to automatically and quickly determine and display the frequency for which the antenna system is best matched, along with the associated complex impedance values at those frequencies.

Manual operation is also provided to allow the user to control the band/frequency of operation while viewing the display of SWR. In this way the relative bandwidth of the antenna system may be determined.

The Analyzer is also able to function as a simple frequency source in manual mode. In this way its signal may be used in troubleshooting various RF equipment.

A unique and exciting aspect to the Antenna Analyzer project concerns the nature of the software used to control the microcontroller. There are a growing number of computer-controller ham radio construction projects being offered today by clubs, small companies and being described in the literature. For the most part, however, they do not provide the source code and design details that are of great interest by a growing number of home brewing amateurs capable of dealing with software modifications and improvements. This Antenna Analyzer project supplies fully documented source code and design methodology for the software used to control the microcontroller. Same too for the software used for the companion remote control and display program in the PC.

The Antenna Analyzer represents a unique, inexpensive and fully functional design for the QRP home brewer community. The Analyzer is a project of great educational appeal - wideband transmitter design and software control of its operation. The low-cost, straightforward and modular design places construction of the Analyzer well within the grasp of a great many amateurs.

Feature Summary:

- Automated, micro controlled antenna analyzer

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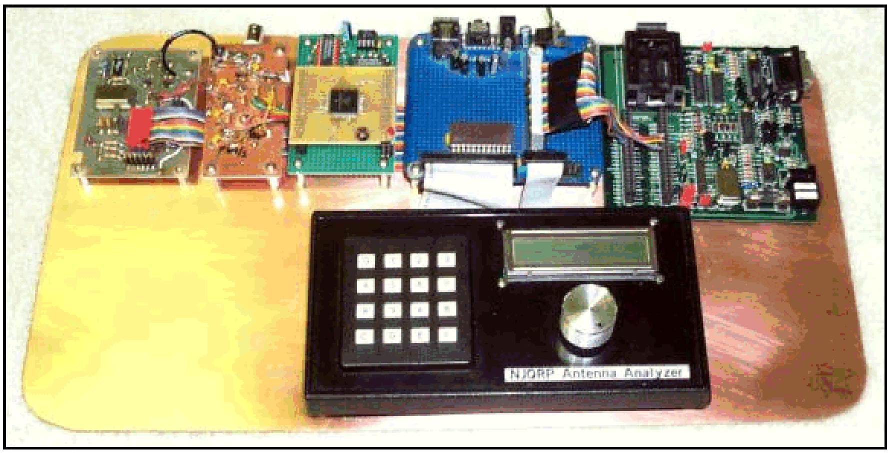
- Wide band, low power transmitter sweeps across HF ham bands
- Utilizes SWR bridge design and circuitry of the Rainbow Tuner
- Multi-coloured LEDs indicate band ... pulsate during scan
- LED bar graph array indicates position in band of lowest SWR Bar graph array also indicates SWR at the indicated frequency
- Serial connection to PC for optional display/plot of antenna performance
- Open software design & source code



BUILDING BLOCKS

We'll describe the Antenna Analyzer in functional sections, per the block diagram above, the schematic, and per the intuitively laid out breadboard used during the early prototyping stages, as shown in the photo below. In this photo, from top left-to-right, you can see the: DDS card, SWR Bridge & Diode Detector, green Buffer Amp card with HC908 Daughtercard mounted atop, blue RS232 and LCD interface card, and the ICS08 ICE debug card from P&E Micro. The top half of the Antenna Analyzer is connected below these boards, containing the keypad, LCD and rotary encoder.

68HC908 Microcontroller Unit (MCU)

We selected the popular Motorola 68HC908AB32 microcontroller as the heart of the Antenna Analyzer project. It was necessary to select such a CISC (complex instruction set controller) instead of a low-end RISC (reduced instruction set controller) like those in the Microchip PIC family. The software already being designed to control the many peripheral chips and I/O functions would be present great programming challenges in a RISC device because of inherent program memory and register memory addressing restrictions. The 68HC908 is the Motorola equivalent of the popular 8051-class of processors from Intel, SST, and others offering plentiful I/O capabilities, unrestricted addressing and high clock speeds. Another deciding factor in the selection process was the massive amount of I/O pins available for controlling all the hardware peripherals in the system – the LCD, DDS, pushbuttons, LEDs, keyboard, keypad, serial port, et al. Eight separate I/O ports provide up to 51 general purpose input and output pins. Many of these pins are software configurable to serve as analogue interfaces, contain integrated pull-up resistors, and couplings to the interrupt structure of the processor. We'll truly be able to work wonders in interfacing the HC908 to all the devices we want to control.

Working in conjunction with the physical I/O pins, the HC908 has some internal macro functions that greatly ease the programmer's job. The microcontroller has built-in modules for asynchronous communications providing an RS-232 serial port, timer modules for frequency counting and timing, programmable interrupt timing for precise interval control, an 8-bit/8-channel A-to-D converter, a keyboard interrupt module, and a watchdog timer. This microcontroller is really quite amazing and is perfect for use on our Antenna Analyzer. Plentiful memory is a must for a CISC microcontroller being used in a large application such as ours. Our HC908 has 32 kilobytes of flash memory that will

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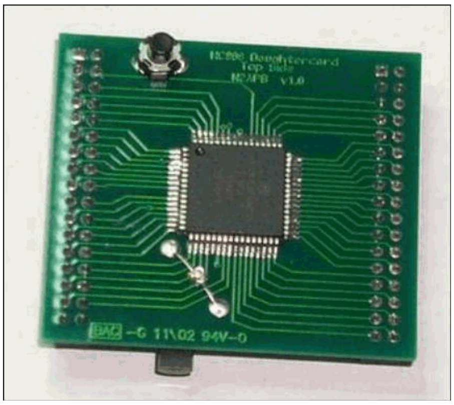
hold the software program itself. There is 1 kilobyte of RAM space available for data variables and other time-changing data. The controller also has built-in EEPROM (electrically erasable programmable read only memory) that will be used to store user-set configuration, calibration and custom string data that needs to be used every time the Analyzer is turned on. From a software perspective, the HC908 supports an enhanced version of the Motorola HC05 programming model. It has 16 addressing modes (direct, indirect, indexed, etc.), a 16-bit index register and stack pointer, and extensive loop controls (e.g., BRCLR n). It supports memory-to-memory data transfers and can perform fast 8x8 bit multiplication and 16/8 division.

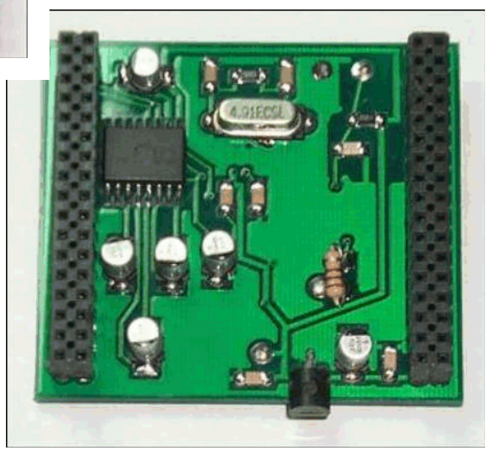
These last two capabilities will prove quite valuable when it comes time to scale input values and calculate SWR, power, and filter coefficients. Finally, the microcontroller's hardware and software architecture is optimized for controller applications and for C-language support as we'll see downstream when the Metrowerks "Code Warrior" development tool is presented. The HC908 Daughtercard We've created a 2" x 2" pc board for the surface mount HC908 microcontroller.

Also contained on this daughtercard are the components required for clock generation, a MAX-232 chip for serial communications, a voltage regulator and a RESET pushbutton. All I/O pins of the HC908 are brought out to edge connectors that permit this daughtercard to be plugged into mating pin headers on a prototype base board containing all other components. Once the design has solidified and stabilized in the coming months, the microcontroller daughtercard can be unplugged and transferred to the pc version of the base board.



HC908 Daughtercard (top view)

This powerful and self-contained module is common to a growing number of NJQRP-based projects The MCU is a 64-pin PQFP device and is soldered in the centre of the card's top side and its many I/O pins are connected by top-side traces to two 34-position sockets located on either side of the card. These long sockets will plug into mating pin headers located on the base board. A small pushbutton is also provided on the top side of the daughtercard. This normally-open momentary contact switch serves as a manual RESET for the system. A "heartbeat" LED is also mounted on the top side of the card, serving as a visual indication that the software application loaded in the module is operating properly. The bottom side of the Daughtercard contains the surface mount components required for clock generation on the microcontroller – a crystal, two capacitors and a resistor. Also located on the bottom side are the LM78L05 3-terminal voltage regulator and associated filter caps, and the components used for serial interface – the MAX-232 level translator for the RS-232 communications port and the five electrolytic capacitors used for charge pump operation.



HC908 Daughtercard (bottom view)

Support circuits are contained on the bottom of this daughtercard module (clock, RS232 se-

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rial driver and voltage regulator). Creating a daughtercard in this manner for the microcontroller proved to be a very enabling decision -- one could easily use the HC908 Daughtercard for other applications.

There is lots of capability in this little 2"-square standalone card – just supply 9-12Vdc and a serial communications line from your PC and you'll be able to download and burn new programs into your HC908 microcontroller.

Getting Software into the HC908 Daughtercard

One of the prime goals for this project was to have the Antenna Analyzer be easily and inexpensively reprogrammed, even after built and used long-term by the home brewer. Of course the unit has ample on-board flash memory, simplifying the board design and making for a non-volatile project. That is, the microcontroller retains its program memory even when power is removed. Getting the software program into the device is sometimes a concern for microcontroller homebrew enthusiasts due to the expense of the "programmer". Oftentimes it's necessary to purchase a $100-or-more hardware board from the manufacturer that will allow you to burn your custom software into the controller's flash memory. In many cases one is able to homebrew this programmer (as in the case of the PIC devices), however this is yet another project that must be done before getting to the fun part of experimenting with your intended project. The good news with our 68HC908AB32 project is that device has the ability to be in-circuit programmed, which means that a conventional +5V power supply and proper timing is all that's required in order to burn a new program into its flash memory ... even while on the target pcb of your project! We've developed a special boot loader program that allows you to download the binary image of your program over the built-in RS232 serial data port connected to your PC. All that's needed is to grab one of the growing "canned" software programs from the NJQRP project website, send it to the Antenna Analyzer and bingo, you'll be running your new and improved program. In this way you'll be able to take advantage of newer software programs that we'll be providing, or you can develop your own customized versions of the programs with the free software development tools on your PC. Pretty cool, eh?

DDS Transmitter

For the short-term bread boarding and experimentation needs in this project, we employed the DDS VFO pc board used by Curtis Preuss, WB2V in his landmark QEX article from 1997. This inexpensive pc board is available from FAR Circuits and contains the near-minimal amount of circuitry required for our application. Most importantly the DDS VFO board has the pc traces for the surface mount DDS chip, enabling us all to easily use the DDS chip within our homebrew Antenna Analyzer. For the production version of the Antenna Analyzer, we incorporated the AD99850 DDS chip right on our main pc board. The DDS circuitry is shown at the bottom of the main schematic. The AD9850 contains a 32-bit phase accumulator, a 14-bit lookup table and a 10-bit D/A converter. It can be clocked at 125 MHz to produce a 41 MHz sine wave output, although we'll use the 66.666 MHz "can" as a commonly available oscillator for now to generate a top frequency of 20 MHz. Be sure to use a socket to mount this can in the pc board so we can later substitute a higher frequency oscillator to allow us to generate up to 30 MHz for the full-HF spectrum Antenna Analyzer. A 40-bit control word is serially loaded into pin 25 using pin 7 as the data write clock. By toggling pin 8 the input register is shifted to the DDS core. The 40-bit control word contains a 32-bit frequency, 3 control bits and 5 phase modulation bits. These bits determine the generated frequency and some software calculation guidelines provided in the AD9850 data sheets. The output of the AD9850 is a differential current on pins 20 and 21. A resistor placed from pin 12 to ground

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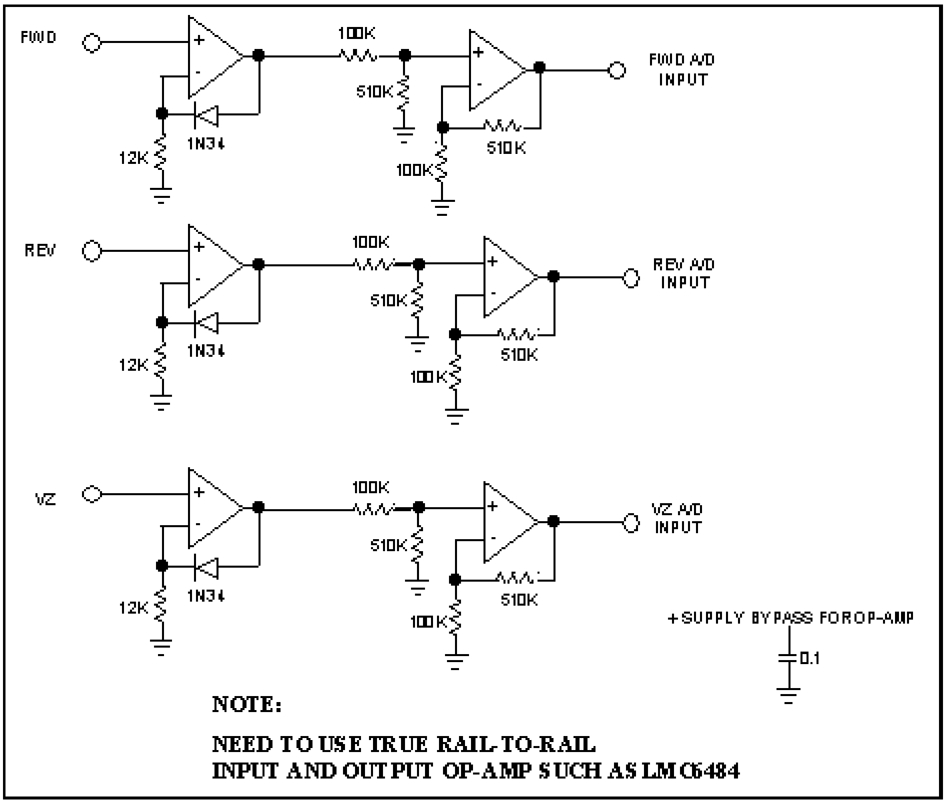
determines the full-scale output current for the D/A converter. Setting the resistor to 3.92K-ohms yields a D/A converter current of about 10.2 mA and a voltage swing of about 250-mVpp into a 50-ohm load. The output of the DDS is a digitized or sampled sine wave. Such a wave shape has strong frequency components at the reference clock frequency plus or minus the output frequency. Filtering out these components produces a clean sine wave. Using a clock frequency of 66 MHz and a maximum output frequency of 20 MHz, the low pass filter must cut off frequencies above 46 MHz while passing frequencies below 20 MHz. A fifth-order elliptic low pass filter used in this circuit has a 55 dB or greater attenuation at frequencies above 46 MHz. The DDS control software is heavily based on the work presented in the Ham-PIC forum spearheaded by Craig Johnson, AA0ZZ, Bruce Stogh, AA0ED and some others. Their ongoing DDS VFO project is popular with the PIC microcontroller crowd. The basic control, display, memory handling and calibration routines used here in the Antenna Analyzer were shamelessly borrowed (with permission) from this group of experimenters. Although the processor is different in our case here with the Analyzer, the same "algorithm" is used to control the DDS chip.

SWR Bridge & Diode Detector

Referring to the figure below, a Wheatstone bridge is composed of 50 ohm resistors with the antenna as the "unknown" leg of bridge. When the antenna is at resonance, presenting a minimum impedance with a pure 50-ohm resistive "real" component, the bridge is balanced and the AC voltages on each side of the bridge are identical. No AC current flows between the legs.

Schematic of the SWR bridge and diode detectors



However when the antenna system is not resonant, the complex impedance of the antenna is not 50-ohms but instead is something greater, which creates a bridge imbalance. The 1N34 diode samples that AC signal imbalance, rectifies it, and after filtering, the DC signal is directly analogous to "reflected" sample of more familiar SWR bridges. We then sample the "forward" power using another diode detector on the original incoming signal. These forward and reflected DC signals are presented to the next stage for compensation, buffering and

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amplification.

Buffer Amp

There are two reasons for employing the op amp circuits shown next. The first amplifier in each path (FWD and REV) compensates for the nonlinearities in the diode detectors when the bridge is operated at very low power levels. These first stage op amps employ 1N34 diodes in their feedback paths to counteract these nonlinearities in the bridge diodes. This action essentially moves the natural knee of the curves closer to zero, thus improving the accuracy of the readings FWD and REF readings ultimately presented to the A/D input on the microcontroller.

Schematic of the LMC6485 buffer amp

The second purpose for the op amps is to amplify. The DC signal levels coming from the bridge, and through the unity gain of the first compensation stage, are fairly low. In order to make the most use of the 8-bit A/D, we need to amplify the detector voltage up to the 5V range of the A/D. Further, the output of the op amp circuits is quite low which provides a better condition when presenting signals to the 10K input impedance of the A/D. (The output impedance of the diode detectors themselves is approximately 100K-ohm. If those signals were directly input to the A/D, they would be greatly affected by the lower impedance of the A/D.)

Building the Bridge and Amp

No special cautions are necessary concerning the construction of either board. In the examples shown below, Manhattan style construction was used to make the bridge, and perf board construction was used to create the amplifier board. N2APB adapted the DDS VFO pc board from the 1997 QEX project by WB2V. In the production version of the Antenna Analyzer, all components are designed to be soldered onto the main pc board.

SCHEMATIC

Referring to the overall schematic for the simple antenna analyzer you'll see the how the whole system is connected together. We think you'll agree that this shows just how simple and straightforward the hardware design can be for an antenna analyzer. The HC908 Daughtercard is at the centre of the project - literally in concept and physically in the schematic. The functionality packed into that 2" square board allows us to design a significantly capable instrument by only adding a few other components.

SOFTWARE

The software program we're experimenting with here is obtainable from this site. You can download the binary hex code as is to yield a basic antenna analyzer instrument as described here. Alternatively, you can use the source code as a starting point for making your own specific enhancements and custom modifications. Let's walk through the algorithm a bit, as seen in the "mainline" routine at the start of the program.

After power is applied and the initialization of I/O devices and variables is done, the mainline of the program is executed. The mainline is a simple loop that performs the following actions over a pre-determined range of frequencies: set DDS frequency display frequency on LCD read analogue signals from bridge/amp compute SWR store SWR in list for post-processing When the scan is complete, the program analyzes the list of scan data to determine antenna resonance (the frequency of the minimum data point) and the Q of the antenna system (how sharp the dip is).

Setting the DDS Frequency

The DDS frequency, phase and control bits are serially delivered to the device via three I/O lines coming from the HC908 Daughtercard: data, clock and load. Per the details provided

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in the AD9850 data sheet, the HC908 delivers these 40 bits of programming information by repeatedly setting the data line to the desired value, and toggling the clock line in order to move the data bit into the DDS chip. After 40 such bit clocks, the load line is toggled which instructs the DDS chip to put that 40-bit programming word into effect. At that point, the output of the DDS changes and the new frequency is present on its output.

Display Frequency on LCD

The frequency is displayed to the LCD by placing the binary coded decimal (BCD) value of each digit into seven sequential locations LCD_dat+0 through LCD_dat+6. These digits represent the 10 MHz position through the 10 KHz position in the frequency display. The LCD driver routines take these BCD numbers and display them to specific locations in the LCD memory, thus making them appear on the display itself.

The numbers contained at these locations represent the start of increment/decrement functions (used in scanning), and in subsequent calculation of the DDS programming 40-bit word (used in setting the DDS frequency.) Read Analogue Signals The forward voltage FWD and reverse voltage REV are merely read as 0-5V analogue voltages by the A/D converters built into port D of the HC908. These 8-bit converters quantize the analogue signal to one of 256 values, based on the analogue signal presented on the respective port D input pin. Thus a granularity of 19.531 mV is achieved. This level of precision is entirely adequate for determining even the low-end knee of the diode detectors primarily because of the compensation diode placed in the second op amp circuit for each signal path.

Compute the SWR Using measured values to calculate SWR means that instrument is self-calibrating. This is a good thing in test equipment! The following simple equations are coded in the software, using the FWD and REV signals read by the A/D.

P = FWD/REV SWR = (1+P) / (1-P)

Computing SWR and Impedance Store the data in list Each frequency sample’s computed SWR and impedance value is stored in a list in RAM memory for processing at the conclusion of the scan. Further, the raw data may uploaded to a PC for additional processing, plotting, display and storage.

PCLINK

A Control Program for the PC Allows Data Upload, Plotting and Remote Control Similar to what we provided in the original Rainbow Antenna Analyzer project back in 1998, the Antenna Analyzer II is able to connect up to the serial port of a PC for uploading of raw measurement data and remote control of the unit. The mode is entered merely by connecting a standard RS-232C serial cable between the Antenna Analyzer and a PC which is running the companion PCLink software provided with the project.

Data Display

After the Analyzer has completed a manual or automatic data collection scan, it may be connected to a host PC which is running software that uploads the frequency/SWR data from the unit and displays a graphical plot of that data on the video monitor. This view of the data will present a more detailed and visually-intuitive representation of the antenna system performance.

Various options are present in the PCLink software package to allow data storage, retrieval and hard copy printout.

Remote Control

The PCLink software running on the host PC allows all operations of the Analyzer to be run from the PC keyboard and display. This mode is useful when the Analyzer is located in an inconvenient or slightly remote location from the operator's bench. Thus, the host PC is a virtual control panel for the Analyzer.

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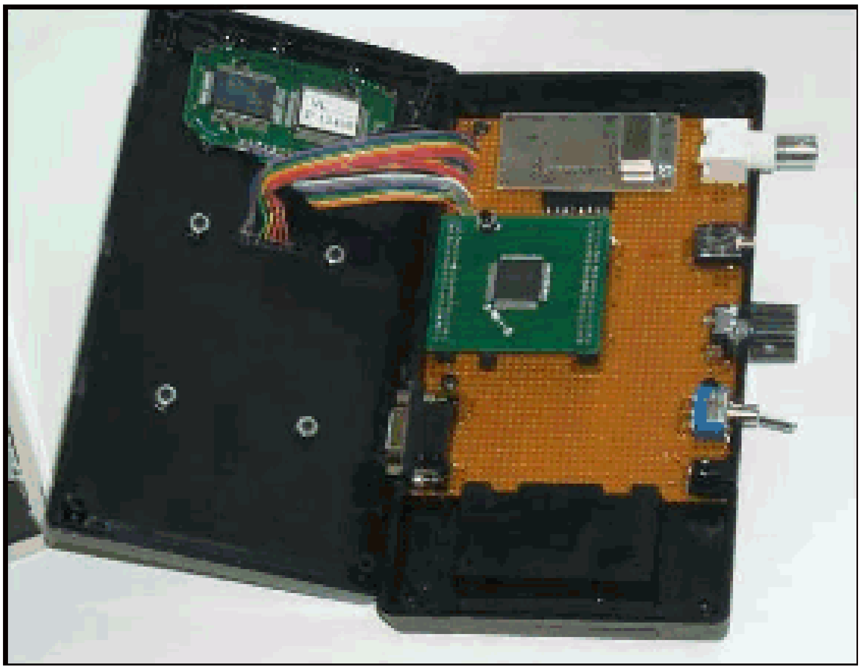
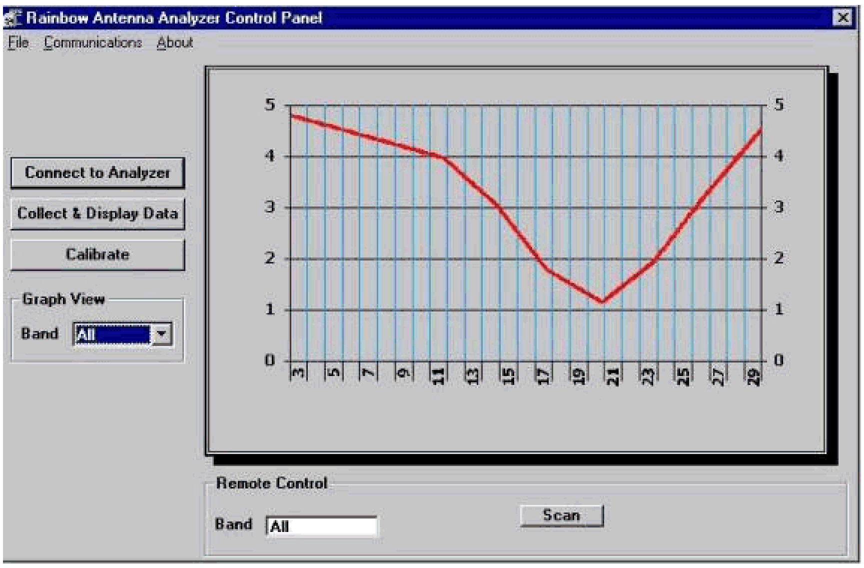


Calibration

The PCLink software package also provides the user with a precise way to calibrate the Analyzer. Specific parameters to be set include: the transmitter frequency, the low and high edges of each band, specific bands of interest (i.e., an ability to select only certain bands to be scanned by the Analyzer), and SWR readings.

There are default values for each of these parameters, so the Calibration function (and hence the PC) is not mandatory. However, great flexibility comes about through use of this facility.

Shown below is a screen shot of the PCLink application being run on a standard PC. The display indicates the collected SWR readings as a red line on the graph. Here you can see the antenna system showing a better (lower) SWR in the 21 MHz region of the spectrum. This data had just been uploaded from the Antenna Analyzer.



The controls on the PCLink screen allow the user to Connect to the Analyzer for subsequent manual control, Collect and Display the Data, Calibrate the system, set the Band for either graph view or for manual control, and to initiate a Scan.

The PCLink program was written in Microsoft's Visual Basic VB6. The project source code and forms files will be posted on the NJQRP website for those interested in modifying the code and experimenting with your own program modifications.

Future instalments of this project series will carefully describe the source code of the Visual BASIC application.

(Continued on page 13)

NJQRP Antenna Analyser - II

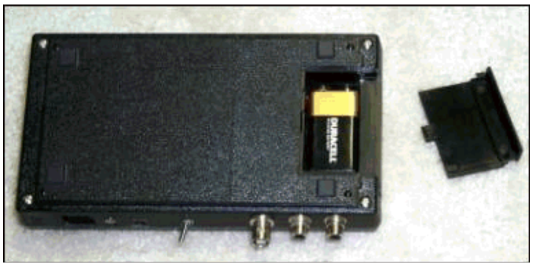
(Continued from page 12)

CONSTRUCTING THE ANTENNA ANALYZER II

The project is in the final prototype stage and the enclosure we've settled on is the PacTec HPL-9VB, as shown below. This neat little hand-held plastic enclosure offers just right mix of portability and internal volume for components, while still letting the unit also contain the 9V battery. The production-version pcb is currently coming in and we'll soon provide a photograph of the Antenna Analyzer containing the actual pc board.

In this vertical-orientation prototype, most controls and connectors are board-mounted for easy, cable-free assembly. The HC908 Daughtercard can be seen in the centre of the board with the keypad mounted over it on the upper half of the plastic enclosure. Also on the top half of the enclosure is the LCD. Both the LCD and keypad are cabled down to the main board. Above the HC908 Daughtercard you can see a DDS Daughtercard being used in this prototype, although the AD9850 DDS chip is soldered to the main board in the production unit of this project. The RS232 "DB9F" connector is mounted on the left side, providing the means for communicating with the host PC for program updates and data dumping/plotting.

This version of the prototype Analyzer was constructed with a horizontal layout. (Picture not shown here) The 16-button keypad serves well for discrete frequency entry as well as for providing lots of pushbuttons in different modes. The rotary encoder on the right provides a convenient method of manual frequency control and menu selection. The 2x16 character LCD is a convenient output device that also serves as bar graph level meter useful for adjusting for nulls or peaks.



The backside of the unit shows where the 9V battery goes. Although expensive, a lithium cell provides much longer operation of the unit when not connected to a bench 12V supply.

CONTACT THE DESIGNERS

Let us know what you think of the project and stay tuned for the introduction of the Antenna Analyzer II Kit by the NJQRP Club during the summer of 2003.

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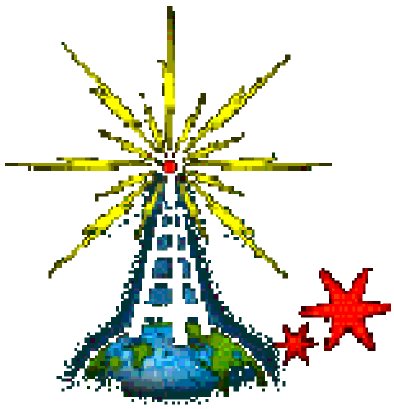
Please send plain text with no formatting to the email address below.

In July 2003, we re-published an Anode Compendium on CD. It has the issues from July 2000 until June this year. This included the new Adobe reader. It has been updated, check with the chairman for details.



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