



LETARC PROPAGATION

The official Newsletter of the Longview East Texas Amateur Radio Club



June 2018

Volume 2018-6

Improved SWR readings on the Arduino Antenna Analyzer – Part IV

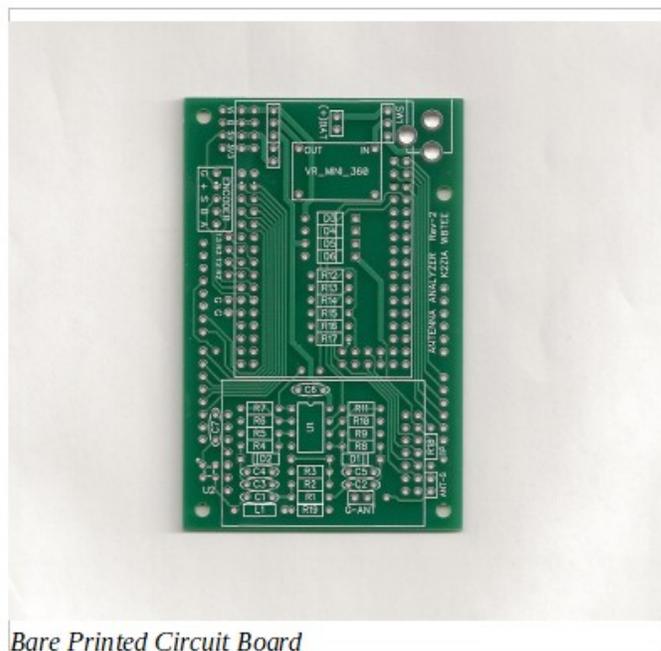
After a few months, I have been able to finally get my Arduino Antenna Analyzer to work pretty darn well. When I first started building this analyzer, the SWRs were off quite a bit and it wasn't a piece of electronic gear I would want to depend upon. There was a collaborative effort with ham radio operators from around the world working on the issues that plagued this analyzer's original design that first appeared in QST Magazine in November 2017. The original design was fraught with some design problems.

Now there are a couple of solutions that make this analyzer a useful piece of equipment to run a quick and dirty analysis on an antenna. One solution that I did not pursue was the use of another Arduino AD8307 board and involved a lot more work. The second solution was devised by Edwin Houwertjes (PE1PWD) who lives in the Netherlands. His solution was the easiest and more practical solution that yielded very good results when analyzing the SWR of an antenna. Edwin provided guidance and advice throughout my endeavor in getting this analyzer to work by providing accurate results. Without his assistance, I would still be experiencing a lot of frustration today. But, the best part about this project is that I made a new friend in the Netherlands who seems to be a really nice fellow. After all, isn't that what ham radio is all about?

Now, let's move on to the antenna analyzer itself by providing a recap of how this project started and what was done to get across the finish line with working unit.

The printed circuit board either comes in red or green colors. The layout is identical for both. It measures around 2.25"x 3.375". The material the board is made of is some pretty stout stuff, but the solder eyelets are something less than to be desired. If you remove components, you must exercise extreme care removing them and be sparing in your use of the soldering iron.

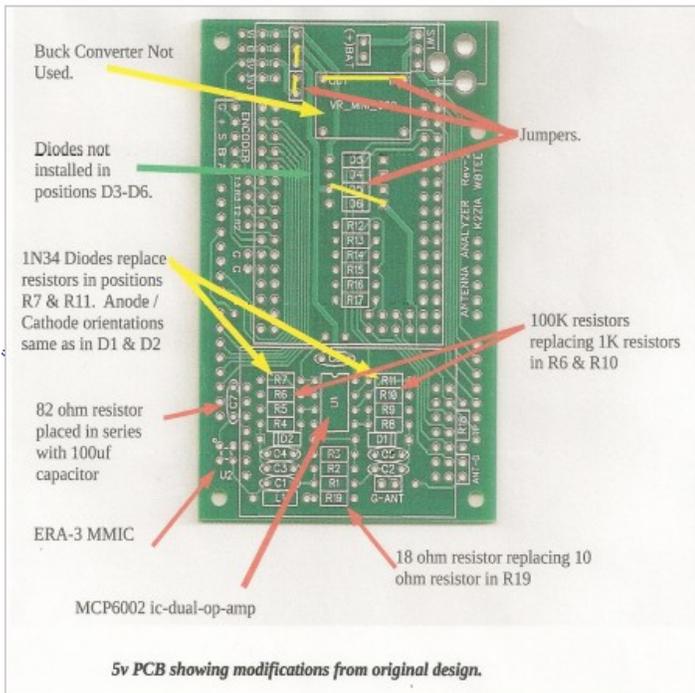
Otherwise, the eyelets will definitely come off and basically ruin your board. If you have the necessary equipment and expertise, the eyelets can be repaired.



Bare Printed Circuit Board

The photo below illustrates the modifications to the board designed by Edwin Houwertjes. His modifications made this board usable so that the antenna analyzer would provide much more accurate SWR readings. Whereas in the photo following the modified board, the original design can be seen. This design has some serious flaws since SWRs are way off and can not be depended upon for providing accurate readings. Basically, the original design did not allow for an adequate signal to be processed by the Mega 2560 Pro Mini board and resulted in low SWR readings.

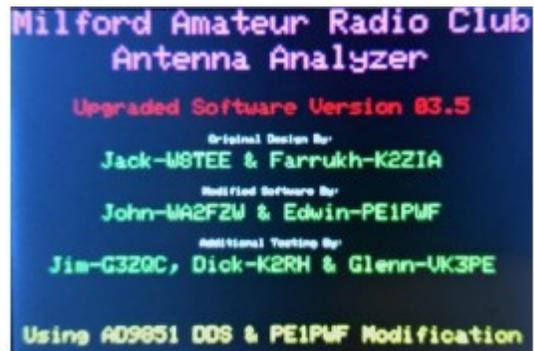
Through the use of a different chip (MCP6002), a more powerful MMIC (ERA-3) and a change in circuitry design, a better signal could be attained for more accurate readings.



The following is how the Arduino Antenna Analyzer is used. Information is presented in an abbreviated format on information obtained from the Arduino Antenna Analyzer User's Manual to present an idea of how it works. These are NOT complete descriptions of the various functions the analyzer is capable of doing.

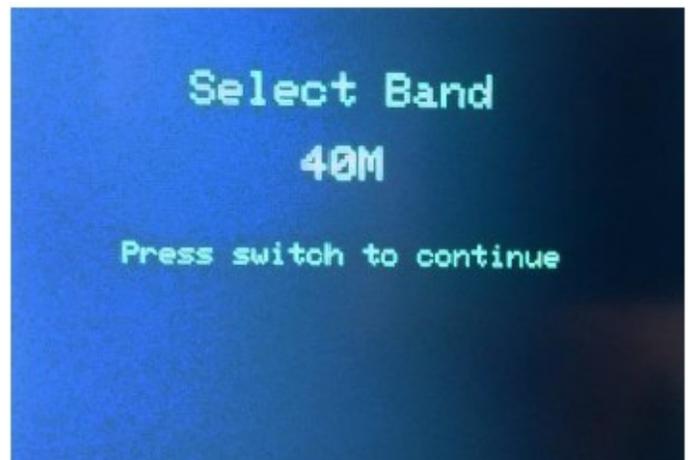
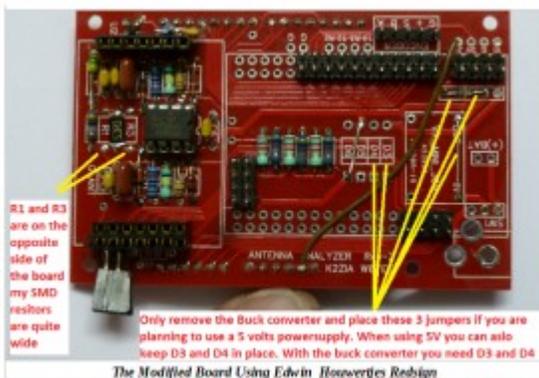
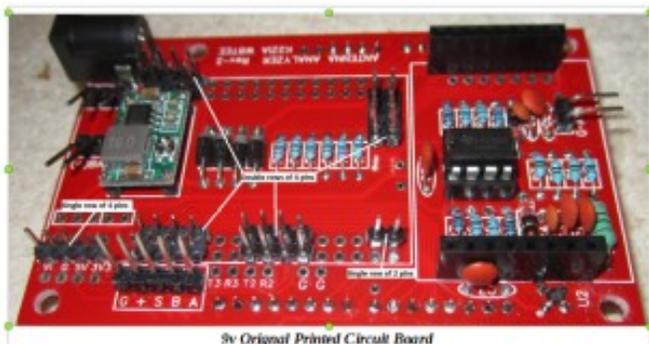
Using the Arduino Antenna Analyzer

Once the analyzer is completed and programmed, it is ready to start up. The first screen to appear is the screen showing all the credits of those who have worked on this project. This is the default credit screen and should be left alone since the developers are due credit for their work. It appears for 3 seconds and then is followed by a screen asking you to select the band you wish to use.



Also, the original design of this board was for use with a 9 volt battery. However, the battery does not last long since the LCD screen used in this project puts a tremendous drain on the battery and after a few minutes of use. Consequently, SWR readings go haywire very quickly. As a result of poor battery life, a 5 volt cell phone batter was used to replaced the 9v power source since the cell phone battery keeps its charge considerably longer. In my analyzer, I can use both a cell phone battery and a 5v Wall Wart.

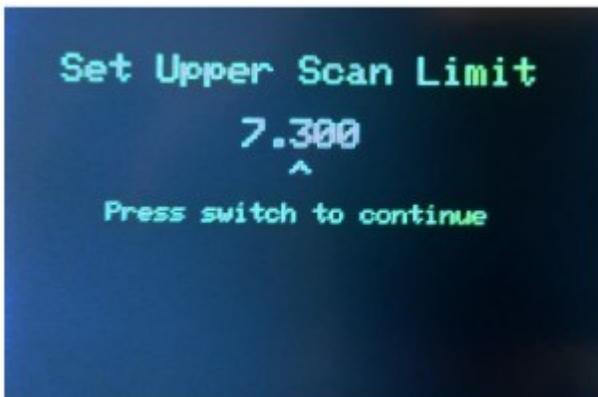
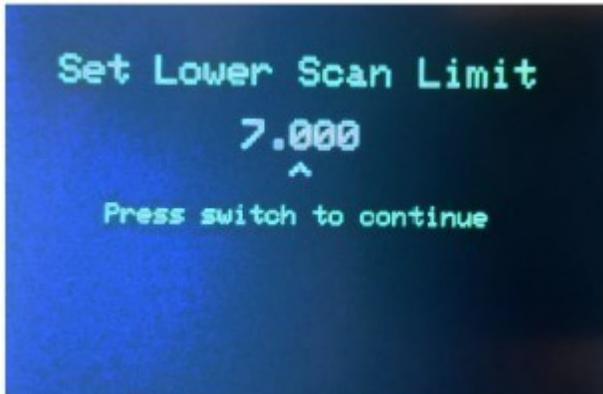
The first time you turn the analyzer on with this software (or if the "Erase EEPROM" function is used) the "Select Band" screen will display "40M" in the selection box. After the analyzer has been used once, the band displayed will be the last one that you used.



It is at this point, the user can turn the encoder knob that is used with this project to change bands. The analyzer has the ability to look at the 160, 80, 40, 20, 17, 15, 12, 10 and 6 meter bands. The analysis of the six meter band must be set up in the

Arduino software and is specific to only the Arduino AD9851 DDS signal generator. If the Arduino AD9850 is utilized, you will not be able to analyze the 6 meter band.

Once you select a band, two screens will appear asking the user to define the lower and upper scan limits. The limits by default are set to the approved FCC band limits. The user can analyze the entire band or smaller segments of the band of his choice. The photo below are for the 40 meter band. The analyzer will not work for frequencies outside the selected band. So, if you want to use 6.9 Mhz for the lower scan limit, the scanner will not allow you to use this lower limit. The same would apply to the upper limit as well.



After selecting a band, you will be taken to the **Main Menu**. There are three items in the main menu, "Analysis", "View/Save" and "Maintenance". At the bottom of the screen the current selected band and scan frequency limits are displayed. There are about five to six choices under each menu item that you can select for different functions.

Analysis – Single Scan

This option will scan the antenna from the lower frequency limit previously set to the upper frequency previously set and produce a graph of the SWR versus frequency.

The SWR values are plotted on the vertical axis, and the frequencies on the horizontal axis. A red '+' marks the minimum SWR on the graph, and the minimum SWR value and the frequency at which it occurred are shown in the heading.

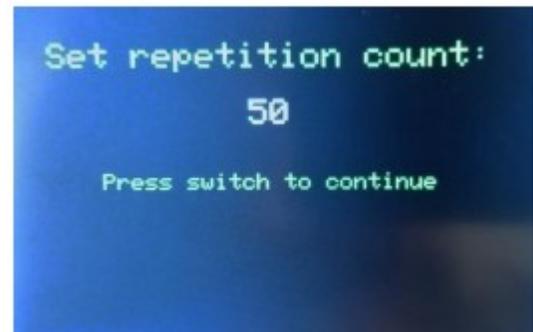
This is a scan of a 40 meter magnetic loop done with the band limits set for 7.0MHz to 7.3MHz.

The graph is shown in a logarithmic scale that is setup in the Arduino IDE software used to program the analyzer. The default is to display graphs in a non-logarithmic (analog) format.



Analysis – Repeat Scans

The analyzer has the ability to "Repeat Scans" any number of times you like (up to a maximum of 100 times). When used, the function will ask you to set the number of repetitions to run. This will allow the user to see if there are changes in SWR over time.



Analysis – Frequency

This selection allows you to measure the SWR at specific frequencies. The display will show the frequency being tested and the SWR for that frequency, and we even added an "analog" SWR meter to the display!



Analysis – Change Band

This option allows the operator to change to a different band and set the frequency range exactly like was done at startup.

Analysis – Set Limits

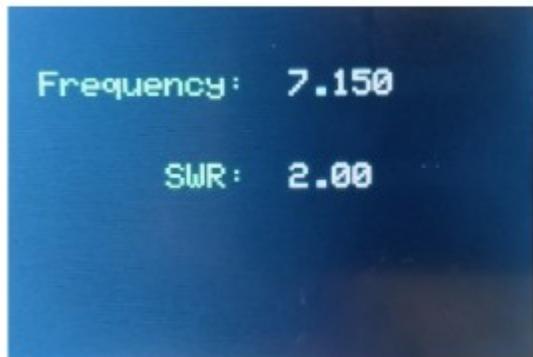
This option allows the operator to change the lower and upper frequency limits without changing the band. It works just like the frequency selection process done during startup.

If the “Fine Tune” option is installed in the hardware, the “Fine Tune” button can be used to cycle through which digit in the number will be changed when the encoder is moved. The digit that will change is denoted by a carat character (^) under the digit.

Analysis - SWR Calibrate

This option will only appear under the “Analysis” menu if you have an analyzer with Edwin’s (PE1PWF) hardware modifications installed and have UN-commented the “#define PE1PWF_MOD” line in the associated Arduino header file.

To use this function, you need to connect a known value resistor to the antenna pins on the analyzer card with very short leads or to the antenna connector. Good choices are 33Ω (SWR should be 1.52:1), 100Ω (SWR should be 2:1) or 150Ω (SWR should be 3:1). **DO NOT attempt to calibrate the SWR with a 50Ω resistor or 50Ω dummy load; it won’t work!**



View / Save Menu

The selections under the “View/Save” menu allow one to save scan data on the SD card or to view the saved data in a number of ways.

View/Save – Save Scan

This option will save the scan range, and the SWR/frequency pairs for the most recent scan in a file on the SD card.

The files are all named “SCANnn.CSV”, where the sequence number “nn” is assigned by the software. Note that the maximum file sequence number is 99. If more than 100 files are created, the sequence number will be reset to zero, and files will be overwritten on the SD card.

The files are “comma separated variable” (CSV) files suitable for reading into Microsoft Excel or other spread-sheet programs.

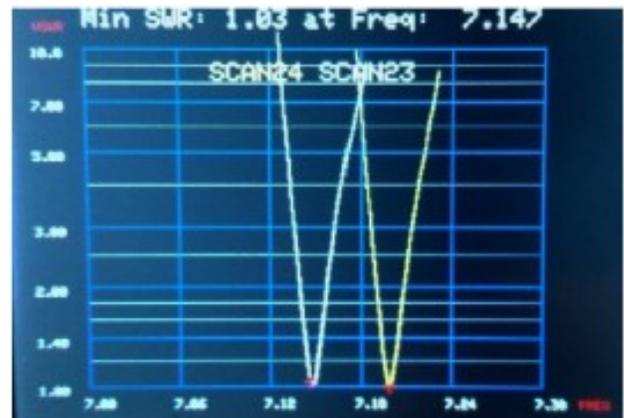
View/Save – Plot

This selection will display a list of the saved scan files on the SD card (up to 20) and allow the operator to use the encoder to select one.

The saved data will be displayed in graphical format exactly as it was displayed when the scan was first performed (picture above), except that the label will show the name of the file from which the plot was loaded. Again, the labels can be turned on or off by changing the definition of “LABEL_SCANS” in the header file.

View/Save – Overlay

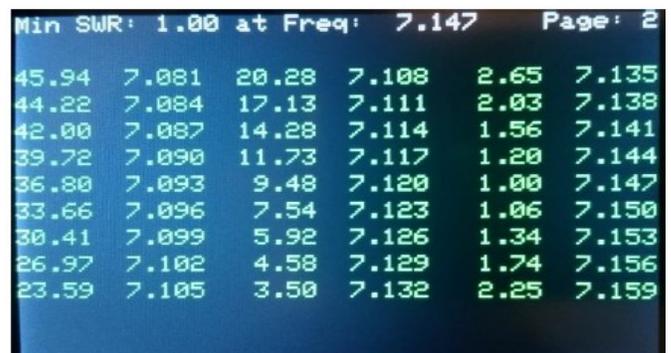
This option can be used to overlay the graphical results of a previous scan over the current one. The SWR curve for the current scan is displayed in yellow, and the overlay scan curve is in white.



View/Save – Table

This selection allows the saved data to be displayed in a table format showing the SWR/frequency pairs for each of the 101 scan points. The output is a multi-page affair. Rotating the encoder will display the next or previous page.

The minimum SWR for the saved scan and the frequency at which it occurred are shown in the header.



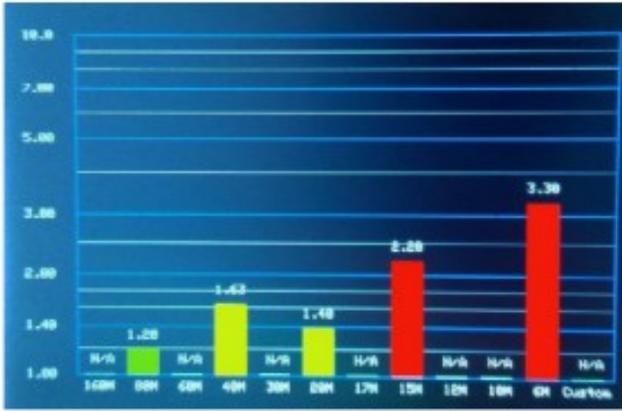
A screenshot of the analyzer's LCD display showing a table of SWR/frequency pairs. The background is dark blue. The text is light blue. The table has 6 columns. The header shows "Min SWR: 1.00 at Freq: 7.147" and "Page: 2". The table contains 10 rows of data.

SWR	Freq	SWR	Freq	SWR	Freq
45.94	7.081	20.28	7.108	2.65	7.135
44.22	7.084	17.13	7.111	2.03	7.138
42.00	7.087	14.28	7.114	1.56	7.141
39.72	7.090	11.73	7.117	1.20	7.144
36.80	7.093	9.48	7.120	1.00	7.147
33.66	7.096	7.54	7.123	1.06	7.150
30.41	7.099	5.92	7.126	1.34	7.153
26.97	7.102	4.58	7.129	1.74	7.156
23.59	7.105	3.50	7.132	2.25	7.159

View/Save – Plot>Serial

This allows the contents of a saved scan file to be sent to the Arduino IDE's serial monitor provided the analyzer is connected to a PC and the IDE is running.

The output is in CSV format. The first line of the output contains the low and high frequency limits (divided by 1,000) for the scan and the remaining lines are the SWR/frequency pair numbers. The output is an exact replica of the data in the file.



The bars are painted in different colors for different SWR readings; a green bar indicates that the SWR is less than 1.5:1. A yellow bar indicates that the SWR is between 1.5:1 and 2:1. A red bar indicates an SWR of 2:1 or more. Those colors correspond to the colors used on the “analog” SWR meter in the “Frequency” function.

Maintenance Menu

Delete File

This allows you to delete a single file from the SD card. It displays a list of the files (only 20 of them if you have more than that on the card; it's an internal limit in the software right now).

Delete All

This choice allows you to delete all the files on the card. It will again display a list of the first 20 files on the card for 3 seconds than take you to a screen to allow you to either perform the operation or cancel it.

Reset Seq#

This allows you to reset the file name sequence number to zero as long as there are no scan files remaining on the SD card.

If there are still scan files on the card, you will be informed of that fact, and the operation will be canceled.

Clear Mins

This allows you to zero out all the saved SWR minimum readings.

Erase EEPROM

As noted in the setup instructions, using this version of the software requires running a program to zero out the EEPROM

memory prior to installing this version. As that also might be required in future releases, I figure it would be a good idea to provide the option under the “Maintenance” menu.

The program detects that the EEPROM is not initialized and takes care of setting things up correctly itself during startup. Note that the function does *NOT* reset the next file sequence number.

EEPROM>Serial

This function reads the data stored in the EEPROM and sends it to the Arduino IDE's serial monitor in a fairly readable format.

Mount SD

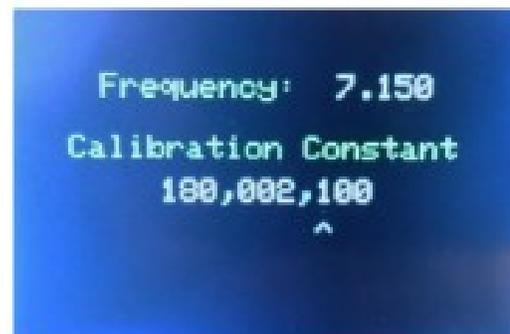
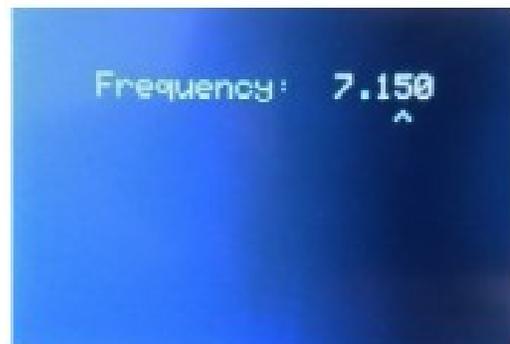
This function allows the card to be installed at any time of the operator's choosing.

Freq Cal

You should perform this function before trying to do any meaningful analysis with the device.

Added in Version 03.3 is the ability to calibrate the DDS frequency. If the frequency is off by a few KHz or so, it's not really a big deal for tuning antennas (except maybe really narrow band ones such as my magnetic loop), however Edwin (PE1PWF) came up with the idea of using the analyzer as a simple frequency generator that can be used for such tasks as tuning IF chains. For that, the frequency needs to be correct.

To perform this procedure, you'll need an accurate frequency counter capable of operating on the band on which you select to do the calibration or an accurate receiver for that band.



Debug

The capability to turn the debugging output on or off via an option under the "Maintenance" menu. This option allows the "Serial.print" statements in the code to be enabled or disabled without having to re-compile and reload the software.

The Finished Product



Since completing this analyzer, there have been two subsequent updates to the Arduino software. The new software includes some additional bells and whistles, but I am not sure whether it will provide any significant benefit from earlier versions.

Suggestion For Builders

As one builds this project, there will be some problems that will pop up that are more aggravating than anything else. In the assembly manual for this analyzer, the on/off switch and encoder are shown being installed in the clear plastic lid to the case being used. Mounting the controls in the lid will cause you noting but problems since you will be opening and closing it several times as the unit is tested and programmed. The solder joints and wires will break after a few times of opening the case.

Instead, it would be better if the controls were mounted on the side of the plastic box as shown in the photo above. The positioning of these controls may make operation a tad more cumbersome, but will definitely stop those delicate solder joints and cheap Chinese jumper wires from continually breaking and eliminate the need to make continual repairs.

Read the assembly instructions at least two or three times before starting this project. Study the pictures in the instructions. You will notice there are some contradictions between the instructions and pictures. Confusion will rule the day until you figure things out. If you build the 5v version designed by Edwin Houwertjes (PE1PWF), many of the components listed in the original design will not be used or changed. Be sure to download his materials from the web link below and look for Edwin's name next to the files.

<https://groups.io/g/SoftwareControlledHamRadio/files/Improved%20Analyzer%20Software>

Web links to the kit

Instructions

<https://qrpguys.com/w8tee-k2zia-antenna-analyzer>

Software

<https://groups.io/g/SoftwareControlledHamRadio/files/Improved%20Analyzer%20Software>

Sort files by date

Final Thoughts

This can be a challenging project even for an experienced individual with an electronics background. There are two ways to get this analyzer to work. I took the easier route by building the board redesigned by Edwin Houwertjes (PE1PWF). There is another alternative build that is said to yield somewhat better results by using an AD8307 Arduino Board. But, going this route was not an option for me due to the increased difficulty.

LETARC MEETINGS

City of Longview Fire Training Facility, 411 American Legion Blvd, Longview, TX.

LETARC's monthly meeting held the fourth Saturday of each month at 0900 at the Longview Fire Training Facility at 411 American Legion Boulevard. Talk-in on 147.34 (+136.5). Presentations, free coffee and donuts and friendship!

The VE Sessions have also been moved to the fourth Saturday of each month at LeTourneau University. The time of the day not not changed. It still takes place at 2:00PM.

Minutes of the April 2018 Monthly Meeting Of The Longview/East Texas Amateur Radio Club

The April 2018 monthly meeting of the Longview East Texas Amateur Radio Club was called to order at 9 am Saturday, April 28th by Vice President John Zenter, AE5OY. Introductions of members and guests were made. The minutes from the last meeting were read and approved after a motion was made by Jim Quinn, AA5CX, and seconded by Marry Jane Burnett, KG5PZR. Next the Treasurer's report for the current reporting period was read and approved after a motion to accept was made by Jim Rogers, N5V6Q, and seconded by Richard Brown, K5RRB.

Guy Navarro, WB5UAA, started off the meeting with a presentation on Ham HF Digital Modes. Afterwards the business portion of the meeting began after a short refreshment break.

Vice President John Zenter, AE5OY, filling in for President Jim Quinn, opened up the meeting.

Risk Strategies (Insurance) 572.83

Total Expenses \$768.12

Ending Balance (as of May 25, 2018): \$11,662.72

1. Jim Quinn gave a report on the progress of the radio room at the MIMS VFD. The room is 10 by 12 and has an 8 foot drop ceiling and could hold up to 3 operators. Jim Perry donated 10 yards of concrete for the base of the HF tower. We could possibly put a repeater on the tower in the future.
2. The Tailgate sale is on the calendar for May 12th at Trade Days at Maude Cobb. In November we will have the Tailgate sale at the Broadcast Museum in Kilgore. This will be a big deal with Chuck Conrad auctioning off electronics from his museum.
3. Field Day is scheduled for June 23rd – 24th. We will have it at the MIM's VFD. Dennis Smith stated that he is having a knee replacement at that time and will not be available to cook this year.

VE testing will be held this afternoon, April 28th, at 2:00 at Le'Tourneau University. The monthly informal dinner will be Sunday, May 6th at Uncle Joes Restaurant at 6:00. With no further business to conduct, the meeting was adjourned at 11:00 am.

Treasurer's Report for April 26, 2018 to May 25, 2018

Brought forth from the last reporting period: \$12,169.55

Income for this period: \$261.29

Membership Dues (Renewals):

Jason Litton	\$25.00
Ron Case	25.00
Dennis Smith	25.00
Jeremiah Hunter	25.00
Reimbursement	161.29

Total Income: \$261.29

Expenses for this period:

Donuts for monthly meeting (Adan's)	\$34.00
BJ'S Restaurant	161.29

EVENTS AND CONTESTS

June 2018

9-11 June VHF

16 Kids Day

23-24 Field Day

<http://www.arrl.org/contest-calendar>

REGIONAL CLUBS

Click on underscored name to visit site.

Tyler <http://www.tylerarc.org/>

Nacogdoches <http://w5nac.com/>

Athens <http://www.athensarc.org/>

Cedar Creek <https://k5ccl.wordpress.com/>

Marshall <http://marclub.net/>

Minden <http://www.n5rd.org/>

Shreveport (ARCOS) <http://www.qsl.net/nw1arn/arcos.htm>

Shreveport (SARA) <http://www.k5sar.com/>

Rusk County (Henderson) <http://www.ruskcountyarc.com/>

Four States (Texarkana) <http://www.4444sarc.org/>

Palestine-Anderson County <http://www.pacarc.org/>

Navarro, Freestone, Limestone and Leon County

<http://www.nflarc.com/>

Panola County (no website)

LeTourneau University – LUARC (no website)

Other Ham Clubs

Fond du Lac Amateur Radio Club, Fond du Lac, WI

<https://www.fdlhams.com/>

The Rare Ones Of New Orleans

Do a little rag chewing with a group of really nice fellows on 40 Meters – 7.260 Mhz (+/- 5 khz) – Most Evenings About 1930-2130 CST.

<https://therareonesofneworleans.loga.us/>

LETARC-To Support Upshur ARES

During the May 2018 LETARC general membership meeting, it was voted upon to support the Upshur- Gregg Amateur Radio Emergency Service (ARES). Below is information regarding when on the air.

Longview East Texas Amateur Radio Club
www.LETARC.org
and
UPSHUR-GREGG AMATEUR RADIO
EMERGENCY SERVICE
N5TQI@aol.com
VHF 147.34 Pos 136.5 tone
LETARC Net: Wed 8:30 pm ARES Net: Thurs 8:00 pm
Message Traffic: www.7290trafficnet.org

Upshur-Gregg County Yamboree- ARES

The Upshur-Gregg ARES, facilitated by LETARC, is setting up a radio station on the Yamboree grounds in Upshur County on October 18-20 for three days from which we will conduct VHF and HF communications with a special event call sign. The station will attempt to do three things: Recruit members for LETARC, Introduce ARES to the community it serves, and acquaint visitors with HAM radio. The event is made possible by the efforts of many members of LETARC so it should actually be considered a LETARC public service and recruiting event.

Next LETARC Tail Gate Sale

This event is co-sponsored by the Regional Amateur Radio Clubs and the **Texas Broadcast Museum**.

When: Saturday, November 10, 2018, 7:00 AM till 12:00 PM

What: Free tailgate sale. Bring all of your new, old, & used amateur radio equipment that you would like to sell. This is an outdoor event and will be held rain or shine. **The Texas Broadcast Museum is planning on having an auction to sell off lots of stuff that are duplicates, triplicates or just not of real interest to the Museum. There will be various old radios, video and audio equipment people will find interesting. Vintage Radio & Phonograph Societies from Dallas and Houston have been invited to attend. There is a \$5.00 donation to tour the museum.**

Useful Links

LETARC Web Site
<http://www.letarc.org>

Radio Tools and Utilities for amateur radio operators
<http://www.dxzone.com/catalog/Software/Utilities/>

eham.net – Product Reviews
<http://www.eham.net/reviews/products/41>

Android Apps – Tools
<https://play.google.com/store/search?q=ham%20radio%20tools&c=apps>

ARRL
<http://www.arrl.org/>

Freedom Link

<http://www.freedom-link.org/>

Testing – Get Upgraded

LETARC is working with LeTourneau University to help with facilities for VE testing. We would like to extend our sincere appreciation to the University for helping facilitate this endeavor.

Directions to LeTourneau Campus



Upon entering the main entrance to the campus, turn right at the stop sign and follow the road around past the Solheim Center parking lot on the right to the first intersection. The building across the street and to your right is Glaske Center. Turn

right and go to the parking lot at the rear of Glaske Center. Enter Glaske Center rear entrance and go to classroom 103.

Now that you know where the place is, why not study a little and upgrade your license. If you have a Technician's license, you can upgrade to the General. And if you pass the General exam, the VE Volunteers will offer you the opportunity on the day of your exam to test for the Extra at no additional cost.

Where: LeTourneau University Glaske Engineering Center – Classroom C103.

January is membership renewal month. Please complete the form on the following page to renew your membership and mail your check to the address shown at the top of the application. Application on last page.

LeTourneau University is located on 2100 S. Moberly Avenue in Longview, TX.

LETARC CALENDAR

June 2018

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
					1	2
3	4	5	6	7	8	9
10 DINNER NEW DAY FOR GET TOGETHER	11	12	13	14	15	16
17	18	19	20	21	22	23 LETARC MEETING VE SESSION
24	25	26	27	28	29	30

Calendar Detail

Sunday, June 10, 2018, 6:00 PM– Posados , 110 Triple Creek Cir, Longview, TX 75601 NEW DAY FOR DINNER GET TOGETHER.

Saturday, May 12, 2018 – Ark La Tex Tail Gate Sale – Longview Fair Grounds, 1123 Jaycee Dr, Longview, TX 75604

LETARC MEMBERSHIP APPLICATION
PO BOX 5613
LONGVIEW, TX 75608-5613

Membership: * New * Renew

Calendar Year: 2018

Date: _____

CALL SIGN: _____ LICENSE CLASS: _____

LAST NAME: _____ FIRST NAME: _____ MI: _____

ADDRESS: _____

CITY: _____ ZIP: _____

TELEPHONE: _____ CELL PHONE (optional): _____

E-MAIL ADDRESS: _____ DATE OF BIRTH: _____

ARRL MEMBER? * YES * NO

=====

TYPE OF MEMBERSHIP (check one)

- Full Membership: \$25.00 per year. A full member shall be an FCC licensed Amateur Radio Operator
- Family Membership: \$35.00 per year. A family membership is available to members of the same family, provided they reside at the same residence. Each member has the same privileges and same membership requirements as a full member.

Privacy: Member names, addresses, (including e-mail addresses and other personal information shall not be supplied to any third party without expressed consent of the individual.

Signature: _____ Date: _____

=====

Please list **all** of your Amateur Radio **Interests:** [Examples: Contesting, CW, 6 meter, 1.2 GHz, Kit building, ISS, AMSAT, Emergency Communications].

Entered master database;__ Confirmation letter sent:__ Entered master email list:__

For use by LETARC