

The Integration Article - P1



SDR Zone

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Like the new Project Ettus article, I plan to run this article in similar fashion, in parts. This is a lengthy topic and I believe that providing it in pieces will enable me to provide you a better reading experience.

What's this article about?

One thing we can do as hams is create an elaborate and extensive set of hardware and software tools on our desktop that we can use while we ham. The goal being to make life easier or more fun while we ham,

augment potential limitations in our station and create the station we enjoy operating.

While the scope of this focuses from an SDR vantage point, the scope of what will be covered here can also be applied and used with quite a few non SDR ham radios!

I wanted to set some ground rules upfront for this article. I do understand in covering this that many hams will just believe that as far as software goes, a desktop like this is a cluttered mess of pure nonsense.

I do respect the right to see it that way and am in no way advocating a ham needs all this. It's possible this article will just not be of interest to you and that's okay. I don't plan on apologizing for how the article is written, and even for any inaccuracies that it might contain. All I write here is in the spirit of sharing and serves as entertainment for many hams who write me offline asking questions.

Perhaps this article is for those hams like myself that like to build, enhance, tinker, ect. Last, I will qualify my attempts here by simply saying that this is one of the enjoyments I get out of hamming. Pulling together an elaborate set of hardware and software packages and getting them all to play with each other as an operator in a meaningful and useful way has provided me several hours of fun and enjoyment.

Before we dig in thought let's talk about the notion of integration, the future of SDR's and contrast them to the non SDR nonintegrated experience.

While completely obvious, let me briefly paint the non SDR experience for a moment and then paint the contrasting view of the integrated SDR experience. We will work our way to the future discussion after we spend a few minutes talking about the present.

Hams for years have simply acquired a radio, a mic, and/or key, antenna and combined them to create a basic shack. That ham would hook it all up, tune to a frequency, listen and then transmit. This was done by either going to a known frequency, or scanning a given band by turning their tuning dial (VFO knob) on the radio until they found a signal, either CW or voice.

Pretty much radio 101 correct?

Radio in general hasn't changed much over the years and even in most automobiles today the radio built into the car has a basic tuning mechanism and we use that to either scan for stations or tune to known stations.

As ham radio evolved, we saw additional features, filters, signal processors ect to make the reception better. In ham radio we invented new operating modes and this is where I will just stop before I put you to sleep.

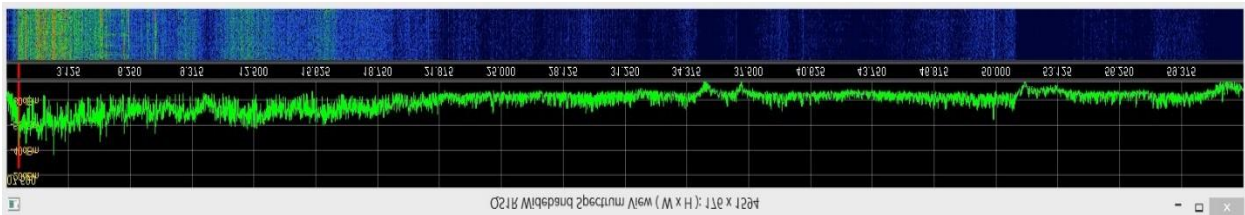
Enter the SDR and this is really being discussed from an operating paradigm and not really from a technology perspective, so please keep that in mind as we move forward. What it fundamentally introduced that is different and can also be added to many non SDR modern rigs by tapping into their IF/IQ signal, is a panadaptor display.



With this advent we could now visualize a portion of a given band or swath of spectrum. This allowed us to actually see the signals bouncing up and down on a display. Greatly shortcutting to the point here, we could click or

tune to the signals we were seeing rapidly or also see a slice of the band had no significant traffic at all and thus tune further up or down the band until we visualized a signal we could tune.

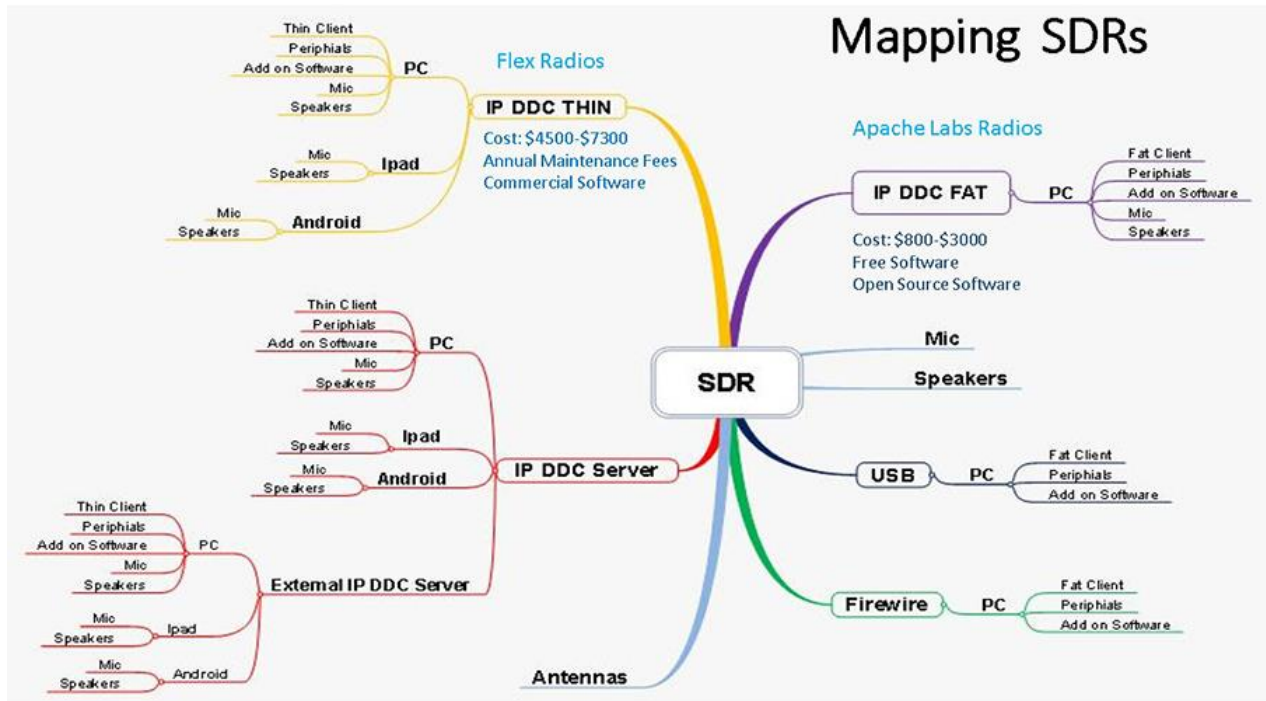
Suddenly we had eyes and as SDRs have evolved we have been given the capability to see more and more bandwidth of a given band. In my case there are instances where I can see the entire HF spectrum in a single view or entire bands at a glance. Wow! Looking for someone to communicate with, how's that for ease of finding someone else on the bands?



Still, I do understand that this does not appeal to everyone and that is ok. There is a little more magic to stumbling on a signal while turning the dial and there is nothing wrong or more right about one way or another. They each have the merits and limits.

In the integrated desktop we take the notion of augmenting hardware and adding more information to operate with by adding additional hardware and software. That allows us to see propagation conditions, and with spotters which allow operators to report their QSO's to a central server that in turn all hams can see and use to help them tune to an active DX without having to hunt it down themselves.

In my own world and this article, we go even further by using the computer to also process the audio we receive and transmit to improve communications.



Much has been made about how the new Flex 6K series of SDR radios are going to further change the game and so its worth discussing for a moment in the context of this article.

The real big difference here that I want to point out revolves around a few key points.

The first is that the new flex radios are radio servers. The computing is done inside the radio and a software program that is greatly skinned down is provide to the user either on a computer or a device. In contrast other newer radios such as the Anan's and similar continue to use your computer or device to also process the signals it receives.

So the new Flex does it in its own on-board computer and sends only the relevant data, primary audio, to your device where as the others non server based do all that in your computer and or device.

Integration in the context I am describing really doesn't have to be different for the two different paradigms and in fact, a Flex 6K user might have the same desktop, functionally speaking, as an Apache-labs SDR user.

Some details may change, CAT control, as well as other protocols, however, the concept I am discussing here truly is integration and I say that because in many cases we can also integrate quite a few of today's traditional non SDR rigs in similar fashion.

Many hams in fact having been doing this for years and so I am not really describing anything all that new, this is really an attempt to bring it all together for newer hams or hams new to SDRs.

In part 2 we'll actually start exploring the desktop and hardware and some basic integrations.

Integration Article P2



The Zone!

Welcome back to Part 2 of the Integration Article.

In the last installment we talked about integration in general, a bit about SDR's and laid the foundation and terms under which the article will

explore integration. If you missed it, you can find that article here [The Integration Article - P1](#)

So let's journey forward and see if I can leave you with a few ideas, be it for SDRs or for your Icom or Yasue rigs with panadaptor display.

The picture above is a Windows 8 screen shot of a desktop that spans 4 monitors, each being 1600 pixel wide. Each monitor is 21" and set to 1680x1050 resolution. There is a 5th USB touch monitor running and oscilloscope.

What you will not see here is that I also have several other programs running underneath these or as background tasks. These are programs such as DDUtil, Virtual Serial Ports and Virtual Audio Cables and other software helping tie everything together behind the scenes.

Even though this is my desktop for voice SSB operations, its important to mention all the software as they are in fact used in other operating modes as well. All of this works with either the Anan I am using or other SDRs with the simple flip of an Antenna switch. There is no reason why much of this can't be used with other SDR's or even knobbed transceivers for that matter. In fact, I have used much of this with a KX3 with NAP3 (SDR Software that works with the KX3) to operate the KX3 just like my other rigs.

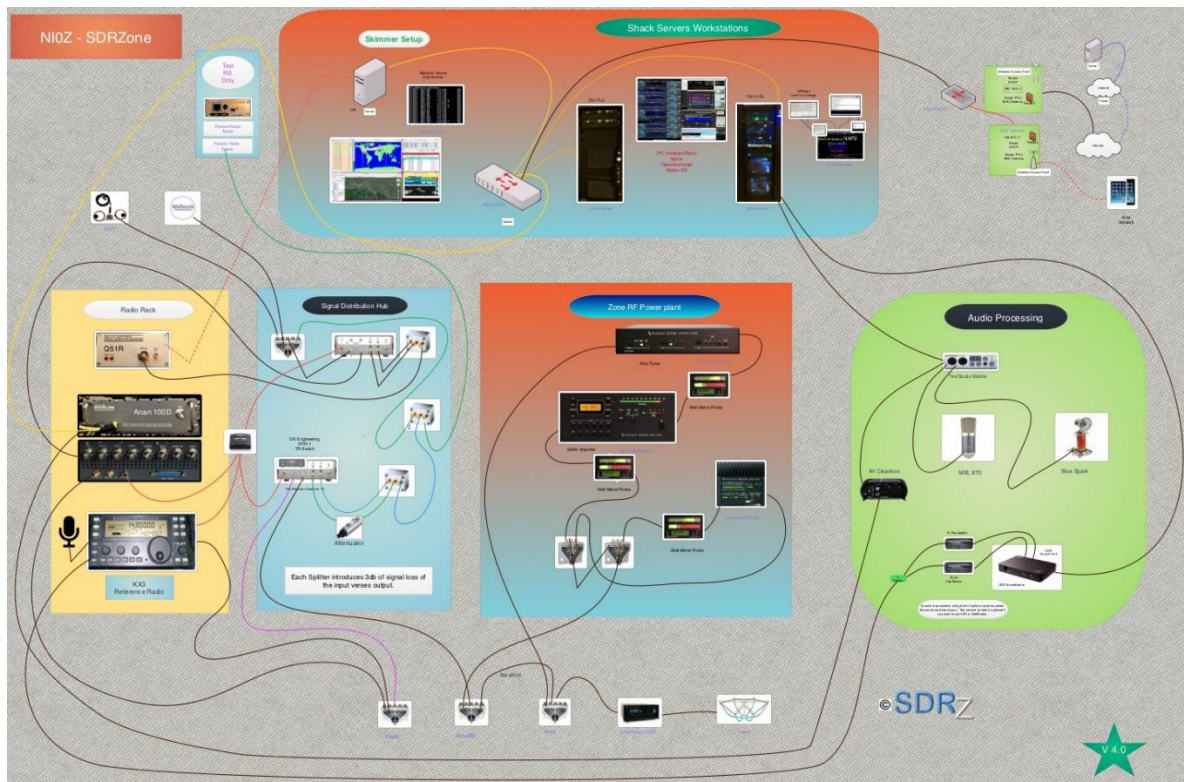
Hardware

Before we dive into software in detail though, its important to talk more about the hardware side of the equation first.

Its a good idea to map your system out before you attempt to connect everything. If your going to build up to a grand system, it helps to plan it ahead of time on paper first. This will allow you to think about

expandability upfront making it easier to plug in new equipment as you go!

This is the latest blueprint for my shack, it was created using a program called Grafio on the iPad. See the [shack diagrams](#) article for more information on building diagrams.



Note that this diagram is my 4th generation diagram and has taken the approach of functionally dividing equipment by high-level purpose. The desired effect is to make it easier to see and understand as well as map a complex shack like mine. As you can see there is a network of switches that enable the connection of multiple radios to multiple pieces of equipment and antennas. Had I not mapped this out and looked for the most streamlined way to connect my equipment, it would have resulted in

several more switches. Each insertion of a switch or splitter causes loss, so efficiency with this regard is important.

Looking at the Signal Distribution Hub in the diagram, you'll see several devices, these are splitters and TR switches that allow me to use the second receiver on my Anan 100D while also feeding the QSR1 or other radios at the same time and protecting them all from transmit RF so I don't blow out the receivers. The net result is that I can be running skimmer along with two receivers on the Anan. Skimmer lets me see real time CW stations on a world map, this providing some resemblance of a real time propagation map. You can get more info on skimmer in the forums here and the QS1R review.

In the SDR world up until recently, we don't usually see knobs on SDR Radios. Newer SDRs seem to be trending that way, however, many don't have them and ironically it can be one of the major deterrents or reasons people get in and out of SDR radios. The assumption for the most part is that you'll use your computer to control the radio. That translates to either the keyboard or mouse for tuning. Many just don't like this and fortunately there are solutions to this.

Linked Image DJ Control MP3 e2 - Click to vist!

The more common solutions are the [Griffin Powermate](#), Flex has a [Flex knob](#), WoodBoxRadio sells the [T-mates](#) (there are two versions) and then Power SDR can leverage a [Hercules DJ](#) panel to assign knobs to various functions in PowerSDR. These solutions require either a CAT connection or in the case of the latter DJ panel, a Midi Interface which in this case is handled over a USB Connection to the computer.



[Linked to Griffin Powermate - Click to vist!](#)



Image Linked from WoodBoxRadio - Click to vist!

One thing to mention here, you may miss your knobs at first, however, after awhile, you may learn to go without. As time goes by I depend on them less and less. One thing they are still great for is fine tuning. Also of note, in some SDR software programs they require you to have the window actively in focus in order to use them. I remember in Flex PowerSDR for example, I had to have the window active. In PowerSDR MRX with the Anan I do not. What this really means is I can be using a logging or other program and use the knob with PowerSDR MRX, however, with the Flex PowerSDR, I could not.

With many radios we also don't see built in soundcards for digimodes like PSK, RTTY, ect. I won't cover all these devices, however, its worth mentioning this in case that is an interest of yours. With SDR's we do this

with software as usually audio from the SDR is already created within the PC and passed via virtual audio cables.

You might find this [link useful](#) for setting up a digital station and also this guide to setting up [digital mode software](#). You may have to login to the zone to access the latter.

Speaking of PC's, you need one for all this and the more you want to integrate, the higher performance PC you'll need. I have an [article here on SDRZone](#) that does a good job of introducing the topic which you can refer. It walks through shopping for an SDR PC. The full [SDR PC Guide](#) is located here by logging into SDRZone.com If you want to keep your footprint small, consider a computer like this one to keep costs and space limited!

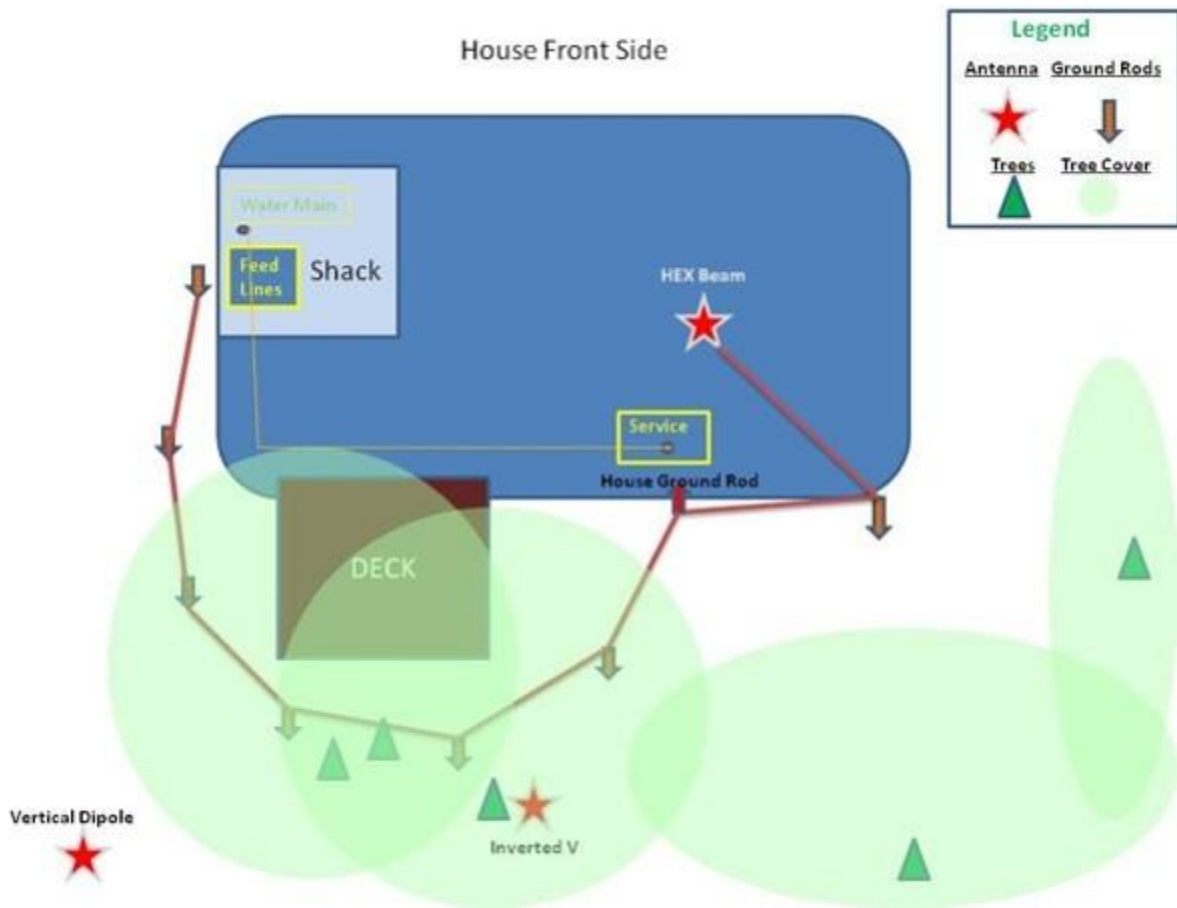


[Linked Image - ITX PC from MITXPC - Click to visit!](#)

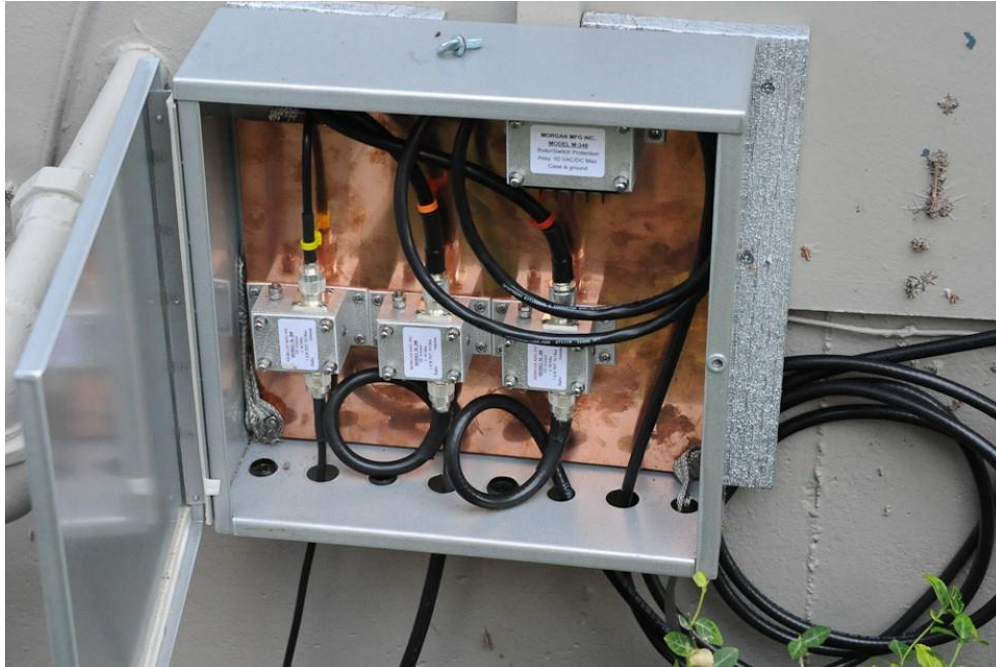
As you can begin to see, this is a vast subject to cover correctly and there is little point in me duplicating content that is already available, so lots of links have been embedded in this article for your reference.

One thing I really have not discussed yet is thinking about the location of your station and its grounding system. Below is a picture of a grounding system I had to develop due to my Antenna and Shack Logistics. I had to account for where my shack could be on one side of my house, and where my Antenna could be on the other side. I had to consult with Several hams about this setup since there are multiple grounding rods. The rods are all doped with salt and attached and spaced to ensure I have a true common

ground point for both the Antenna on the roof tower and the station in the basement. The huge hex beam had to be placed on the other side of the roof to keep it out of tree branches harm! A roof tower was used to ensure everything could withstand the winds we get here in Kansas.



You might want to consider a good box to run cables into the house and provide lightning protection as well. Make sure you get a box with a lock to keep people out!



My new hex beam antenna and grounding system helped lower my signal noise floor from S8.5 to S5 and lower depending on the band. Definitely worth considering if your wanting to design a high-performing station. Much easier to hear an S7 Signal when your noise floor is S4 than when the noise itself is S8. A cheap Yaseu rotator was used for the roof tower and beam.



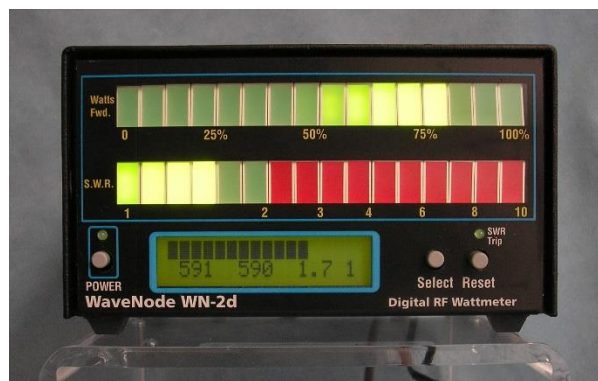
If you want to get into Software Defined Audio, you can look [here](#) and find the sections on hardware. I will be covering some of the software defined audio I have implemented in my shack here within the article.



Hardware wise there are Amps, Antenna Rotators, Watt Meters, Switching Controllers, Weather Stations, and other devices that can be integrated into one's station. Some hardware and its software I have implemented will be covered later in the article. It will serve as a reference of what you can do and explore for your own station. Below are some images and links of equipment used in NI0Z's shack. The Rotator and Watt Meter have software access on the computer desktop.



Green Heron Engineering - [Rotator Controller, Deluxe](#) - Click to visit!



WaveNode - WN-2d Wattmeter - Click to Visit!



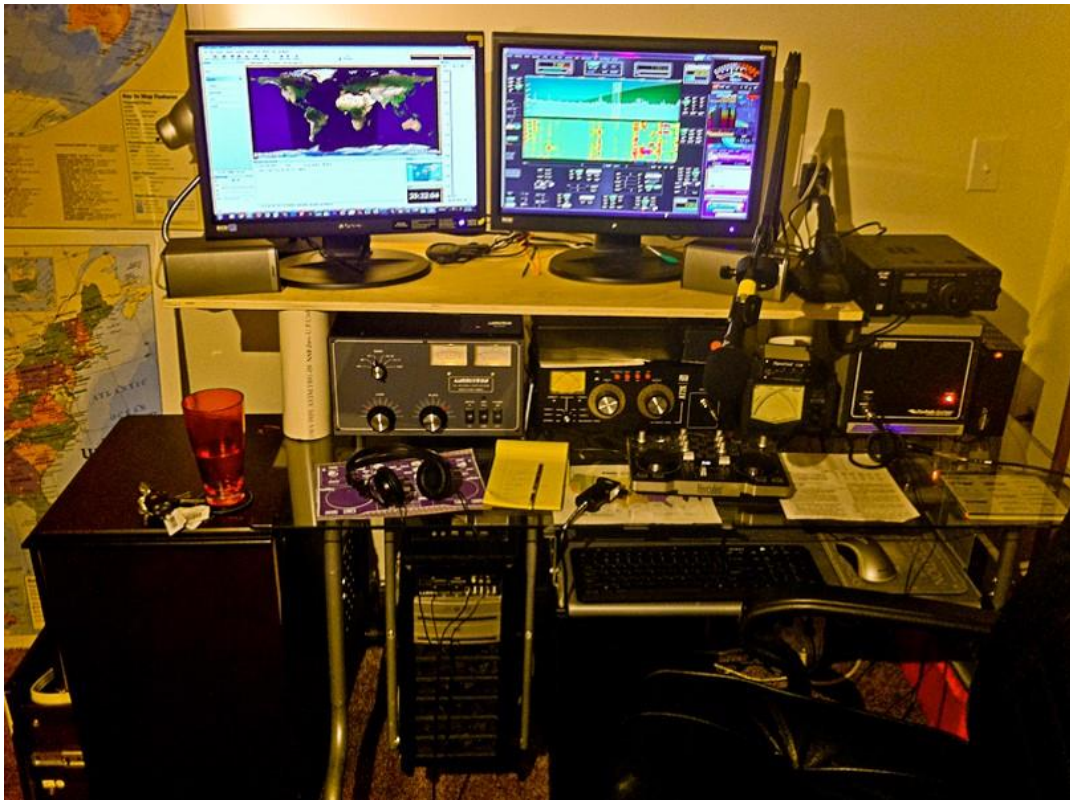
Elecraft KPA/CAT 500 Amp and Autotuner

For the new ham that asks, what's next after they get their license, this article can be an answer until itself of all the things one can get into, buy/build and explore. While all this can cost a fortune, one doesn't have to have it all at once and can build much of it themselves which in itself could keep a new ham busy for years and years. For that matter, I have spent hours upon hours plotting out my station in those diagrams and slowly built it into what you see today.

Lets take a look backwards of how the station evolved!



2011



2012





2012



2012-3



2014

As you can see, things evolved over time and still are! Right now I am very happy with how the station functions and have pretty much technically covered all my wishlist. You can see at one point the station was very visually appealing and is less so now. This is really the next project that lies ahead, and that is to go back to more of a desk single rack world. Specifically though, I think I will get rid of one rack and add another desk. This will give me the look I am now seeking!

Now that we have covered hardware at a very high-level, we'll explore software in part 3.

Stay tuned!

Integration Article P3

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The Zone!

Welcome back to Part 3 of the Integration Article.

In the last installments we talked about integration in general, a bit about SDR's and laid the foundation and terms under which the article will explore integration. Next we discussed hardware. If you missed parts 1 & 2, you can find that articles here:

[The Integration Article - P1](#)

The Integration Article Part 2

I think a high-level overview description is in order first before I us a little deeper. The picture below labels a few things to get us started. This first picture shows the receive software I am using, obviously the SDR Software is used for both transmit and receive so it will be in all the views that follow.



We'll talk more about this as we progress, however, the receive audio modules outlined in orange are based off two primary pieces of

software. The first is Reaper which is a Digital Audio Workstation package and there are several third party plugins (or apps if you prefer) running inside its engine. The second at the very bottom on the USB monitor is True RTA in oscilloscope mode.

Before we move on this is a great time to explain some basics for those that may feel a little lost right now about all these screens.

As I said earlier all this runs on 5 monitors. In Windows the desktop combines all these into one large mega desktop. For those that are PC nerds like me, these 5 monitors represent about 3300 by 2100 pixels of real estate which starts to compare to the new 4K displays that run at 3840 by 2160. To be quite honest, I eventually see a 4K display in my future once we get good video cards for them that I can install in my ham computer.

You can place and resize all these programs across the 5 displays and that is what I am doing trying to find the best place for them all. Some programs won't let you change their size or dimensions and so you have to work with them as best as you can to find homes for them.

So if we look at the picture above we can see the main SDR Software (PowerSDR mRX) running in the bottom left corner of the bottom left display. The oscilloscope (bottom) as we said earlier occupies the little USB display and the rest of the left 2 top and bottom displays is all

occupied by receive audio processing software which we will explore in greater detail later.

In summary the two right screens (next picture below) serve as homes for the transmit audio, propagation software, world time zones, and antenna rotator controls.



I am running a multitude of programs, most for a reason. I believe when you are working DXs you want to know what propagation conditions are like as well as the general weather.

I like having a browser up as well so when I get a call sign I can look it up. I have run out of display space so I am actually using a browser now on another computer and display that is virtually connected to my main

computer to share one keyboard and mouse to access that without having to change screens. I'll cover that later in the article.

At this point it probably makes more sense to start sharing pieces of the desktop and explain their purpose and how I make use of them in the operating experience.

At this point you might need some coffee or other liquid refreshment to get through this, so now is as good a time as any to take a breather. This will end up being a very lengthy article to provide full coverage!

The Software Defined Operating Experience

While operating, there are two things I look up first. The first is the bearing that my Hex Beam needs to be set at into relation to the DX I intend to work. I can look up where it is verses where I am currently pointed and the distance of the DX. I can get this by being logged in to QRZ and clicking on the details tab of the potential QSO, or I can see this is the DX has been spotted and reported via my spotter software.

So if I hear a DX, I will look them up, look at the propagation forecast and then decide whether to work them. I can then point the beam if I do in fact work them and I will cut and past the call into CommCat so I am ready to log the QSO. I'll work them, log them and send the spot assuming it's a new spot in this scenario.

This can also work in reverse where I might see a DX in the spotter and then click on it in the spotter, rotate my beam and see if I can hear them and then work them considering propagation and the other variables.

You might notice some world clocks, these are to also let me know what time it is around the world. If I am hunting for DXs I will consider the time and look at propagation, look at the spotter and see if there are spots I want to work or if I want to aim at a country and CQ for DXs. Usually I will work the spots first if I need them before going after my own DXs. Working a spot is as simple as double clicking it in CommCat and it will send the frequency and mode to PowerSDR and change the it and the radio. One could setup the rotator to also be updated and rotate the beam. I prefer not to set this up that way as I want to decide when and when not to rotate my beam.

When I work QSOs I will keep an eye on the radio and my amplifier SWR and power outputs. My amp can handle about 35 watts in before the grid protection circuit trips and I would see a fault.

Before moving to my new amp and auto tuner, the Old Amp and Tuner were set for a band before working it. They were both currently manual adjustments. They have both have been changed out so they auto tune now on the first transmit attempt. This works extremely well and takes the hassle out of changing bands.

I keep an eye on CPU usage as of all this stuff I run and the computer I dub Hamzilla was built to handle it all and more, however, paranoid from past experience on a computer dubbed Big Bertha and how I slowly ran out of resources, I actively keep an eye out for Hamzilla resources.

Ham Radio Deluxe can serve as a conduit for linking together CommCat and Studio 1 to PowerSDR and or NAP3 and my KX3. NAP3 is a offshoot version of PowerSDR that allows an operator to use their IQ output from the KX3 to create a point and click panadaptor display on their PC.

So at a high-level that's what all the screens are about and most of the software.

Let's talk about the most controversial part of my station. The one that people either really dig because they think I have nice audio, or the one they don't like because they like simplify and feel my station is unnecessarily complicated.

I caught this bug early on when I got my Flex, one of my original Elmers who was a HIFI AM addict is to blame!

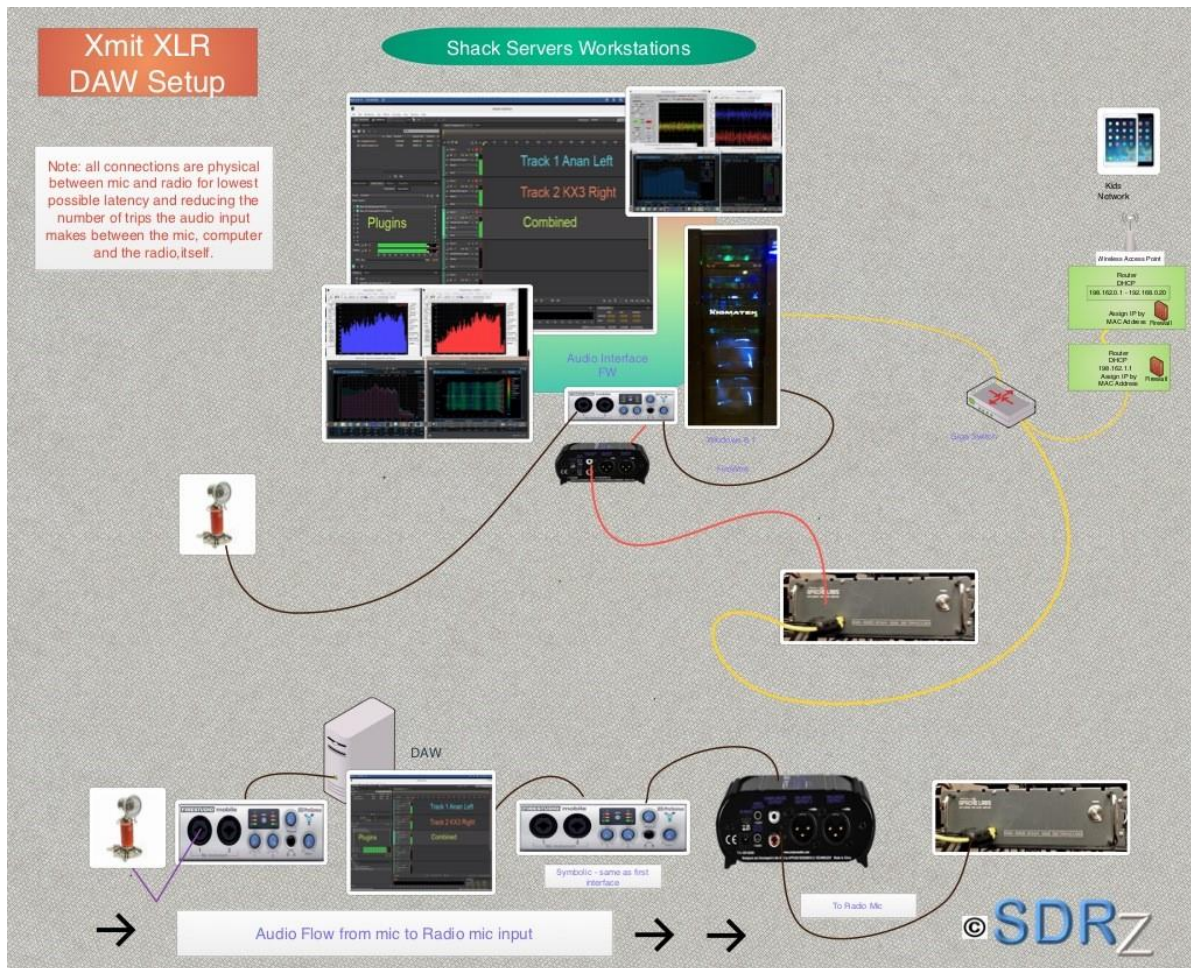
More Details

Ok, before we start into a little detail, you should know that I started off running a hardware based front end audio processing rack consisting of a

Behringer mic amp, EQ, exciter and fx unit and a mixer. My dream goal if you read past articles on my old site has been to do all this type of processing both send and receive with software on the computer. I had not pursued it due to the fear of the amount of computing resources that would be required to make it all work. I have placed my old rack up for sale now and as of today am 100% satisfied with the virtual rack which I call Software Defined Audio.

As referenced earlier, I run a Digital Audio Workstation package, software that musicians and the music and broadcast industries use to produce music and podcasts, ect. A microphone is routed into the computer and software via a soundcard where the software can process it and then its routed back to the mic input on the radio.

Lets start on the transmit side of the system.



Grafio Created System Design

You can read more about this in the Software Defined Audio article on SDRZone, however, we will cover some basics here and assume that you have read that article and understand the fundamentals.

Above I have depicted the hardware software transmit setup. The Mic inputs into an external computer audio interface, its sent into the DAW software on the PC, any processing effects I wish to deploy are added in as

plugins into the DAW, the settings on each are set, the audio is processed, sent back to the external interface, converted from balanced to unbalanced audio, cleaned and fed into the mic input on the radio.

Let's look at the plugins I am currently using to process my audio!



Magna FX Virtual Audio Rack

Above you can see the virtual rack components, here is what they do for me.

The first plugin in the virtual audio rack is a simple display only spectrum analyzer so I can see the input levels of the sound my mic is producing and

view them from an EQ like perspective. This greatly aids in setting the equalizer correctly to produce a desired voice curve.

The EQ is obviously there to adjust my transmit lows, mids and highs. We only use the 125 to 4K adjusters since that's the range of audio we use for SSB. I don't enhance my audio outside the legal range like some hams do. I suppose for AM I have raised the EQ for the higher and lower frequencies to take full advantage of AM. This also lets me drop off some of my fan noise that lives on the low end.

The SpectraGate which functions as a Downward expander. I used default settings and was stunned when all my background noise simply disappeared. This plugin is a pure miracle for my shack and cleaned up most of my fan noise and even the loud relay click on keying. Basically you adjust the attack and other controls to silence your mic unless you are speaking. Since those receiving your audio only hear your voice when you are transmitting, they are not likely to hear fan noise over your voice. The gate cuts off your mic when you pause between words which cuts the background noise off and from being transmitted. This is highly effective and seems to work far better than the built in one in PowerSDR.

Last but definitely not least is Claritone which is an all-purpose enhancer that can fatten your bass, strengthen a chorus or add clarity and sparkle to a vocal performance. While I do not have a lengthy formal explanation for the Claritone component, for me it polishes up the processed audio and adds just a smidge of crispness to my voice above what the EQ provides. I have it minimally adjusted. The Claritone also seems to add depth and fullness as well.

The virtual RACK itself comes with a VST Plugin pack called Magma and the plugins take effect in the order they appear and were inserted in the rack. IE, the Spectrum Analyser does not show the effect of the other plugins as they come after the analyzer. Incidentally, the plugins above are made by NomadFactory and come as a bundle of 65 plugins for a very modest price compared to most commercial CST plugins. The whole set costs \$99.

The next plugin is inserted after the Magma rack and is a spectrum Analyser view as well and does show the impact of the plugins and the audio being sent to the radio. A spectrum analyzer is great for seeing the range and distribution of your audio. The view below represents the 3.2K wide filtered audio and shows how effective filters are in processing your receive audio. The roofing filters show in very dramatic fashion when looking at the KX3. Here we is that the Software defined filters are less effective in cutting off the response.



BlueCat Frequency Analyst Pro

Next is an Oscilloscope view also of the Audio being sent to the radio.



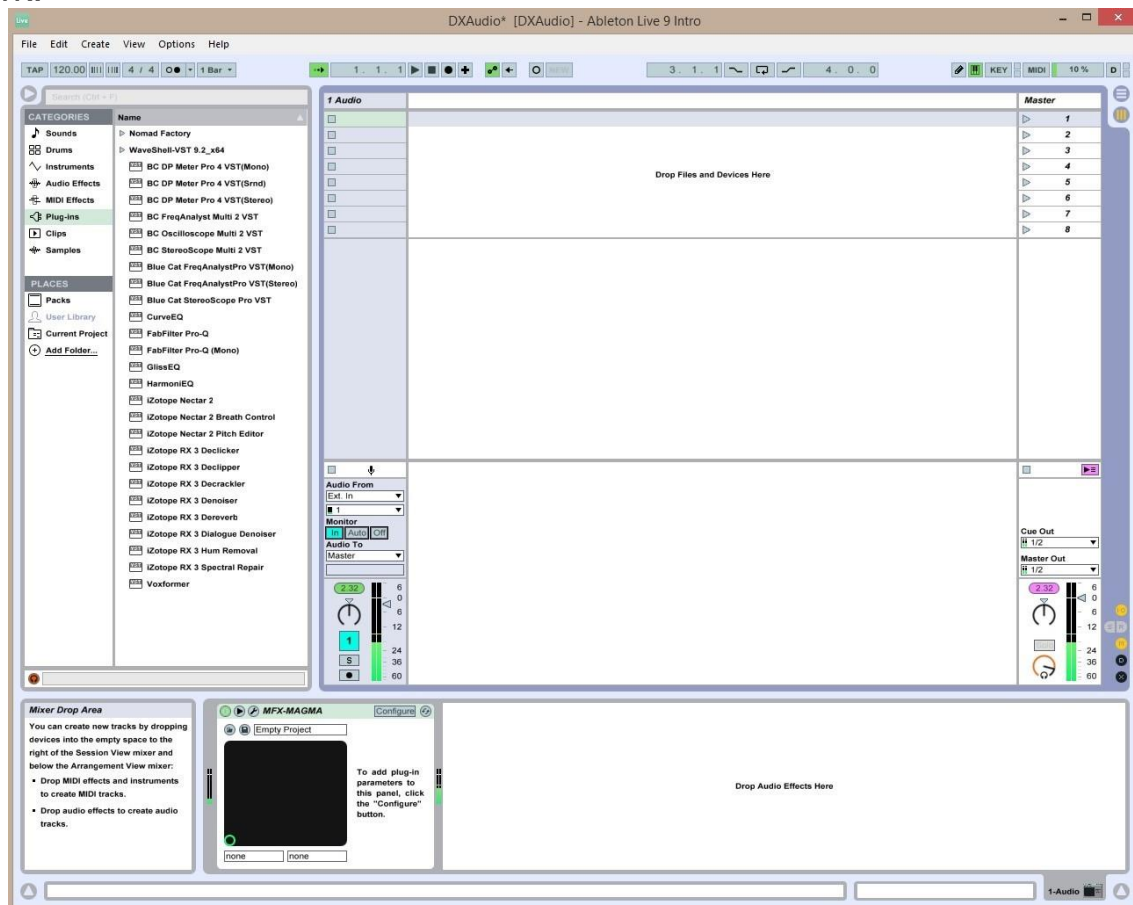
BlueCat Oscilloscope

The scope here is helpful in making sure I am not clipping off my audio by having the gain set to high. Its nice to have readily available visual representations of this.

These are not essential to me right now so my desktop might be reworked to exclude them in favor of other plugins and or no plugins as my audio sounds pretty darn good right now. They are great for the initial setup of your audio for each sessions, however, they could be hidden afterwards. This later begs the question of what instrumentation do we really want and need and that is something that you can decide and play with on your own stations integration.

Behind the audio rack is Abelton 9 Intro Live software, which is the DAW that all the transmit audio runs through. A separate DAW is used on the receive side to prevent interference.

The result of all this is what I feel to be some lively bright audio for SSB work.



Abelton Live 9 Intro

Let's move on to some other parts of the desktop quickly, some need little explanation while others we will talk about a little more.

There are a few Analog SWR Meters and or Radio Panel views. Bobs Meters and FXPad are really ham comforts to me. I like seeing my SWR meter as the traditional analog view. Bobs meters provides that to me. I used to run FXPad on the USB Touch Monitor, however, I just stopped using it and have never really missed it.

Receive Tools

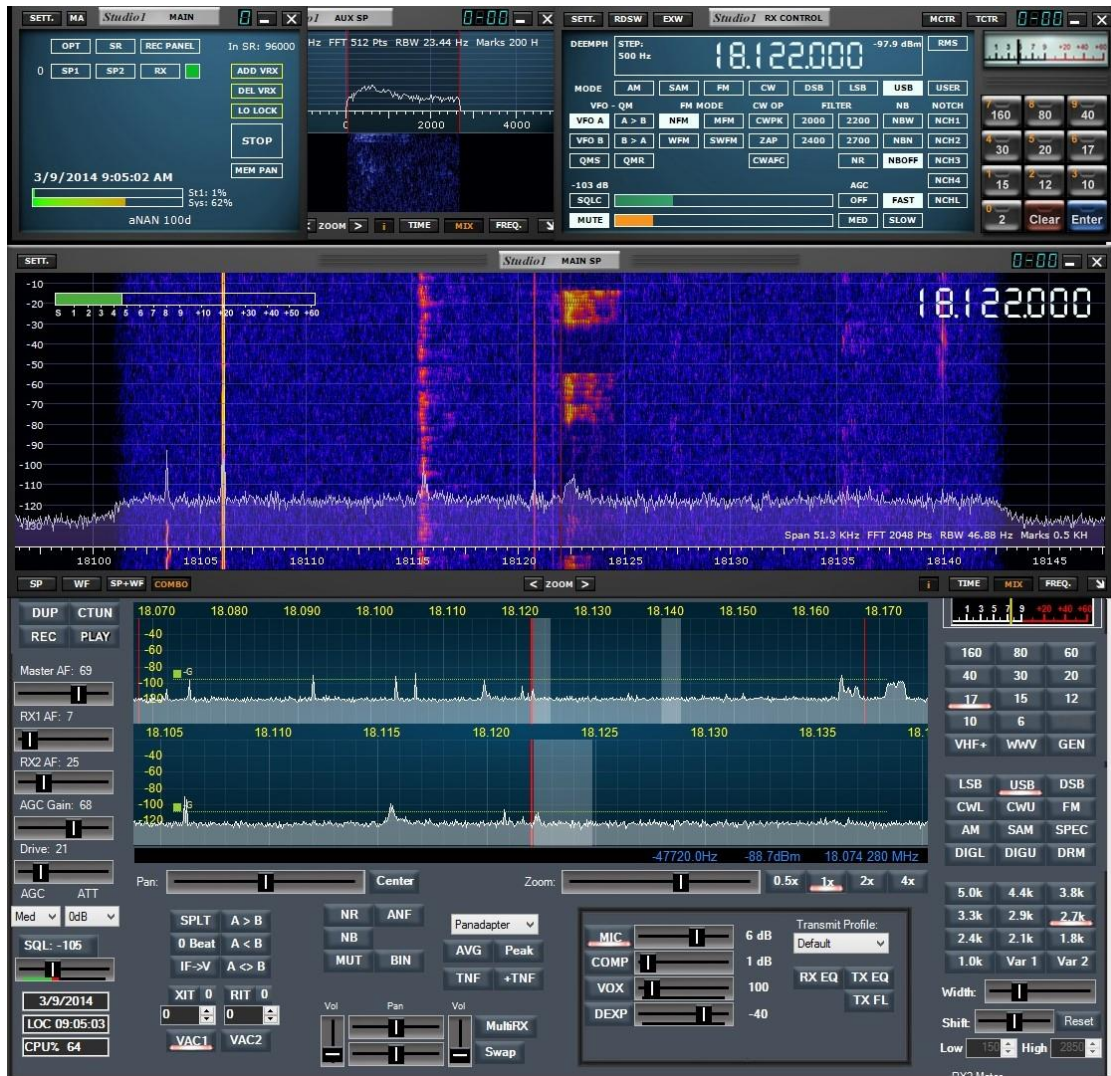
Even though we started with transmit audio tools, I am going to walk through some other tools before we finish up with receive audio processing.

We haven't covered the SDR Software yet and while PowerSDR MRX is pictured below, there are choices depending on the SDR you use and whether you are transmitting or merely receiving.

The obvious screen is PowerSDR MRX. It's a self-compiled version as referenced earlier that enables Bobs Meters and other CAT enabled packages to be run with it.

I really happen to like Studio 1 and I found a cool feature in PowerSDR MRX that allows you to forward the I/Q Signals on a VAC Line. This allows me to use Studio 1 in sound card mode. Using CAT (not pictured or tried yet) I will be able to sync the PSDR VFO to Studio 1 so it can track Frequency, Ect. If that works then this screen may change more as I seek to leverage the Studio 1 screens more in my integration.

Why am I so partial to Studio 1? I just really like the modern UI and controls. The panadaptor is very nice as you can see below one can set the spectrum to overlay ont he waterfall.



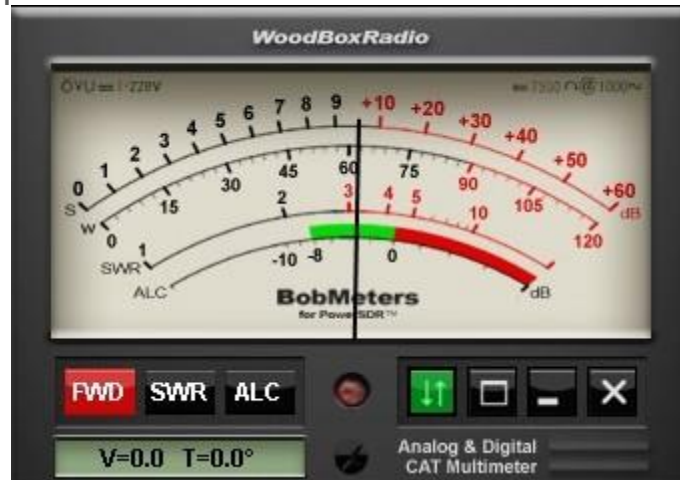
PowerSDR MRX & Studio 1 Running together

PowerSDR in my case is the software used with my Anan 100D to process the analog to digital signal received by the radio and processed by the filters if enabled.

In addition to the Panadaptor display which is setup in the most basic fashion in the picture, you have several radio controls. Some of these like the VFO's, Volume, Zoom, AGC, Power, ect are also mapped to the DJ panel we discussed earlier for physical controls which are very nice for those that prefer them.

Above you see a view of Studio 1 that is using PowerSDR MRX which was layered underneath Studio 1 as a slave for a panadaptor control and basic radio control package. Note, even with PowerSDR being out of focus (not the active screen) and being slaved this way the add on knobs on the DJ Panel still work!

Next up is a simple S-meter.

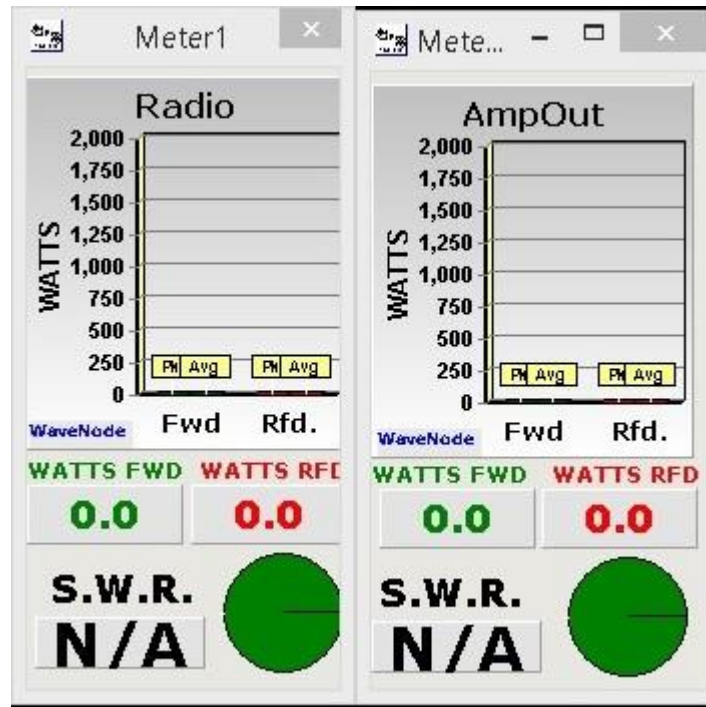


Bobs Meter

While PowerSDR does have an S-meter, I prefer a larger one while working contacts and prefer it on the right side of my desktop near my logger spotter programs. As you can see Bobs meters depicts a nice analogue meter that is large enough to easily view and read. It is connected to PowerSDR via a virtual serial port. I'll come back to all the software not visible on the desktop last as it is an extremely important piece of the integration puzzle!

Below we have the Wave Node Watt Meter displays. The Wave Node is a wonderful Watt Meter that has sensors that plug into to your transmit path. It supports up to 4 sensors, I only have two inserted, one after the radio and one after the amp. There is a much larger screen with additional meter views and controls running behind the other windows, I have just undocked these two meters as they are the most relevant in my ham

cockpit view. They show the power and SWR out of the radio and then the amp.



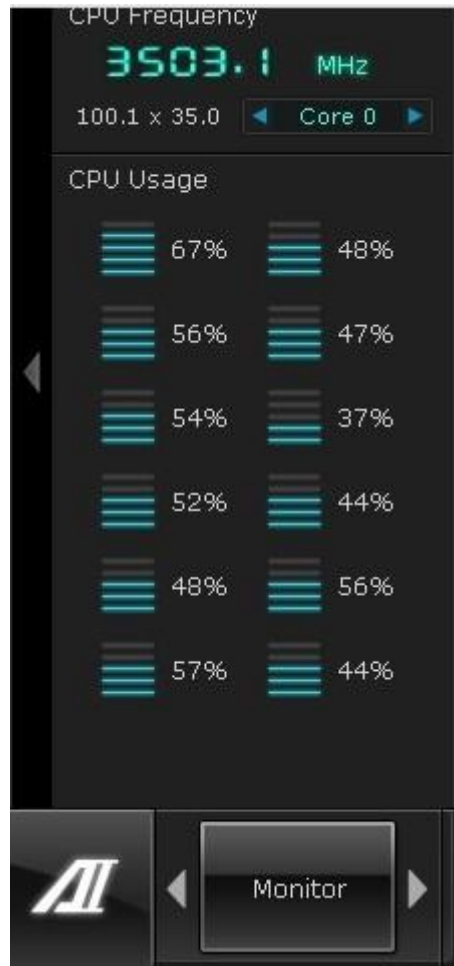
WaveNode

Below the watt meters you can see a set of world clocks. I don't really like these as I preferred the widgets I had in Windows 7, but MS dropped widget support in Win 8 so this appeared to be my best option. I have 9 time zones set to help me approximate world time at a glance.



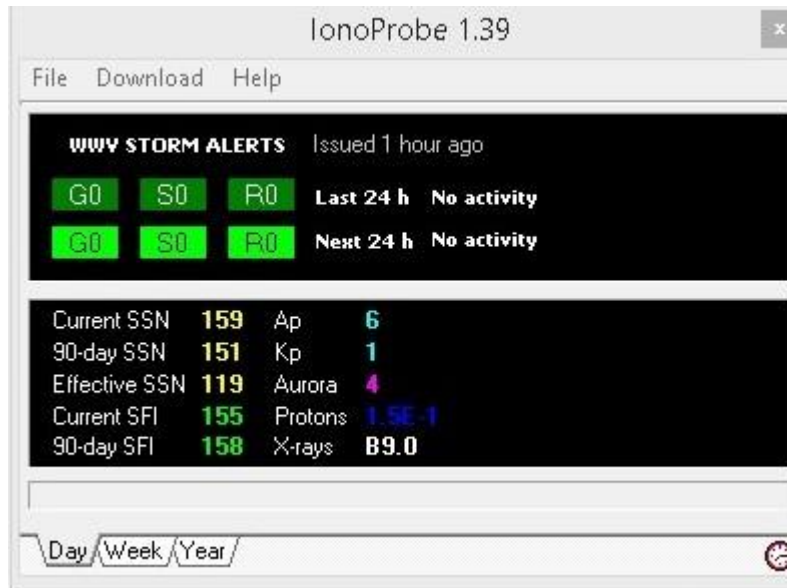
Sharp World Clocks

I use the computers ASUS included CPU meters that come with the motherboard. I also am not thrilled about these, however, its my preferred option for Windows 8 right now since moving off Windows 7. You could use the windows built in option available from task manager, however, they consume more screen real-estate which becomes a consideration when you run everything I am running.



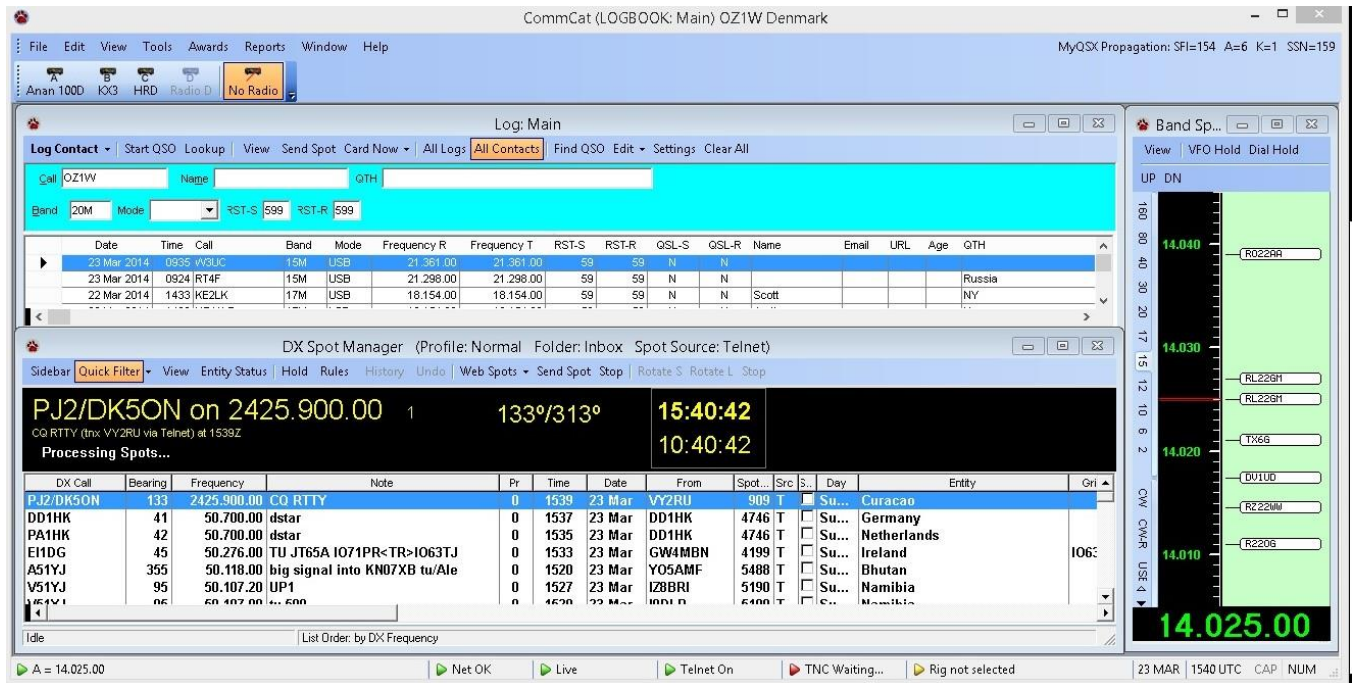
ASUS CPU Meter

Next up are the tools I use for at a glance propagation pictured below. Ionoprobe collects sunspot info in real time and displays it for you. You also notify you of geomagnetic storms in real time. Ham Cap links to Ionoprobe and DX Atlas in real time as well. Those two appear below Ionoprobe.



IonoProbe

Ham Cap has a map view and a band selector. You can select a band and it will update both its own map and DX Atlas with a real time propagation guesstimate. Remember, this is not exact science on these forecasts. DX Atlas can be maximized on the fly if I want to dig into map detail, ect. If you want to learn more about [propagation tools](#), check out the article on SDRZone.

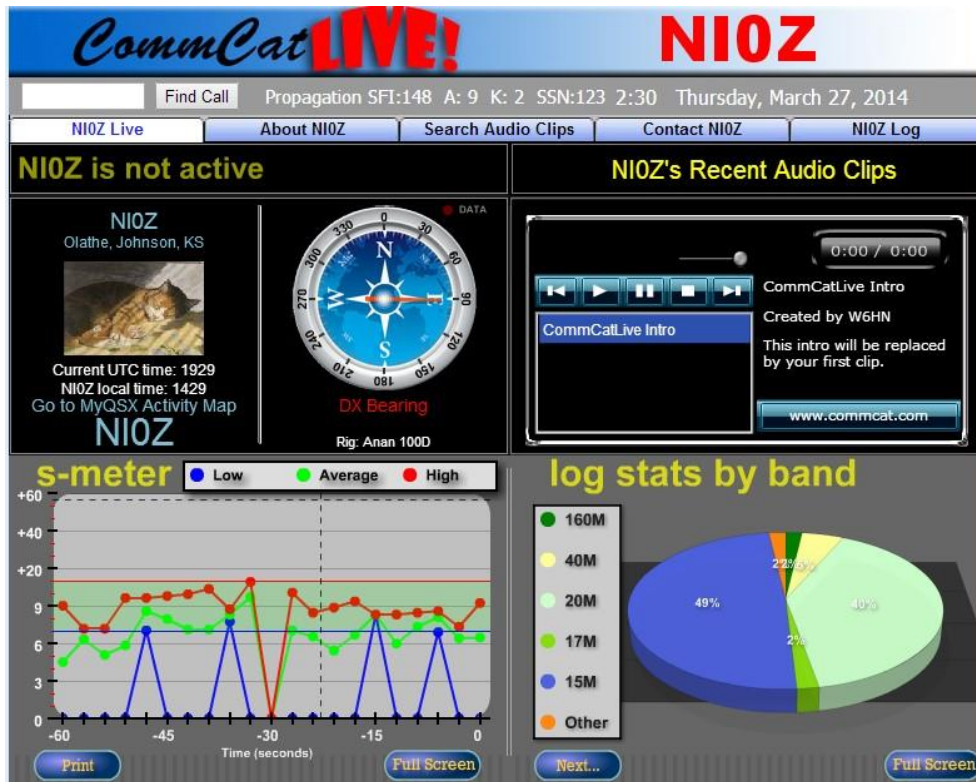


CommCat Logger Spotter and Much More

Clicking on spots in the lower window changes the radio frequency and mode if needed and also places the spot call in the log ready for updating. This is also done through a virtual serial port connected to PowerSDR through a utility call DDUtil.

I also can get the bearing from this (second column lower window) and if I have my rotator setup correctly can even swing the beam. I really don't want my beam to swing though on every click so I have chosen not to integrate things that way.

One other cool feature CommCat has is an Internet SWR QSO meter.



CommCat QSO

Users can visit a little website (service provided by CommCat) and see their signal as received by you live. The site also allows you to post audio clips and other information about your station. It also integrates with the CommCat log and shows band usage.

That brings me down to the last screen below I am going to share and discuss before we move into receive audio.

Rotator control has been of interest to me and PST Rotator is a very nice package you can purchase to use in a variety of ways. Originally I wanted for remote control as it can setup your rotator as an IP service which you can then access as a client over a network. I later learned that it has a variety of support for it in other software packages and a nice graphical interface using google maps. I have limited the zoom on this, however, you can move in and out and then click on the location you want to point your beam and it will move there.



PST-Rotator

All said and done, once you arrive somewhere and use a tool the way you thought it would be meaningful, sometimes it just doesn't pan out in reality. While this looks cool and is rock solid in usage, in everyday operations right now, it is simply easier for me to look at my green heron controler and adjust the beam heading using the knob. Funny how things work like that!

Receive Audio

I have recently ventured into this realm as evidenced by recent articles on SDRZone. Its been an exciting opportunity to integrate my receive audio into the desktop and improve reception.

I use Reaper for my receive audio DAW to run the processing plugins.



Reaper 64bit DAW

Your looking at a version scaled down to show me only the relevant controls. The plugins which I will describe next run from it and float as separate program windows on the desktop. There is one that is not showing and that's a sample grabber that sends audio to the spectrum analyser I use on the receive side.

The first thing I want to do is look at how I am receiving the audio from the radio software.

This is a stereogram view and I have learned that its highly useful in looking at AAGC adjustments. The rule of thumb I have developed so far is to keep yellow to a minimum balancing that with receive audio. I have another spectral view at the end of the processing change before its sent to my speakers so I can see the net effect before and after the plugins. More on that in a minute.



BlueCat Frequency Analyst Pro

Next up is a meter view of the input audio levels.

I convert the mono input to two channels left and right with a mono to stereo adapter on the output of the radio and input to the audio interface feeding my DAW. I can create my own stereo and or other effects this way between the two channels.

We can apply plugin processing to individual channels in the DAW, or to the combined output. This offers a tremendous amount of flexibility! We can limit the CPU load by applying the effects to the combined channels and then apply them sparingly to individual channels for stereo. For example, to create suedo stereo we could add a delay to just one channel to create the stereo like effect by changing the phase slightly between channels. We could also apply them all to one channel and then have an A vs B scenario to compare processed and unprocessed. And as depicted in the ham audio analysis article on the site we could feed two radios into the DAW and use the analysis tools to compare them.



BlueCat pro Meters

Next up is the graphic equalizer. The EQ below turned out to be a favourite and is extremely powerful in letting me adjust around specific frequencies and has a nice feature that lets me hear how my setting changes impact

the specific area of the audio where I have applied them with a click of the mouse.



Fab Filter Pro EQ

This allows you if needed to create a notch filter or just apply curves of your own making to shape the receive audio sound as you please.

This also allows me to block out lows and unwanted highs below 200hz and above 3.2Khz for SSB as an example. I can store that setting and then create others for AM or other modes.

Noise reduction is our next plugin, this was a rather expensive plugin and my demo of it seemed to far better than after my purchase, I am still playing with it to determine how to get the best noise reduction.

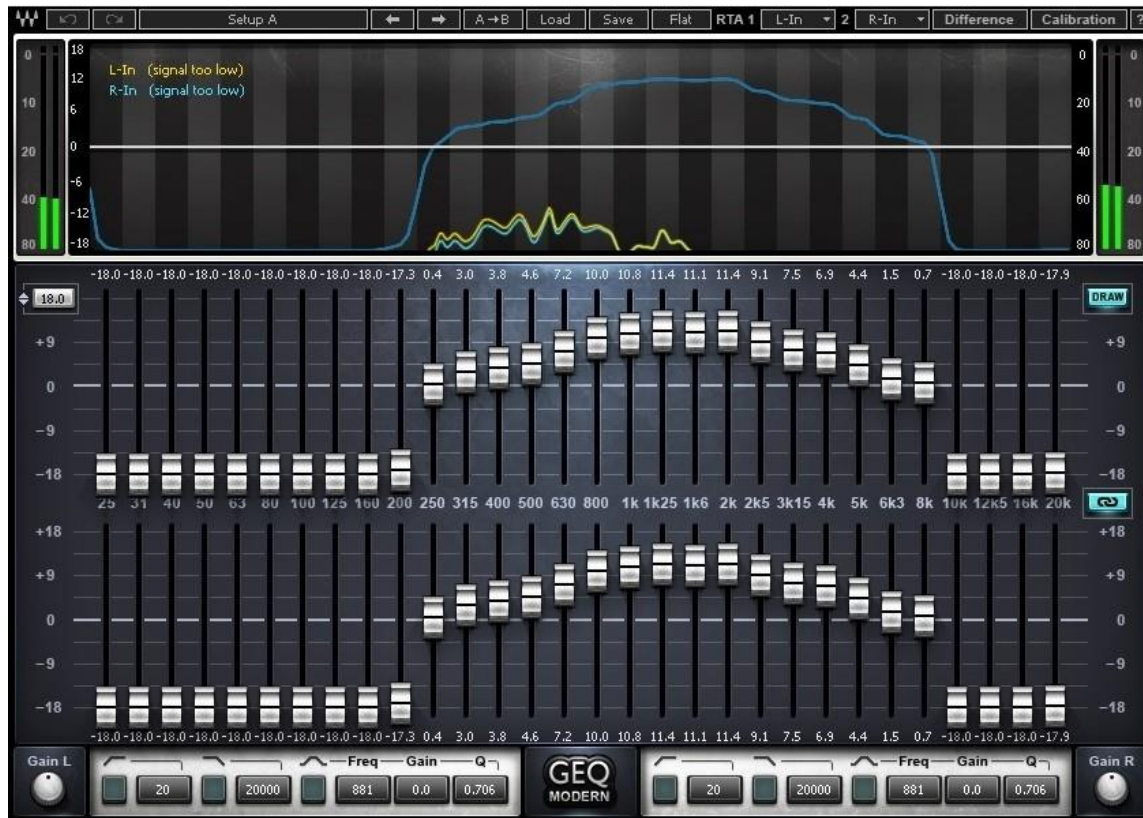


WNS Noise Suppressor

Fortunately I got it on sale otherwise I would be disappointed had I paid full price. That said, I am still fiddling and it makes a significant difference without effecting the quality negatively for a net gain on receive audio.

It has a learning mode that you can apply and its fun to apply it when you are on a frequency and there is dead air. You can demo this as well before purchasing. It might be that I had it engaged in tandem with another plugin and have not figured it out yet.

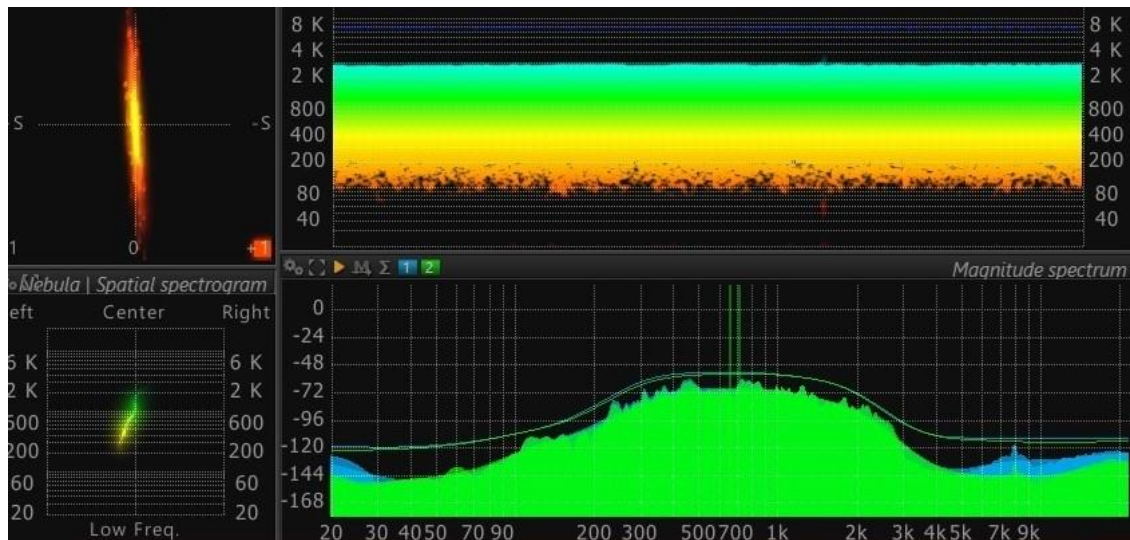
Next up is a straight graphic EQ.



Waves EQ

This allows me to spice up the processed audio before its sent to the speakers. Sometimes when you tweak things in one way to solve a problem, you create new problems and a second EQ lets me take a second stab at correcting new issues I created.

Finally from a VST perspective I have a very high-tech spectrum analyser that lets me look at the resulting spectrum and stereogram of the processed audio.

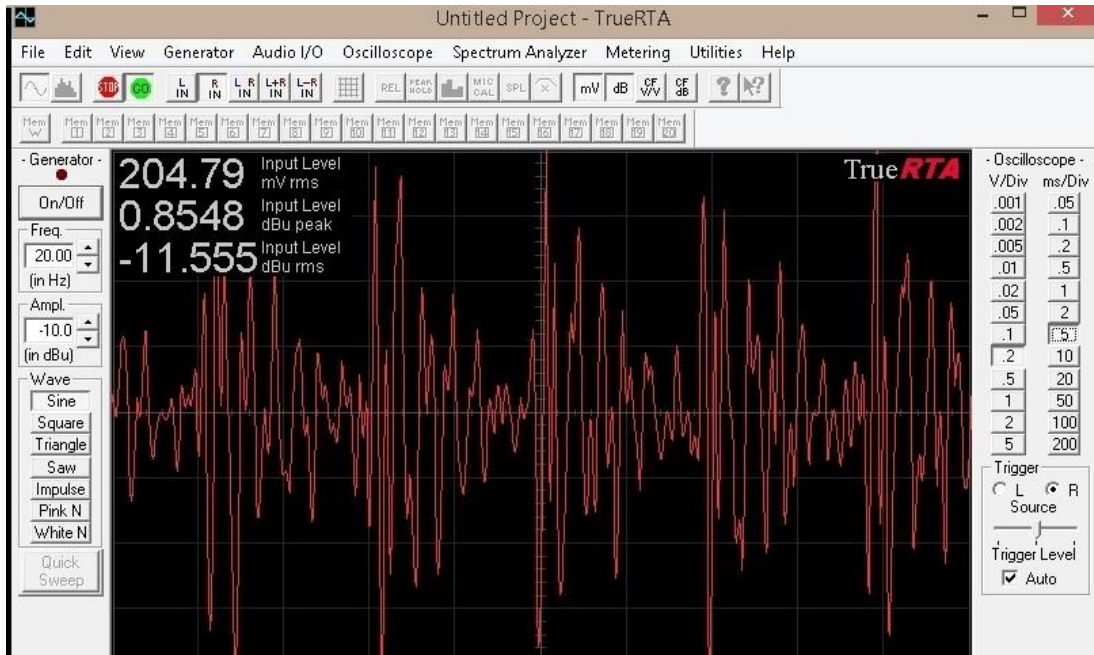


Flux Spectrum Analyzer

We have multiple views here that let us see the spectrum on the bottom, the stereogram above it and then some Left Right Channel balance views on the left side.

I was not impressed with this plugin at first, however, I am very pleased with it as the last plugin in the chain, especially comparing it to the input audio and visually seeing the differences. For example, you may notice no indication of audio on the stereogram below 100hz. Back in the original input we had traces of it and so you can see I zapped it right out of there.

There is one last tool I use on occasion, and that is TrueRTA. It runs nicely on my USB monitor and provides me an Oscilloscope view of the received audio directly from PowerSDR via a Virtual Audio Cable.



True RTA

I have been working on a correlation between receive audio input levels and legible audio.

This sort of represents an interesting test here as previously I correlated audio below 200MV as unusable and so I can see if my processing has enabled me to make a difference or not for those weaker DX's.

Don't read into this view here as this makes it appear like I have a strong signal at 200mv and I believe that might be because I am looking at it via VAC verses line type audio which is what I used before.

This concludes Part 3 and the 4th and currently planned last part in the series will look under the hood at some software running in background that helps make a lot of this all work and then wrap things up!