Guerrilla Broadcasting

Contents

"Lights out! Guerrilla radio! Turn that shit up!" - *Zack de la Rocha (Rage Against the Machine)*

"We want the airwaves!" - *The Ramones*

Pirate radio can be one of the most effective tools we have in our arsenal beyond a good web presence, we can own that media and even reach people who are too poor to afford a computer or MP3 player. Now use the skills we teach elsewhere to fill the waves with content entertaining and informative enough to warrant the effort of tweaking the FCC's nose.

Money or time properly invested in building or buying quality transmitting hardware and antenna is not wasted, there is less chance of complaints against a station that stays on frequency and does not bleed over. Most propaganda against low power radio brings examples of small stations using low quality transmitters which interfere with other nearby stations. Once you get some listeners you will want dump the junk to upgrade a quality stable VFO that will not drift frequencies or have distorted sound. With our instructions you should be able to make a really good pirate station in under a week for between $50 and $100 for everything except the hospital bill from falling off of your tower.

Transmitter Kits

Don't be afraid of making the simple radios and amps now available. All the electronic parts you need are either in your kit, at Radio Slack or online at places like Digikey. An electronics course or a radio frequency physics college course will help immensely, but with the easy kits out now all you really need is a soldering iron and the ability to read.

Free Radio Berkeley (http://www.freeradio.org/) has somewhat expensive but well designed and tested quality gear that if you make an initial investment will serve well for years producing quality sound. RFB also has radio camps aimed at teaching the techniques of building your own transmitter with help building your kit along side experts. Beyond RFB there is also lots of information at the Amateur Radio Relay League website (http://www.arrl.org/) and posted by many amateur radio operators on their personal websites.

There are many sources on the net to order good quality transmitter kits that require some basic soldering ability and some basic test gear. Consider building a few spare low power kits for situations where the cops will be expected to confiscate the gear. Learning to build kits will likely be much cheaper than ordering from an international mail supplier and also since you will learn how to repair and tweak performance it will likely outperform something ready made purchased from a questionable gray market source.

If you really feel like stepping out after trying your hand with kits, design your own or follow a schematic even more fun is to try to keep with recycled components from junked electronics.

Homebrew Transmitters

Making your own starter transmitting gear has gotten much easier since the advent of mp3 FM transmitters to designed to send your tunes to car or home audio systems. If you find an MP3 player FM transmitter that uses a crystal or and you know the exact open frequency you want go with this type, order and install a quality stable crystal, otherwise go with one that has a digital variable frequency ocillator so you can tune any FM channel. Most of these tiny FM transmitters can have their 3v power input doubled and add a proper antenna (most of them are attenuated to reduce range to around half a meter) about a meter long wire will work or a feed line installed to feed a lineral amplifier like below. Run a wire from your computer's sound card, mp3 player, or tape deck to the input lines, and hit it! A decent small city pirate radio station is easily within the budget of almost anyone in the world now but watch for frequency drift and sound quality issues.

Equipment

Power Supply

A noise free power supply for your transmitter and amp are very important. It is possible to build this yourself but you will have to check it with an oscilloscope to verify a really clean output. To smooth noise on a dc power supply, connect capacitors in parallel with it.

Tools

Keep both a quality butane (for field repairs when electricity is unavailable) and electric soldering iron, side cutters, desoldering tool, and multimeter in your kit to make repairs. It might be a good idea to search the internet for a cheap frequency counter kit (even a quality radio receiver with a digital frequency display will work but costs more) and pack this too so you can keep watch on frequency drift.

Playback Equipment

Be sure to use quality playback equipment, the best transmitter and amp won't fix crappy sound from a junk sound card or CD changer. Properly ground your mixer board, computer, and anything else electrical that is connected to your radio station. If operating mobile try shutting off the car engine and running from battery if noise is an issue.

Use quality shielded cables especially since you are near an active radio transmitter try to keep the cable runs as short as possible.

A speech compressor, available at ham radio shops and some truck stops with a CB radio area, is a circuit that eliminates all but the signal required for clear voice, these will kill music quality so have a bypass switch, but a speech compressor really squeezes the most range out of your available transmitter

wattage. You can also probably improvise one by bandpassing an op-amp using an rc chain in a negative feedback.

Buy a low RF noise power supply for any computer you are using for playback.

Amp it Up!

^Jmage:10w amp.gif

If your are a soldering iron amature you can build a small linear amp based on the schematic above. There are many ways to either home print a circuit board, cut circuit pathways in scrap copper clad board, perforated hobbyist board, or use a reusable test "bread board". Follow the schematics above.

Once you get advanced enough to figure out band pass filtering and how to keep the impedance right why not rip apart a high power car stereo amp with finals that will respond on your chosen frequency and use the big transistors and heat sinks to build a really juiced up pirate station.

Tuning

If you visit the radio shack of most every ham operator you will see a tuner somewhere in line between the radio and antenna. Tuning is required to match imbalances in impedance between the radio, feed line, and antenna. What most radio operators with transmitter power only limited to their amplifier budget don't worry about is the radio energy that is converted into waste heat when an unmatched antenna is used. You will need to get a SWR (Standing Wave Ratio, or reflected lost energy that surges back into your finals) meter that is designed to work on your transmitter frequency band. A bad mismatch in impedance and resulting SWR can fry your radio finals.

When you need to set up your station quickly and have no time to make a perfect antenna

- 1-Just find a nice high spot with a good view of your audience area
- 2-Shoot a wire antenna into a tree with a slingshot and fishing weight on the end
- 3-Repeat #2 in the opposite direction making a nice Vee
- 4-Tune until you get a SWR reading around 1.5
- 5-Get back on the air.

OK, so you waste some precious power but you can be on air in around three minutes which is great if you are operating in some park from a bicycle trailer during a protest. Gotta run? Cut your antenna wires and pedal hard!!

Antenna

The antenna can be both the least expensive and also one of the most effective ways to maximize the potential of your transmitter. Unless you have an unlimited budget there is no reason to buy an antenna just make one.

For a good wire antenna divide 234 by the frequency in megahertz with the sum being length of antenna in feet, this gives you your half wave length, the theoretical best antenna length although fractions like 1/4 and 1/8 are effective too.

Don't forget to use a good ground(unless you use some variation of dipole antenna), a copper cold water pipe works well. Hide antenna wires inside plastic gutter pipes or other creative long places (metallic paint can adversely affect antenna operation), the FCC radio pigs will be looking for unusual wires or towers in the area that a pirate station transmits. HOWEVER, note that a tower with guy wires which have insulators in them can be used as improvised antennas, just connect the feed wire to the end of the wire at an insulator, and use the insulated section with an antenna tuner and you're on the air. AGAIN, the ground is required, but the anchor block for the guy wire is a ground, a big metal (and concrete in some cases) thing in intimate contact with the earth.

One wire cut to the calculated length is called a monopole the other end is fed to a ground.

A dipole is two wires of the same calculated length strung out in opposing directions from a center feed line. (both of these have 50 Ohm impedance) and matches most transmitters and 50 ohm feed line.

A bent dipole or monopole is just a di/mono pole antenna where the antenna wire doubles back on itself at half its length, this antenna matches 300 ohm feed line but is a mismatch to most transmitters (it will require the use of a balun to fix this mismatch) You can use twin lead to make the folded dipole.

If you need to have a shorter antenna you can cut multiples of half from the size of the antenna but each halfing will reduce performance while still keeping antenna SWR tune. You can use the metal frame of you vehicle as a ground plane for monopole antennas.

While most commercial and amateur operators just tweak and tune the impedance to a match with a tuner not caring about wasted watts, careful use of an antenna analyzer (which can be built from an inexpensive kit) and careful trimming of the antenna gives the best results by far.

Antenna Feed Line

Coax

It is reasonably easy to find 50 Ohm coaxial (coax) cable with a center conductor and braided copper inner sheath at electronics supply stores. Be sure to read the Ohm rating printed on the side of your cable since coax for TV and old computer networking is 75 ohm, a mismatch!! Coax is wasteful in that it converts radio signal to heat more quickly than most other feed lines due to the sheath/core design but the up side to the sheath/core construction is there is very little signal leakage and it is possible to be pretty indifferent about running your coax past other radio frequency interferance, wires, and metallic objects. Use some sort of sealer putty or caulk to keep water out of your coax ends as moisture can cause problems at higher frequencies. Keep coax runs as short as possible. Most transmitters you will be using have an output impedence of 50 Ohms the same impedance as a normal dipole and monopole antenna which makes your life easy if this is all you have in your system.

Twin Lead

Twin lead feed line is still easily available as it is used to feed the TV antennas on the roofs of millions of Amerikans. It can be recognized usually as the brown plastic ribbon insulated wires on the edges, some are perforated in the center, some are flat oval shaped. Twin lead line almost always has a 300 ohm impedance and will need the use of a balun to match 50 ohm antennas and transmitters. Twin lead is low loss and will waste little radio energy even with a longer cable run, the tradeoff is that it leaks energy like crazy if there is any kind of parallel wire or metal object like pipe, appliances, or even rebar in the cement. You need to use non-conductive offsets (wood, plastic, glass, rubber) to keep it at least a foot away from metallic items, walls, or wires.

Balun

Here is an easy transformer type balun (BALance-UNbalance) designed to give you a five to one conversion which will let you get close to the 50 to 300 ratio with enough play to allow minimal use of your tuner. If you really plan to stick to one frequency you can go for a closer balun match for your feed line. For our five to one balun wrap 25 turns of one color (red) magnet wire (take this out of an old electric motor) around a ferrite torid (donut magnets work good if you cant afford to buy radio torroids) and five turns of the other color (green or more red colored with a sharpie pen). A full turn is considered when the magnet wire crosses its starting position.

The five turn side is connected to your 50 ohm antenna or transmitter and the 25 turn side connects to your 300 ohm twin lead feed line.

Putting it All Together

- 0- Audio signal comes from your computer, live microphone, hard disc MP3 player, or CD changer and feeds to
- 1- Your transmitter (can be as simple as the MP3 hack to a deluxe kit) likely 50 ohm output
- 2- Use your 50 ohm coax to connect it to your amplifier (if you are using one)(this is likely 50 ohm too) with as short a cable run as possible
- 3- Next comes your tuner (if you will be using one) again keep the cable runs short.
- 4- After this is the feed line, which could be just a short run of 50 ohm coax to your antenna if you have everything in a mobile van or on a rooftop.
- 5- If you are going with 50 ohm everything else just make a grounded monopole (use a good ground) or dipole antenna

Alternately if you need to run a long line to an apartment roof from a lower floor

- 4a- If you will be using twin lead for a longer feed line you need to use coax to the outside to prevent leakage to the metal objects in your house
- 4b- then place a four or five to one balun between the coax and the twin lead to the antenna location

Choose your antenna type, realize that there is some loss every time you use a balun

- 4c- either add another balun to go from 300 to 50 ohm,
- 5 a- and use a dipole or grounded monopole
- 5b- or use a folded dipole or grounded folded monopole which is already 300 ohms and takes up less space, since it is folded in half and has nearly the performance of a dipole.

Don't forget to test the SWR with your meter at low power setting between every stage of your radio station, bad SWR mismatch can burn out your transmitter and amplifier!!!

Ground the case of *every* electrical component from your mixer board, to your transmitter, to your antenna mast for safety and to prevent noise

Coverage Survey and Publicity

Now you have your station set up, tested, and transmitting. You should take a radio some headphones and cycle around your area finding where the signal is available, if not good enough for you move your antenna or boost your power. You can chalk out a tower hobo sign and frequency where available, don't forget AM or FM. Wheatpaste posters and hand out fliers to cool neighbors. Don't be too clear what you are doing that it will show up on the cops radar.

Radio Station Rebrodcast Override

Quick communication can often be sent through small FM rebroadcasters licensed by the Federal Candy Commission. In many cases, these licensed stations simply use a high-grade radio and antenna to rebroadcast a weak signal. Their range is generally about 1-10 miles, meaning a good portion of a city or an entire small town can be covered. The first thing to do is check and see if the station rebroadcasts using an FM receiver. If so, all you do is find the broadcast location, transmit a powerful enough signal to override the station intended to be rebroadcast, and that's it!

Shortwave Broadcast

Even better than listening to shortwave is having your own regular show, even considering the low price to potential audience ratio of commercial shortwave stations an even cheaper alternative is possible. Most proper HAM radio sets are able to be modified for out of band transmission. Look for a radio set that is recommended for digital mode as this has a long duty cycle, in other words, you can transmit for a long time without overheating the set. A linear amp set and a well tuned antenna and you are ready to get the word out across the globe, at least to those that have a quality receiver. Otherwise use the information we give above and build a dedicated shortwave broadcast set from a kit.

In the USA, legal low-power unlicensed broadcasting on shortwave can be done on the 22 meter band. According to an article on the Low Power Radio blog (://lowpowerradio.blogspot.com/2009/09/low-power-on- shortwave.html), you can transmit "from 13.553 MHz to 13.567 MHz, with a field strength limit of 10,000 uV (microvolts) per meter at 30 meters from the antenna" without a license. The article continues, "About 1.8 mW to 3 mW would be needed, depending on the antenna. Unlike low power AM medium wave, however, there is no limitation on the size or type of antenna, feedline or ground for shortwave low power stations." This will require very good receiving stations and excellent radio propagation for this to work beyond a mile or so under normal conditions, but if ionospheric conditions are good a receiver with very sensitive front end and a great antenna setup might pick up the signal thousands of miles away. Morse code instead of voice will increase the effective range but few listeners will bother to listen to code.

”Legal” Unlicensed Broadcasting

One unlicensed station, Pirate Cat Radio (http7/www.piratecatradio.com/) in San Francisco, CA, kept the Federal Communications Commission at bay with a unique strategy. When the FCC sent them a letter threatening legal action for broadcasting without a license, they sent back a passage from the United States Code of Federal Regulations; Title 47, Section 73.3542, Paragraph (a):

- *”Authority is granted, on a temporary basis, in extraordinary circumstances requiring emergency operation to serve the public interest. Such situations include: emergencies involving danger to life and property; a national emergency proclaimed by the President or the Congress of the USA; and any continuance of any war in which the United States is engaged and where such action is necessary for the national defense or security or otherwise in furtherance of the war effort.”*

While the FCC has not challenged the assertion that Dubya’s War On Terror makes it legal to broadcast without a license, the station went off the FM air after it was fined $10,000 in August 2009. According to Wikipedia: ”The fine occurred after a broadcast on a frequency higher than legal limits was found in April 2009. According to Monkey (nickname of Daniel Roberts, the station’s founder) the broadcast was from an apartment rooftop two blocks from the station by a listener using the station’s internet stream.” While PCR no longer broadcasts on FM, there have apparently been a number of FM broadcasts of PCR’s web feed from other locations. To quote Monkey in the January 2010 edition of *Monitoring Times* magazine, ”The FCC can’t come to you if someone else decides to start broadcasting your Internet radio station. Nothing shows that I broadcast all those transmitters.”

Another station, Power Hits 103.3 (http7/www.myspace.com/powerhits1033) in Bettendorf, Iowa, also used Title 14 to keep the FCC at bay, except it was shut down by the landlord over a rent disagreement. A low- power television station, W10BM (http7/en.wikipedia.org/wiki/W10BM) in Moorehead, Kentucky, is using the same claim while it argues with the FCC over its apparently canceled license.

If you’re going to start a permanent radio station and want to keep in the good side of the law in the USA, consider ”Part 15” broadcasting on AM. Under the FCC regulations, an unlicensed AM transmitter can put out as much as 100 milliwatts (that’s 1/10th of a watt), as long as you’re not interfering with a licensed broadcaster. Part 15 transmitters are available in both pre-assembled and kit forms. Some pre-assembled transmitters are FCC certified to meet the requirements of Part 15 regulations, which may be highly valuable should you be visited by a field agent of the Federal Communication Commission. Kit transmitter are also available, such as the AMT-3000 offered by SSTran (SSTran.com (http://www.sstran.com/)). While kits offer a lower cost alternative, they are not FCC certified and a field agent may be more likely to shut down your station when using a non-certified transmitter. The two currently certified Part 15 transmitters are the Rangemaster AM1000 offered by Hamilton (AM1000Rangemaster.com (http://www.am1000rangemaster.com/)) and the Procaster manufactured by ChezRadio (ChezRadio.com (http://www.chezradio.com/)). Both transmitters offer excellent performance. While the Procaster offers built-in audio processing and automatic power regulation, the Rangemaster offers full 125% asymmetrical modulation and multiple transmitter clustering (synchronization) ability. Both Rangemaster and Procaster transmitters operate under Part 15.219 in which is not a radiation limitation but is a power and antenna length limitation. These can kick out a signal for about 2 miles at best if the antenna is at least 20 feet off the ground. You can also increase your range by running several transmitters spread in a pattern through your target areas.

Radio Systems, Inc. (iamradio.net (http://www.talkinghouse.com/)) sells the "i A.M. Radio" Part 15 certified AM transmitters. Radio Systems purchased the assets of the former Talking House transmitter manufacturer and now offers both the Talking House transmitter and their improved i A.M. Radio version to individuals, churches, schools, businesses and real estate agents. They sell a variety of packages for talking signage applications, educational stations for school campus broadcasting and more.. Their website says their units can carry signals "up to and beyond 1 mile".

Excellent resources for both experienced and newcomers to Part 15 broadcasting are:

- HobbyBroadcaster.net (http7/www.hobbybroadcaster.net/) - Online technical resource and reference for AM and FM broadcasting under Part 15 regulations
- Low Power Radio Blog (http://lowpowerradio.blogspot.com/) - Popular blog regarding how to set up and operate a low power radio station.
- Part15.us (http://www.part15.us/) - a popular discussion board for Part 15 broadcasting hobbyists
- Federal Communications Commission (http://www.fcc.gov/mb/audio/lowpwr.html) - Government agency which oversees radio spectrum usage in the United States

Guerrilla Television

"A modern revolutionary group heads for the television station, not the factory. It concentrates its energy on infiltrating and changing the image system." - *Abbie Hoffman (from "Soon To Be A Major Motion Picture")*

While most people who have reached the revolutionary mindset have killed their TV's the majority of the impressionable majority consider it a vital service like water or heat, a television transmission is practically a direct cable into the viewers mind. Think about your audience, consider what they want to hear and bend that in the direction of your message. Talk to members of your demographic and see how different messages play out with them, exploit existing prejudices against big business, corruption, and government but do not stoop to exploiting prejudices that are against our cause. This is the approach that most low brow media outlets take and it can also be used by our media. It is very important that no matter how hard you spin a story **NEVER LIE**, people can forgive you for reporting from your radical point of view. But outright dishonesty is a broad weapon to attack the alternative media. Most importantly make your media interesting, entertaining, and maybe even a little sexy so the viewers will not just switch to another channel.

Microwave Override

Many large television and radio stations can be hacked by sending a high enough microwave transmission (using that station's microwave frequency) directed towards the station's broadcast antenna. While most microwave broadcasting equipment is expensive (at least $1,000 used) and many stations have switched to hack-resistant encoded signals, the potential to broadcast messages to thousands of people makes the cost worthwhile. It is also possible to home-brew a microwave transverter for the simpler analog systems for digital you still have to figure out the encoding. A transverter just frequency shifts from the VHF output of a VCR or computer video card up to microwave frequencies. Be aware that cable and circuit loss at microwave frequencies can be very high if you crush or kink your cable or use a badly planned DIY design.

Experiences of TV Signal Override

Before the downfall of the Soviet Union, there were a number of reported pirate TV operations scattered around Eastern Europe. Many were guerrilla style hit-and-run operations that would rig up a low-tech transmitter with a junked VCR, set to go on the air during the official government newscast, overriding the signal for several blocks. When the authorities found the transmitter, often on the roof of an apartment house or in an vacant building, they would find home-built equipment that had been abandoned, rigged to a timer switch. Much of the programming was very short (since the authorities would be searching for the source within minutes) and usually consisted of recordings from foreign broadcasters like Voice of America and Radio Free Europe, with still photos for visuals. One brave pirate in Moscow would show a tape of the official government news broadcast, with someone else's voice dubbed onto the soundtrack, reading uncensored news peppered with dirty jokes.

In 1977, back when the UK used analogue television, someone identified as "Vrillion" of the "Ashtar Galactic Command" over-rode the audio channel of England's Southern Television for 6 minutes.

In 1984, "Telstar TV" aired movies and music videos for eight weeks by broadcasting a signal into the vacant feed to BBC2's transmitter for the Northfield and Rubery areas of Birmingham, England, after the BBC's signal feed was turned off for the weekends (much to the BBC's embarrassment).

http://wiki.stealthiswiki.org/wiki/GuemHa-Broadcasting 8/10

In 1985, some very brave astronomers from Poland's University of Torun used home-made equipment to superimpose pro-Solidarity slogans over the images of the state-run TV network. You can imagine how the viewing public (as well as the authorities) must have felt when, during the official government news broadcast, the words "SOLIDARITY TORUN: ENOUGH OF PRICE HIKES, LIES AND REPRESSION" flashed on the screen. The activists were later arrested and fined.

For 4 minutes in 1986, the East coast satellite feed for Home Box Office was overridden by a color bar test pattern with the words "GOOD EVENING HBO FROM CAPTAIN MIDNIGHT, $12.95/ MONTH?, NO WAY! (SHOWTIME/MOVIE CHANNEL BEWARE!)". Investigation finally led to the arrest of John R. MacDougall, a satellite dish dealer in Florida who was pissed at HBO for scrambling their once free signals and charging people for descramblers.

In 1987, some talented TV pirates overrode the signals for TV stations WGN and WTTW in Chicago, Illinois, showing someone in a Mad Headroom mask. The WGN signal was overriden for only 30 seconds with only electronic buzzing, but the WTTW signal was overriden for 90 seconds with "Max Headroom" babbling jokes and making comments about a sportscaster on WGN. The persons responsible were never caught and (wisely) never took credit.

In 2007, members of the Czech artist collective Ztohoven (slang for "insane" or literally "a hundred shits") managed to hack into a weather forecast and splice fake footage of a nuclear blast. Charges were dismissed but they could have faced six year sentences.

Free-To-Air Satellite TV

In many rural parts of the USA, a big thing is "Free-To-Air" (FTA) TV dishes. These are common in the UK and parts of Europe, but are only starting to pick up in the USA. You'll need an unobstructed view of the sky (South in the Northern Hemisphere, North in the South), room for a dish (with a directional motor so you can watch more than one satellite) and a receiver box. A decent set-up will set you back about $200-300 plus installation, but there's no monthly fees. You won't get Dish Network or DirectTV (and if you do without subscribing, they'll sue you for Theft of Services), but there's lots of TV and radio channels to be had, as well as some network feeds. Depending on where you are, you can also watch foreign broadcasts. Also, there are two types of dishes: The Ku Band (like the little home subscription service types) and the C Band (those big five-foot dishes). The following are good places to start (Some may require free subscriptions to post onto the forums):

- http://www.abadss.com/
- http://dssrookie.com/forums/
- http://www.gosatellite.com/
- http://www.myftahome.com/
- http://www.satelliteguys.us
- http://www.visionplus.us/smf/

If you can get an old C-band dish, the big backyard dish about six feet in diameter, you can save some money when setting up a free-to-air station. Unless the dish is made of sheet metal you will probably need to apply glue with a paintbrush and add a layer of aluminum foil, the metal mesh embeded in earlier fiberglass dishes allows Ku band microwaves to pass without reflecting them. Be sure to paint with flat color over the foil or you will have a solar cooker which might fry your LNB at some point. You will also need to update your LNB or Low Noise Block the electronic receiver at focus point of the dish. The LNB is a microwave down-converter which moves the signal to a frequency which will have less loss along the transmission cable. For receiving FTA signals the replacement should be capable of dual C/Ku reception with linear polarization, for pay service DBS it will need a high band Ku LNB using circular polarization. If you want to upstream programming you will need a special LNB with a signal frequency multiplier high power and probably a larger dish, you will also have to somehow acquire space on a satellite transponder

A ”peoples network” consisting of a Free-To-Air satellite channel feeding low-power stations and FTA dishes may be pricey, but can be done. There are a number of religious and ethnic services, as well as a few ”family entertainment” services, already on satellite. There are also a number of FTA services that are run by expatriate citizens of other countries, such as ”Tapesh TV” and ”Simay Azadi” which are based in the USA but serve viewers in Iran, often broadcasting news and information that may be censored by the viewer's government. To contradict Gil Scott-Heron; The revolution might very well *be* televised, but it probably won't be on cable.

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