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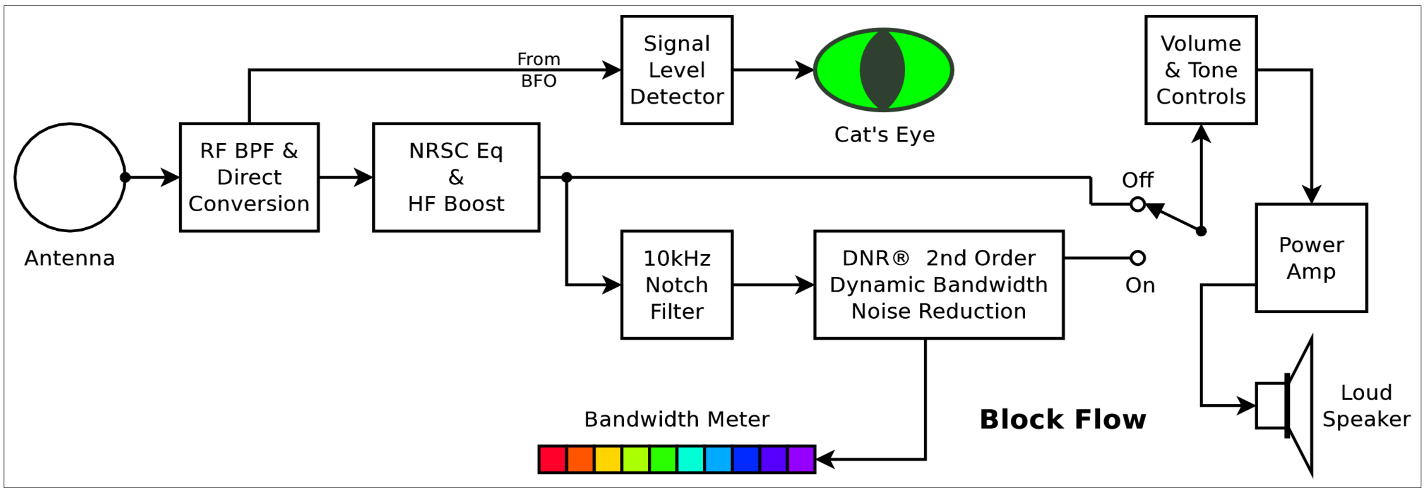
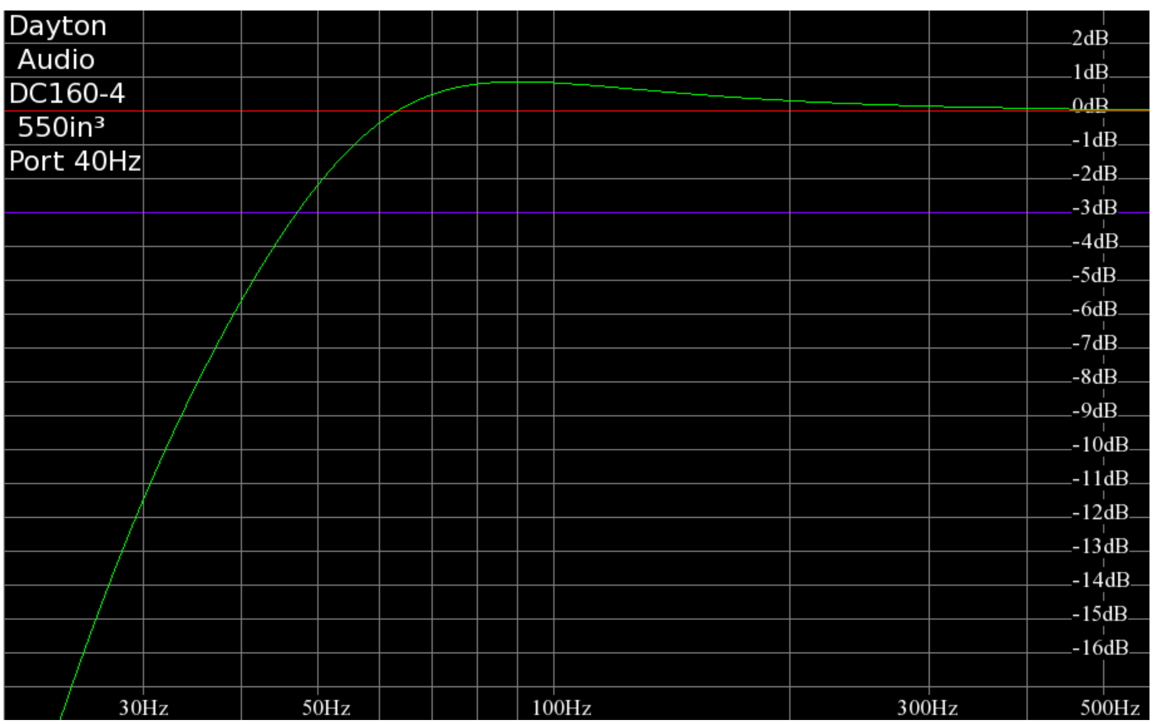
Actual Size @224 D.P.I.   OD: 12″H × 8″W × 8″D

⅜″ Hard Wood, ID: 11¼″H × 7¼″W × 7¼″D, Port: 7¼″W × ¼″H × 6½″L (w/Horn, ¼″ round, 6½″+½″=7″L)

Since there are no Thiele Small parameters available for the Infinity speaker shown port tuning was done using a Dayton Audio DC160-4 woofer providing a –3dB response at 46½Hz. Although not coaxial this speaker would be a good choice for the box but an additional tweeter and crossover would need to be added. Rolloff response will probably be different for the Infinity speaker and port length may need to be adjusted for best response.

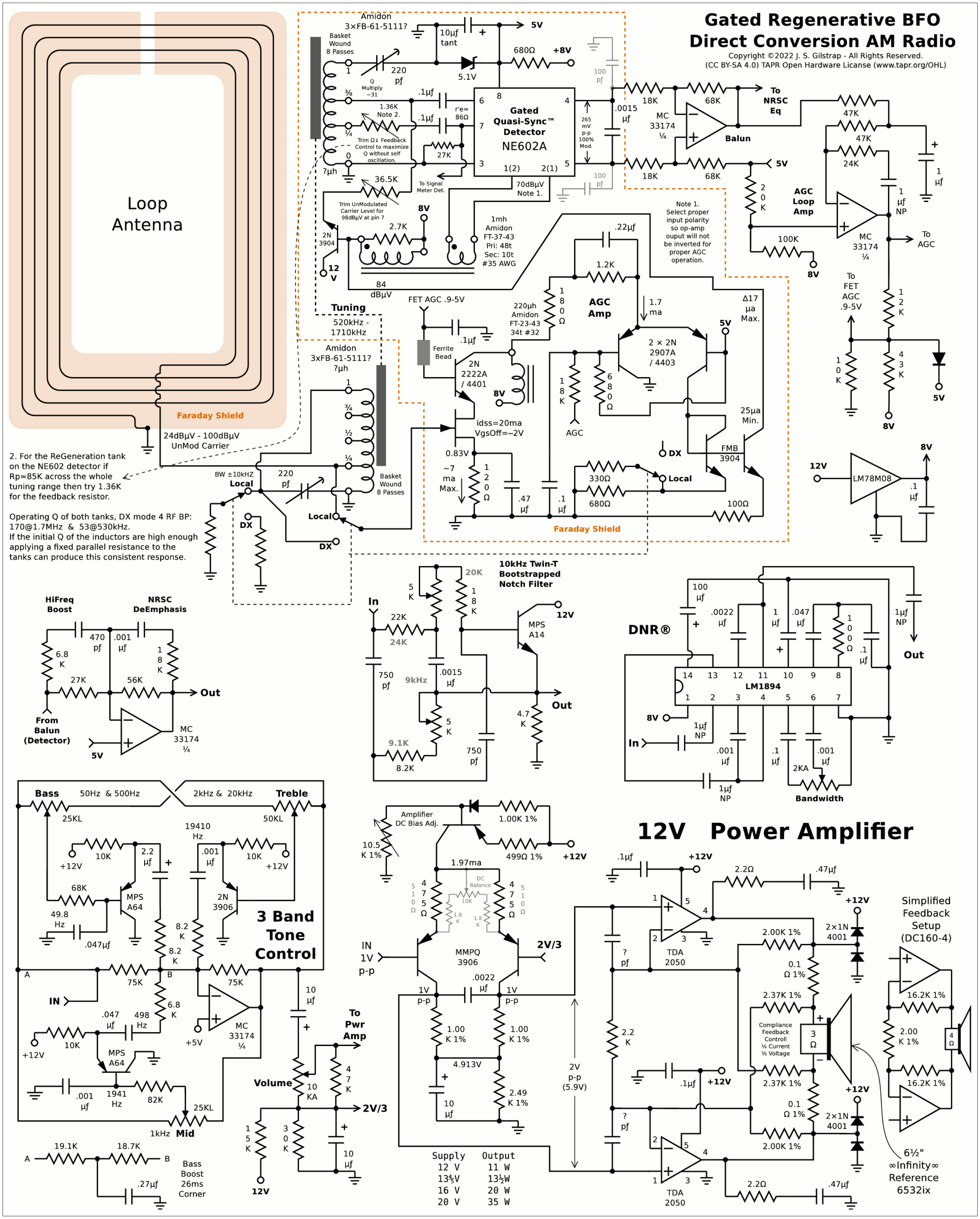
NeoRetro™ Regenerative BFO Direct Conversion AM Radio





Ported Box Response with Dayton Audio 6½″ Woofer
2nd Order Low Pass Crossover Frequency ~1½kHz, Q≈0.9, 10µƒ & 1mh

Would pair well with Dayton Audio ND20FA-6 ¾" Neodymium Dome Tweeter
2nd Order High Pass Crossover Frequency ~2½kHz, Q≈1, 10µƒ & 360µh w/light bulb protector.
Invert Polarity. Mount in front of Woofer with thick felt behind it for HF blocking.



Direct Conversion provides several benefits of circuit simplification and performance improvements. Only two identical tuned LC tanks with perfect tracking are needed, no mixer, no wide bandwidth ceramic IF filter, etc... Fewer stages means a more natural sound with less degredation. Using a single bandpass (RF) allows for easy equalization providing a much smoother detected audio bandpass response. Slug tuning provides a linear tuning response for dial display while also allowing for a fixed bandwidth control across the tuning range by using a fixed parallel resistance across the tank. As long as the detector signal input is not overloaded a received signal of Hi-Fi quality with extremely low distortion and full bandwidth (>15kHz) is realized, one which would rival FM in quality. It is only limited by the transmitt/receive signal's bandwidth/quality, which for now in the U.S. is 10.2kHz.

One of the benefits of a superheterodye receiver is to move the signal processing to a frequency outside of the broadcast band but for direct conversion it is the same as the desired signal so to prevent interference all RF processing and detection must be placed inside a Farday shield.

For PLL based synchronous detection a lock detection circuit is used to control the switching between synchronous and envelope detector which will prodoce a chattering effect unless a blend circuit is used. Think of this as quasi-synchronous detection with auto-blend without the complexity.

The maximum audio bandwidth is defined only by the RF bandpass but selectivity is defined by the very narrow bandwidth regenerative amp which drives the product detector. This is akin to using synchronous detection in which the BFO for the detector defines the relationship to the sideband energy and which the adjacent channel signal's detected output is also defined and not in relation to its own carrier if it should be stronger after being bandpass filtered. Unlike synchronous detection which requires a PLL and lock detection circuits to eliminate squeel when not locked onto the signal, this setup provides a natural tuning response not unlike that of an envelope detector without most of the pitfalls. It may even have a minor mute effect in between channels. As long as the narrowband filtered signal which drives the switching of the product detector is of sufficient level no amplitude modulation will effect detection as long as the detector is switched hard. If the Q multiplication bandwidth of the regen amp is ~550Hz then the highest modulation frequency of the BFO in both amplitude and phase is ~275Hz and this is well within protected area of the carrier itself. Removing most energy from the sidebands means that amplitude modulation is greatly reduced to the point where the switching of the detector will never invert under almost all conditions when the incoming signal is 100% modulated. This also virtually eliminates any phase produced by sideband assymetry or adjacent channel interfetence.

Co-channel interference via the capture effect of the detector overriding the carrier of the desired signal is possible but this is also true for a PLL used for synchronous detection but a PLL is more immune to chattering between the two carriers. The chatter effect produced is probably similar to an FM detector when two signals are competing for capture in which the hysteresis is determined by its protection ratio. It won't switch between the two signals like FM but both signals will be detected and only the one in which carrier has captured the detector will be clear while the other would sound like an SSB signal with a poorly adjusted clairifier. Since a PLL's frequency is controlled by the loop amp its immunuty can be greater. A carrier's incidential co-channel phase modulation of ±12° whould only produce a cosine modulation of ~2% or ~**⅕**dB and barely noticeable. As long as the AGC maintains a strong input level to the detector's BFO input the switching will remain hard removing any amplitude modulation. When the AGC range is exausted and as the signal level greatly fades in strength this will provide a natural blend to a quasi-envelope detection without inversion and thus an automatic gating effect for the blend.

The primary use of RF banspass filtering is to greatly reduce the level of the adjacent signals to maximize detector input headroom and to maintain good S/N ratio and not image rejection since there is no image. In lieu of the bandwidth being controlled by RF & IF filtering for selectivity and since Quasi-Sync™ detection defines all sideband energy related to it frequency response can now be controlled at the audio level via a low pass filter. Using **D**ynamic **N**oise **R**eduction to do this offers an adjustable bandwidth providing a 2nd order 9-12dB/Oct. roll off. The **DNR** chip using the standard decay capacitor has a fast decay response of 60ms. If the noise level gets too high this fast response may produce undesireable effects. Another noise reduction system which uses a much slower decay time may be less fatiguing under these conditions. Switching the 1µƒ on pin 10 to 4.7µƒ will increase this to 280ms and a 10µƒ will increase it to 600ms.

While the AGC circuit is built from discrete components an good integrated AGC amp could also be used.

Balanced Push-Pull PreAmp Setup

Using a non-resonant loop antenna reduces output level so an active antenna preamp is used. In the first setup the loop is directly connected to the tuned LC tank and depending on the load/tap setup this will vary how much effect it will have on tuning as far as perfectly tracking the LC tank used on the regenerative amp which drives the product detector. It may be possible to adjust the resonant capacitor of both so they will properly track each other. If this is the case then the first setup should work well. If not then this setup should get around the issue.

The AGC amp is connected via a 1mh isolation transformer to the preamp tank output but a lower inductance could probably be effectively used. At the low end of the tuning range its inductance is high enough with a 30:1 ratio as to not affect the tank inductace as far as tuning goes. At 1:1 and the inpedance at the base of the transistor in DX mode, defined by β×(r'e+15Ω), presents a load of ~5K which transforms into an ~82K load across the tank. The LC values of the tank should be chosen with a goal to provide a ±5kHz bandwidth across the tuning range. If tank LC impedance values are too low to obtain sufficient Q in DX mode it may be necessary to increase them and also change the 1:1 transformer ratio and possibly change the 15Ω and 220Ω swamping resistors to adjust the tank load. The alternate, shown in **gray**, is a secondary winding on the tuning coil that is more straightfoward but for good tuning range windings should be a multiple of a full coil length i.e. 1 pass, 2 passes, etc... although this does not offer the finer impedance ratio tuning that the transformer does. Originally 2N2222As were used for the cascode buffer but the output addmittance De-Qs the tank too much when tapped at ½ so 2N3904s are used. They are much better but a ligher load on the tank would be desireable. Perhaps using ⅓ tap would be better with a 12 pass winding. If a secondary is used then it would be a $^1/_{12}$ tap in 1 pass. The 2N3904s admittance specs are pretty good if a better transistor exists then use it.

Matched J-FETs, in a single or dual package are needed. A model like the Vishay 2N5566 will work but is not SMT. InterFET has several SMT models that would probably work, e.g. U430. Choose the source resistor using VgsOff/idss/2. The parameters to look for are idss≈20ma and VgsOff≈–2V.

The FET AGC provides ~15dB while the differentail pair provides ~45dB. Local/DX switching could add another ~15dB making the total Δ gain range >70dB. Since the antenna input is balanced a mobius setup using 75Ω coax can make an economical shielded loop. The number of turns will need to be determined to achieve proper input levels. Adding a capacitor and resistor in parallel for a De-Qed resonant tank may provide greater ouput with fewer turns, Q≈3 & f≈1.5MHz. Given the capacitance of the coax using enough turns for it to be self resonant and De-Qing it with a resistor is also an option.