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Collins Collectors Association

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Collins Radios, Still the Best in Town! - Part 1

by Edison Fong, WB6IQN - edison_fong@hotmail.com

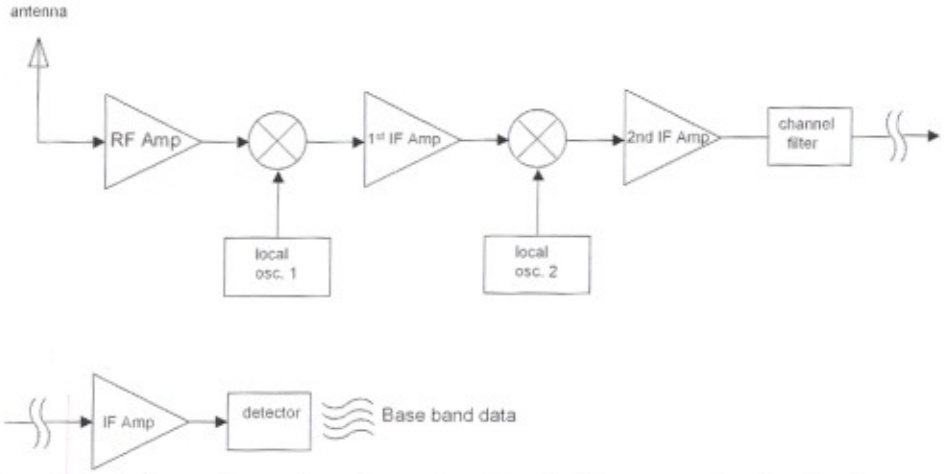

Figure 1. Block diagram of a superheterodyne receiver. Virtually all receivers are based on this design.

Ed Fong, WB6IQN, was the keynote speaker at the annual Collins Radio meeting in Cedar Rapids, Iowa in 1995. His talk was on his experiences with Collins radios, and in particular the Collins R390A family of receivers. It was originally was published in "Electric Radio" in November and December of 1996. At the request of Floyd, W8RO, Ed updated that material for publication in "The Signal." It is a multi-part series that will run for the next few issues. The diagrams associated with the text will be presented as they relate to that part of the article printed herein.
Gail, K2RED, Editor, "The Signal"

Since my last writing, I spent four years at Motorola designing analog CMOS integrated circuits. While at Motorola, Mike Wright, K6MFW, and I started the Motorola HT220 Preservation Society. Our theme is the appreciation and restoration of old Motorola HT220 walkie-talkie transceivers (www.batnet.com/mfwright.HT220.html).

I have worked in the electronics industry for 25 years. Throughout those years I have been involved in the design of either radio equipment or analog integrated circuits. I have loved radio since I was a child. I was always intrigued with electronics and all the wizardry it could produce. I remember back in 1964 when my dad bought me a pair of 100-milliwatt walkie-talkies. From then on I was hooked on how one could transmit information through the air via radio waves. To make a long story short, I have spent a lifetime trying to improve on that phenomenon. I now work at Foveon Corp., where I design high-resolution CMOS image sensors (www.foveon.com). Foveon is a spin-off of the original CMOS image-sensing group that was started at National Semiconductor in 1996. I am also a part-time instructor in the Department of Electrical Engineering at UC Berkeley, teaching graduate courses in RF Wireless communications.

A common question asked of me by both my graduate students and fellow hams is "Are today's receivers really better than those made 40 years ago?" Being a diplomat, I never say yes or no. It all depends on what one is looking for in a receiver. You would think that with Pentium IVs clocking at 3.5 GHz, wireless 802.11g transferring data at 54 Mbps, and cell phones being given away, HF receivers would have progressed to a point where they are vastly superior to receivers of four decades ago. Unfortunately, I am the bearer of bad news. Receivers of today are no better than the top-of-the-line receivers of the 1960s or even the 1950s. Skirt selectivity has gotten worse overall. Overload noise performance has gotten worse. Audio quality has gotten worse.

What do we get for our $600 to $1000 today? It clearly is not performance, but features offered in today's under-$1000 radios are quite impressive. These days a typical ICOM or Kenwood rig offers a variety of features starting at about $600. (I personally am very impressed with the ICOM 718 given its price range. Another good radio is the Yaesu FT-817, which Ham Radio Outlet is selling for $479.) You get digital readout down to 10 Hz resolution. You get a very stable oscillator with less than 100 Hz drift. You get unlimited memories (in the 1000s), and you get a computer-interface control so you can control the radio from your computer. I almost forgot: Many include even a DSP processor for filtering and noise reduction. Unfortunately, you do not get the most important feature of all—a "high performance" receiver.

The modern-day under-$1000 ham receivers (or transceivers, as the case may be) are adequate for everyday consumer use. Make no mistake about it, though; these receivers will not perform with the quality of an old Collins R390, 75A4, or S-Line. Even an old Kenwood 520 will outperform many of the radios available today. Thus, it's not just the manufacturers; it's in the design philosophy of transceivers.

To give a recent example, at Field Day 2003 I went out with the Sunnyvale, CA amateur radio group. My operating shift began late Saturday afternoon. When I arrived at the site at about 4 PM, the antennas were up and two HF stations were already on the air. The equipment was a Kenwood 850 and an ICOM 706, both with all the available filters. These are respectable radios by today's standards. When I glanced at the log book, I noticed they had only made a few dozen contacts. I asked them, "What's gone wrong here?" The answer was "We can't seem to hear them; everything is all garbled up." I sat down and started

In this issue...

Hamvention 2005

by Tony Sokol, W9JXN
tonysokol@sbcglobal.net

Dayton 2005 is rapidly approaching, and hopefully most of you are making plans to attend. Dayton is May 20, 21, & 22. This year's Dayton CCA activities include a hospitality suite each night at the Holiday Inn Fairborn. The CCA Banquet is scheduled for Friday night, May 20th. Our featured Friday evening banquet speaker will be announced soon. As always, we plan to have some nice door prizes along with some exciting prizes to raffle off at the banquet.

In addition to the Awards Banquet on Friday, the CCA will be sponsoring a booth at the Hamvention, providing a great opportunity to enjoy the camaraderie of our fellow members. There will be items for sale at the booth, including CCA caps, CDs, and other Collins-related goodies.

Reservations for the banquet can be made by sending $35 per attendee along with your name, call, and meal preference (chicken or beef) to: Collins Collectors Association, P.O. Box 354, Phoenix, MD 21131.

Special room rates of $99 per night are available to CCA members at the Holiday Inn Fairborn. Reservations can be made directly by calling (937) 426-7800. Be sure to tell them that you are a CCA member to get the special $99 / night rate. For more information check out our web site at www.collinsradio.org.

We will have the fleamarket dance cards available at the hospitality rooms and at the CCA booth. Don't miss out on the fun!

CCA Election Results

The following are the election results as of the recent CCA Board of Directors election:

CCA Board of Directors:

Dutch Maurer - WB7DYW	258
Sandy Meltzer - KW6KW	414
Floyd Soo - W8RO	406
Robert Turner - W5APN	307

CCA By-Law Change:

Yes	419
No	46

Respectfully submitted, Walt Barczak, *KB3CGZ*
The CCA Board of Directors thanks Walt for Chairing the CCA Nominating Committee and for processing the election returns!

Winter 2005
NET NEWS
Fred W1SKU Net Manager - Dean KA6BGW Asst. Net Manager

75-Meter Net: The 75-meter band has been very unpredictable over the past few months. As we said goodbye to the high QRN levels of the summer months, we all looked forward to the quiet, good propagation of winter. Well, that didn't happen. As I write this, some nights the band is long and sometimes it is short, but rarely have we had a good mix of long and short. The NCOs do their best to get everyone checked in, but with the spotty propagation it has been a very difficult task. As long as the band is in this condition, please listen for those stations trying to check in that the NCO isn't hearing and relay them to the net. We don't want to leave anyone out. On the positive side, the number of check-ins has gradually been increasing over the summer months.

20-Meter Net: The 20-meter net has, as always, been the most popular net. The number of check-ins has increased in the winter months as more members check in. The propagation on 20 has also been very unpredictable, but with two NCO stations we manage to get all the stations checked in. Another positive note is that we are getting very close to having a full roster for the weekly nets. We still need two positions filled on the 20-meter band, weeks four and five.

10-Meter AM Net: We are still looking for someone to take over the 10-meter AM net. If you have an interest in doing so, please e-mail me, Fred, W1SKU, at w1sku@direcway.com, or Dean, KA6BGW, at daprull@aol.com.

I hope that everyone has a very Happy and Prosperous New Year, and I again look forward to seeing many of you at the Dayton CCA Banquet.

In the Shack

Bob, K4TAX, in the shack

This is a recent picture of me, Bob, K4TAX, in my shack on Bon Aire Mountain on the western edge of the Cumberland Plateau, some 7 miles east of Sparta, Tennessee. On the second shelf is the Collins station, all Winged Emblems, a 32S-1 transmitter, a 75S-3B receiver, and a 516F-2 power supply and matching speaker. I personally have cleaned and restored all of the pieces and am very proud to now have my first Collins station on the air.

Being licensed in 1959 and having owned several different radios, from homebrew CW rigs to the latest in solid-state transceivers, I can say the Collins S-Line is a very impressive performer. From the time I was licensed as a junior in high school, it was always a dream of mine to have the "ultimate station," a Collins S-Line. Now, some 45 years later, that dream is a reality.

Over several months, I obtained each piece via a popular on-line auction site. Upon receipt of the receiver, I discovered that it was a real mess, with the description of "dirty" being only a mild statement of its condition. It appeared to have served as a home to a rodent family, to the extent of a dead and very dry mouse carcass in one of the switch shield cans on the bottom. The rodents had chewed wires in many places, severing the leads to the output transformer. The urine and feces accumulation was throughout the radio. Seeking advice from the members of the CCA reflector, a cleaning plan was launched. With pains-taking effort and time, the radio was cleaned up, with little remaining evidence of its past residents.

Replacing a few aged defective components, carefully replacing wiring with the original color and size material at several points where the insulation was missing, followed by a complete alignment, brought the radio to life and to its original specifications.

As to the transmitter, it came from Texas and was operational upon receipt. In-depth investigation revealed that it was plagued with "aged resistor" issues and a few dirty switches. These were cleaned and replaced as required. Again, a full and detailed alignment was done. The transmitter, too, performs flawlessly on all bands. Fortunately, with each case and each piece of equipment, the cabinets and front panels were in excellent condition cosmetically, although very dirty.

All knobs were original, and no chassis or electrical modifications were found. You might check my bio on QRZ.COM for a wee bit of other info about my station. 73, Bob, K4TAX

On the Workbench:

Basic Troubleshooting Tips

by Dutch Maurer, WB7DYW wb7dyw@ev1.net

I am sure I have covered this topic before, but because there are so many new CCA members, I feel it is a good idea to go over it again. It solves many problems in so many Collins rigs.

The symptoms are low grid drive, low output, some bands not working, and poor performance. The radios covered are the KWM-2/2A S/Line transmitters and receivers.

We are talking about the "slug rack" and the associated trimmer caps under it. My suggestion is if you think your rig needs adjustment, start with the manual and study the section covering this procedure, keeping in mind that you MUST follow the manual step by step . . . no shortcuts!

Begin by checking the 75-meter band. Go to 4.2.5 RF circuits alignment in the KWM-2A manual, or the appropriate section in the manual of your rig. Start with section "B," as we just want to check for a problem at this point. Follow the instructions to the letter, with the main dial at 100 and the band switch on 3.6, exciter tuning at 2.1. Check the coils on the slug rack for maximum grid drive.

Remember to keep the mic gain down so you can see any improvement in grid drive. If you see a substantial change here, you may need a complete alignment of the slug rack and trimmer caps.

If it has been a long time since this was done, it may be time to do it again, as it will greatly improve the performance of your rig.

Now we come to the hard part, and that is the trimmer caps. If you have a few caps that do not respond to tuning, they may be dirty or stuck together and need to be removed and cleaned. Let the games begin!

Start with removing the radio from the cabinet and placing it upside down. Remove the fiber shaft on the band switch by loosening the set screws at the front of the shaft and then pulling it out of the small hole at the rear of the chassis. Do not turn the band switch until after you put it back. If this makes you nervous, contact me and I can talk you through it.

Next remove the silver cans over the coils, making sure to save all the hardware.

On the bottom of the trimmer caps there is a "Y" contact. You can grab it with a pair of needle-nose pliers and pull it off the center stud, releasing the top of the cap and the plate. Carefully remove them from the rig and inspect them for any dirt or metal tracing from wear or adjustment. They should be very clean and white. To clean them use a toothbrush and some AJAX cleanser with bleach (or the equivalent) and carefully scrub them. Then rinse them, making sure they are very clean and all the cleanser is rinsed off.

Be very careful of the small wafers, as they will crack easily and then are no good. Re-assemble in reverse order. I would suggest doing all of them, as if one is bad, the rest are of the same vintage and could stand a good cleaning and alignment.

Remember to follow the instructions in your manual to the letter.

Again, if you need help or have questions, contact me and I will be happy to help you.

I believe you will be very happy with the results, as the rig will operate like it did back in the "old days."

. . . 73, Dutch, WB7DYW

Join Us on the Air!

- Sunday 14.263 mHz at 2000Z
- Tuesday 3805 kHz at 8pm CST
- Thursday 3875 kHz at 8pm CST
- Friday (West Coast) 3895 kHz at 10pm CST
- Sunday 10m AM 29.050 mHz at Noon CST
- 1st Wednesday AM 3885 kHz at 8pm CST

Sunday for Technical, Buy, Sell & Swap
Tues., Thurs., Fri., & Sunday for Ragchew

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www.collinsradio.org

Using the MFJ-554 as a Sidetone Oscillator for Collins

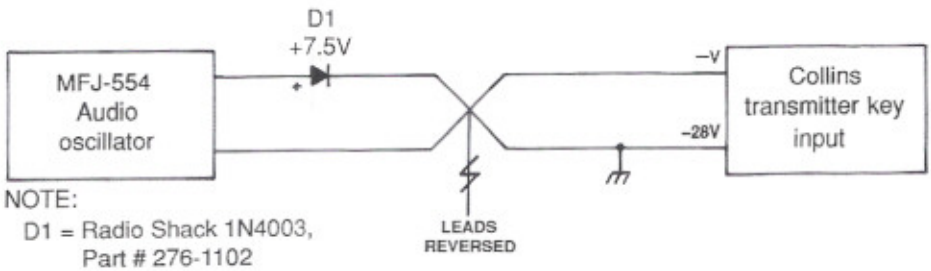
by Joe Prewitt, W0TUT

MFJ calls the MFJ-554 the finest keyed audio oscillator on the market, with .2% total harmonic distortion, no key clicks, and frequency adjustable from 400 to 1,000 Hz. The main reason why I like the outboard sidetone oscillator is because the Collins sidetone audio frequency will be 1350, 1500, or 1750 Hz, depending on the model KWM-2A, and this is a higher tone than many CW operators prefer. Most CW operators like to listen to a lower frequency sidetone, and this variable frequency control allows it to be adjustable from 400 to 1,000 Hz. It is also convenient to have a good audio oscillator hooked up to your key to be able to practice sending CW at any time, instead of having to reconnect the key lead.

The input to the 554 has +7.5 VDC (9 V wall-wart supply) to a keyed FET amplifier, and Collins has a negative keying bias of approximately −24 VDC. Therefore, to prevent interaction between the solid-state FET volts and negative grid bias, I connected a common 1N4003 silicon diode as shown in the diagram.

The leads from the Collins transmitter are also reversed to apply positive volts to the cathode of the silicon diode. This keeps the 24 volts off the FET amplifier.

This diode-connected, external sidetone oscillator has been in use at W0TUT for nearly two years, with good results. Be careful, however, if you have a lot of RF in the shack, as the FET could be damaged.



NOTE:
D1 = Radio Shack 1N4003,
Part # 276-1102

Collins Radios, Still the Best in Town! - Part 1 *(continued from page 1)*

by Edison Fong, WB6IQN - edison_fong@hotmail.com

tuning around and sure enough, it was impossible to pull a single station out of the pileup. It was simply a case of the receiver front-end folding. When this occurs, it is impossible to recover the original signal. Once the front-end is overloaded, it reverts to its nonlinear mode. If there is only a broadband bandpass filter from the antenna input to the first RF stage, all the signals on the band mix, which results in unintelligible signals.

Going home and bringing my Collins S-Line was out of the question. However, we needed something high-performance and convenient. This was a job for the Drake TR7A. This workhorse was designed by Jim Jaeger, K8RQ (formerly WA8KDR). The transceiver offers broadband and extremely high overload characteristics, high transmit power (150 watts), and is all solid state. These transceivers were used (and many are still in service today) on board military ships, in embassies, as well as by hams who required uncompromising performance. Thus, I drove back home and got the TR7A, PS7 power supply, speaker, and microphone. Sure enough, when I hooked up the Drake, the stations came in clearly and we began to make contacts at the normal rate. The tides then turned and we were not only able to hear stations, but we also worked everything we heard. We even got some responses when we called CQ.

What does this say about modern-day receivers? Receiver design of 40 years ago was quite different from that of today. Primarily, designers did not have the availability of inexpensive microprocessors, software, memories, etc. From that point of view, much had to be brute forced. Things had to be done in the most basic form. Although the design quite often was very elegant, the design engineer was limited to the basics: basic LC (inductor and capacitance) circuits, no CAD (computer-aided design), no varactor diodes, no PIN diode switches, no hot-carrier diodes, no digital logic gates, no gate arrays, no PLLs, and no fancy microcontrollers.

What these classic receivers lacked in electronic technology they made up for in mechanical ingenuity, which resulted in unsurpassed performance, even by today's standards. I hope that after this presentation, one will better appreciate the works of Warren Breune, Art Johnson, George Pappenfus, and the gang at Collins during the 1950s and '60s.

This article is presented in several parts: first some historical review, then the RF front end, various mixing schemes, the generation of local oscillator (LO) signals (which will include a discussion of PLLs), the IF filtering, and then concludes with the audio stage.

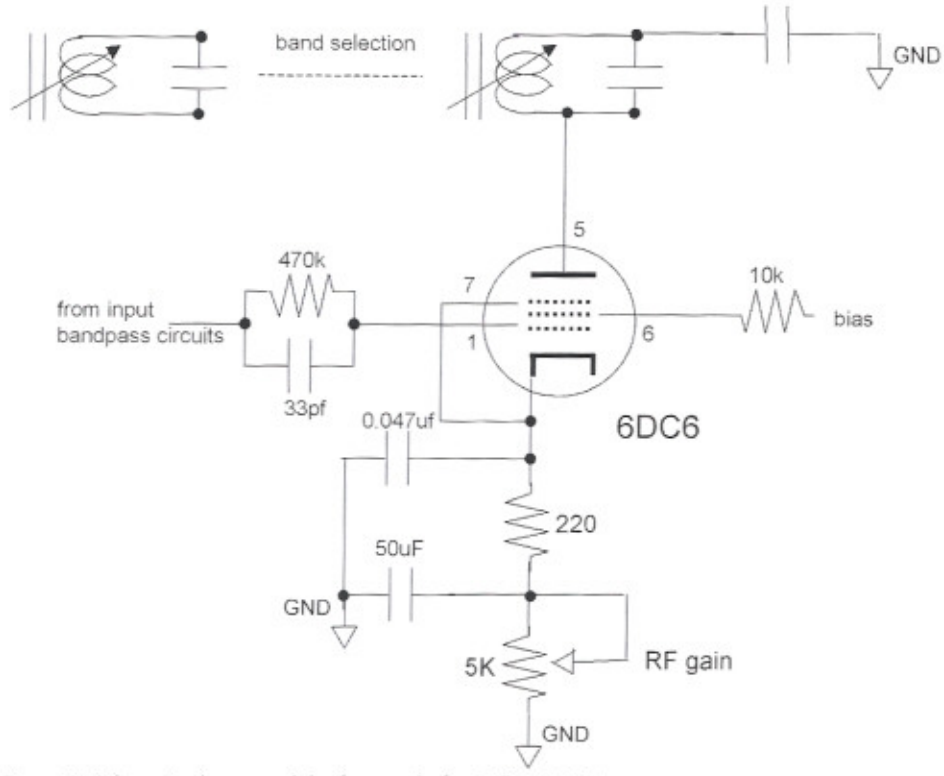


Figure 2. Schematic diagram of the front end of a Collins R390A.

Historical Review

Let's start by reviewing the sections of a basic superheterodyne, shown in Figure 1. Virtually all HF receivers are based on this fundamental design. Some are dual conversion, some are single conversion, but the principles are the same. This holds true whether it is a $5000 Collins rig or a cheap Radio Shack pocket shortwave receiver. They all have RF front ends, LOs, mixers, IF amplifiers, detectors, and an audio stage. It is the makeup of these stages which results in a good receiver and a super receiver. In this article I will clarify some of these differences and relate how they have evolved over the past 40 years.

If you were to buy a Collins KWM-380 for, let's say, $5000 today, you quickly would notice that the receiver's noise floor cannot match that of an old Collins R390A made back in 1960 (originally designed in 1954 with US contract 14214-PH-51). I personally have measured noise floors of R390As at -140 dB. This is a good 3-6 dB better than any radio I have tested, old or new. A typical KWM-380 is only about -135 dB. What makes this 40-year-old boatanchor tick? The reasons probably are not that simple. If they were, these elements could easily be incorporated in today's receivers.

Obviously, the major problem confronting manufacturers today is price. Manufacturers would like to deliver the best value to the customer. $1000 today is the equivalent of $150 thirty years ago. What could one pick up for $150 thirty years ago? Not much. Maybe an Eico 753, or Heathkit DX-60 transmitter with an HR10B receiver. In terms of value, we get quite a bit these days. We just do not get top performance unless we are willing to pay for a Harris 3200 or Ten-Tec Omni VI. These "professional" receivers (transceivers) all go for about $5000 and up. This is not to mention the Collins HF 80 series, where if you have to ask, you can't afford it. My goal is to present the differences in today's modern-day receivers compared with those made 40 years ago.

RF Front End

The RF front end is probably responsible for a good portion of the receiver's performance. If the front end is overloaded, there is nothing in the following stages, short of artificial intelligence or an act of God, that can recover the signal. To preserve the integrity of the signal, an ideal front end should have the following characteristics:

1. Handle the weakest signals and yet not overload with strong signals.
2. The front end should hold its own. Automatic gain control (AGC) is not a substitute for a high-dynamic-range front end.
3. The front end should be as linear as possible and not introduce distortion to the modulated incoming waveform.

(continued in Part 2 - next issue)