

## A Guide to the Evolution of HF General Coverage Receivers at Collins Radio

The story of the evolution of receivers at the Collins Radio Company is an interesting walk both through the progress of technology, and also a look at how, and where, Collins Radio did business over that time period.

What is presented here will by no means be complete. To try and be all inclusive would be both too long, and almost impossible to get right. Even with that caveat, I am sure that there will be cases where someone will say that a sin of omission has occurred, or that this or that should be selected in place of one chosen here. For sure, there will be entire marketplaces that are omitted since, after all, there were eventually amateur radio, microwave, commercial, military, avionics, space and even a humble broadcast band receiver.

Since our audience is almost exclusively mainly interested in the area of HF and Amateur Radio, the focus here will be in that area that is overtly aimed at (or could be applied to) Amateur Radio use or collection. At the same time, this sampling will attempt to demonstrate the evolution of technology and manufacturing during the period represented. Again however, we will see Art Collins' almost premonition/vision of the importance and future roll of the computer come to life.

To start, one must be aware of the fact that Collins Radio did not set out to be a receiver manufacturer. This fact.. this mindset ... was driven mostly by Arthur Collins' search for significant communications technology and progress in areas where he could make significant contributions. Additionally, early on, there were many more fairly mature for their time receiver companies already in business at the time the Arthur entered the scene. National, RME, Millen ..... Just to name a few.

For easily the first four or five years that Collins Radio was in business, they considered themselves soundly as a transmitter (and to some degree early on a transmitter parts) manufacturer. In fact, one of the first names chosen (there were several) by young Arthur when he first started in business was just "Collins Radio Transmitters". Re-named the Collins Radio Company by the time it incorporated in 1933, it still approached its future with the "Transmitter" mindset.

Never the less, receivers did enter the picture very early in the history of the company. One of the things that we do know – driven by a passion for getting business that smacked of recovery from a depression – is that Art would do almost anything to get a sale, or go after business. This passion led him in a number of documented cases, and there are probably more, where he provided a receiver "solution" to a customer who came to Collins looking for a communication system.



50A Receiver

During 1933 and 1934, there are three documented receivers, the 50A, 50B and the 51A that show up in early documentation. In these three cases, it is believed that just one receiver was built for one customer who also purchased a transmitter.



50B Receiver

The 50A and 50B pictured here are representative of the companies design philosophy at the time. All three of the receivers mentioned above are built with standard off the shelf National - with perhaps a little Millen thrown in - components. They are however constructed on, and with, typical Collins chassis and hardware components of the period, and may involve some further circuit development. We do not know for sure. They do have an appearance of being very similar to the National AGS of the period.

The third photo shows the complete system provided for the *Standard Fruit Company* and contained the 50B, a Collins 150C in an enclosed cabinet system with a door. This was the first totally rack mounted system believed sold by Collins.

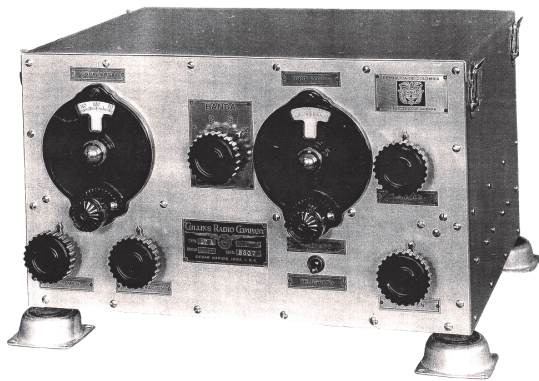


50B Receiver  
In 150C System

Also in this same early period, we have documentation indications that Collins changed their receiver numbering from the 50 series to the now familiar 51 series. There was a (low volume) 51A and then we have one letter indication there was a 51B.

The first "volume" production receiver built by Collins Radio was most certainly the Colombian Army Air Force contract 17A. Again, this piece of business was developed as a system solution for the customer in order to capture this, what amounted to, huge piece of business for its day. In 1935, the fledgling Collins Radio Company received their first really large order for a suite of equipment that included airborne receivers, transmitters (and support components) as well as ground station equipment. The airborne equipment was destined for a number of different types of aircraft with some model variations by aircraft.

There isn't a detailed accounting of these various models remaining, but we do know that the order was for \$57,677 and that the dominant receiver design involved was the 17A pictured below. While the entire order is known to have been enough to provide communication for 50 aircraft, the exact volume of the 17A build is not known. There are at least 8 pictured in one photo that survives.



### 17A Colombian Receiver

Regarding the 17A receiver, little is known about the circuitry of this receiver other than it was a 4 band HF receiver with main and band spread dials and was intended for both AM and CW reception. Since the contract covered both fighter (Curtis Hawk) and bomber type aircraft, it is not known what type this one receiver was intended for.

Following this Colombian contract activity, little remains of the records of individual receiver activity until we see the 51F receiver emerge in 1939. We should point out that, in April of 1939, Collins did announce the 18M/TCH Transportable Transmitter Receiver and in this context, the first actual production receiver was the 18M receiver that was completely independent inside the 18M.

In August of 1939, Collins Radio announced the 51F rack mounted single channel Phone or CW receiver and this would go on to have – what appears to be – just one build of receivers before the WW II efforts started to shut down commercial product development and focus at Collins.

The following "Guide" to the evolution of general coverage HF receivers is thus presented in this context. More information on the 51F can be seen in the article in this issue, and more technical information relating to feature evolution can be found in Don Jackson's nice Service Line article herein. Please see our website for a more complete pictorial guide to receivers @ <http://www.collinsradio.org/receivers>

### Receiver Guide—HF General Coverage & Derivatives

General Coverage HF receivers of significance in the development of the receiver products at Collins Radio: Period covered is from 1939 though 2005. This spans from single channel fixed tuned single conversion superhet though the Software Defined Receiver (the 95S-1) from 1995, and the more current KGR-70 VLF/LF Receiver that is baseband A/D converted right off the antenna and then all "more classical" functions are accomplished in the processor.... Arthur would, indeed, smile. See the articles in this issue on the 95S-1 and the KGR-70 for more information on this amazing evolution of receivers over a 65 year period.....and it goes on - Not Your Grandfather's Oldsmobile.



### 51F Receiver

Single Channel  
1.5—20.0 Mhz Phone/CW  
Rack or Cabinet Mount Opt.  
Introduced: August 1939  
Used "New" RCA Metal Tubes

The first production volume announced standard product receiver was unique in many ways. It used a modular custom order

factory construction method that came and went with this model. It could be ordered with one or two RF stages, crystal or variable injection oscillator, optional CW BFO and an optional Squelch module. It also sported a new style that was short lived as well. Less than 20 produced. Rare. It "reappeared" redesigned in January of 1946 as the post-war 51N-1. (Weight 22 lbs.)



### 51H-3/ARR-15 (R-105) Airborne Receiver

Autotune 10 Channel + Analog  
1.5 - 18.5 MHz AM Phone/CW  
Shock Mount Airborne  
Introduced: 1944  
26.5 - 28 Vdc 1.4A w/ Internal  
DY-34 Dynamotor supply 220 V.  
Wt. 39 lbs. - Uses 70E-2 PTO

This receiver was developed early in WW II as a mate to the very successful ATC/ART-13 transmitter done initially for the Navy. The R-105 used the same channeling scheme as the ART-13 and could be channelled from the same control head providing pilot controlled "transceiver" operation on 10 channels—a first at that time. It did not see service in WW II but served through the Korean War & beyond.



### 51J & 51J-X Series

General Coverage - 30 Bands  
0.5 - 30.5 MHz AM/CW  
Rack or optional cabinet mount  
Introduced: 1945  
115 Vac Standard Power Req'd  
Wt. 80 lbs. - Uses 70E-7A thru  
70E15 PTO

Anticipating the end of the war, development was started in 1944 for this first post-war general coverage receiver. The Project Lead was Roy Olsen. Following Roy's departure in 1946, Lou Cuillard continued development, leading to the 51J-X and the 75A-X family of receivers. They all shared a unique combination of electrical/mechanical features using the new linear PTO, crystal controlled 1st injection oscillator and mechanical slug rack and geared tuning to achieve revolutionary electrical stability and frequency readout accuracy and reset ability. This line of receivers set a new standard and was remarkably successful.



### R-390

General Coverage - 32 Bands  
0.5 - 32.0 MHz AM/CW  
Rack or optional cabinet mount  
Introduced: 1950  
115/240 Vac 60 Hz, 115 Vdc or  
28 Vdc depending on options  
Wt. 85 lbs., 33 tubes w/ 3TF7

The R-390 was developed by Lou Couillard at Collins Radio on a Navy contract during 1950 and production commenced in 1951. It was developed as an improved version of the 51J series which culminated in the 51J-3 in this timeframe. It was much more expensive than the 51J series and first contract cost to the government was \$2500 per unit. The R-390 was developed to be much more rugged than the 51J series and also it was completely modular. Any functional module could be quickly removed and replaced at a field depot without the involvement of highly trained maintenance staff.



### R-390A

General Coverage - 32 Bands  
0.5 - 32.0 MHz AM/SSB/CW  
Rack or optional cabinet mount  
Introduced: 1956  
Same power opt. as R-390  
Wt. 85 lbs., 26 tubes

Development commenced in 1954 on a cost reduced and improved version of the R-390 which became the R-390A. It featured mechanical filters for pass band definition and was intended to bring the R-390 into the Single Sideband era.. It was wildly successful with over 50,000 produced by Collins and associated subcontractors. Like the R-390, it features triple conversion or double—depending of frequency, and uses just 26 tubes. Discontinued in 1970 with some exceptions.



**51S-1 (S-Line) General Coverage**

0.5 - 30 MHz AM/SSB/CW  
 Introduced: 1959 - 1982 w/ over 12,000 produced  
 Wt. 28 lb. Shock, rack, or cabinet mounting optional  
 IF pass band Transformer or Mechanical Filter



**451S-1 Receiver –Limited Production (10)- circa 1980**

0.2 to 30.0 MHz AM/SSB/CW—Derivative of Casper Project  
 Same construction as KWM-380  
 Frequency Synthesized 10 kHz steps w/ Mechanical Filters  
 Wt. 28 lbs, Project Lead : Jerry Vonderheid



**651S-1 (651S-1B Shown)**

General Coverage - 30 Bands  
 0.25 - 30.0 MHz AM/SSB/CW  
 Rack or optional cabinet mount. Wt. 30# - Synthesized  
 Introduced: 1970  
 115/240/28 Volt Optional



**851S-1A Prototype—Updated Display & Control**

Developed during 1980s as follow on to 851S-1  
 General Coverage - Frequency Synthesized  
 0.25 - 30.0 MHz AM/SSB/CW

This receiver was a derivative of the 671U-4/718U-X Commercial comm product line at the Collins Division of Rockwell International. The receiver employed a significant change in receiver architecture at Collins—using initial up-conversion to 99 MHz, the use of roofing filters and then down conversion to the first IF. It was the voice of the future and shared many boards in common with its parent products.

Early versions used NIXIE tube display technology, while the later units employed LED displays. Production ran from 1970 though 1977. It was also the first table top receiver to be frequency synthesized and capable of digital control through a serial port.



**HF-80 Rcvr Family**

HF-80 851S-1 Variable Gen.  
 Coverage 0.25-30 MHz  
 All Mode 38 lb.

HF-8050A One Synthesized  
 Channel 0.25-30 MHz  
 All Mode

HF-8054A 4 Ch. ISB  
 0.25-30 MHz  
 All Mode 1981-1989



**851S-2 Prototype**

General Coverage - Very similar to 851S-1 production version  
 0.25 - 30.0 MHz AM/SSB/CW  
 Wt. 38 lbs.

Developed by Paul Zeigelbein (851S-1/2) and Sil Dawson (8050A & 8054A), this family of receivers led the industry in cost-performance and was a very successful high performance, lower cost family of receivers that was developed in conjunction with the entire HF-80 lineup of exciters, transceivers, receivers, controllers and amplifiers.

The entire story of the development project and program history is available in the Q4 issue of the *Signal Magazine* from 2013. It is a fascinating story of change in an organization. The products all featured a new design paradigm employing off the shelf components where possible and "just enough" performance to win in the market place. It was hugely successful and the products still serve today in many applications—some 25 years later. Mating exciters are the HF-8010A and the HF-8014B—the single channel and 4 ISB channel versions respectively. Amplifiers range from 1 KW (HF-8020) tube and solid state (HF-8023) workhorses to the more eclectic 3 KW (HF-8021) and 10 KW (HF-8022) monster amps. The transceiver is the HF-8070)



**HF-2050—Production**

General Coverage - Synthesized, 1st DSP RCVR to production  
 0.1- 30.0 MHz AM/SSB/CW w/ 99 Stored Preset Frequencies  
 Feature VLSI circuitry and just four circuit cards  
 Rack or optional cabinet mount  
 Mil Std 461 Qualified (No Deviations) - 1150 units produced  
 Produced 1985 through 1988 - Project Lead: Dave Church  
 Major customer was Canadian Government