

## BC-348 Page

This is about the oldest



FIGURE 1—Radio Receiver BC-348-H

vintage of receiver I deal with. One model of it is populated with metal tubes with grid caps. A real blast from the past. As best I can tell, the design of these receivers dates from the mid-30's. They are a completely classic single-conversion superhetrodyne design. No frills, nothing too fancy. Good, solid, and reliable. Inside, a great deal of the metalwork is either stainless or alluminum, so these receivers rarely show any significant corrosion. Since they are typically 60 or more years old, they are often full of various kinds of insect nests and dust, but nothing more serious than that. Unfortunately, it is rare to find one of these receivers that has not been modified. In fixing up these receivers, I spend much too much time backing out half-baked mods that some yo-yo wired in decades ago.

They did do one smart thing in the design, which was to move the intermediate frequency up to 915 kHz. That helps with the imaging problems in the high band, which are inherent in single-conversion receivers. This gives the filters in the RF

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stages a few more hundred kHz to do their job. It is noticeably better in this department than, say, the R-5007 (see my R-5007 page), which is a 455 kHz single-conversion receiver. Another help is that the BC-348 only goes up to 18 mHz. Also, the gain in the RF stages seems to be deliberately set to a relatively low level. This keeps the signal small up to the conversion stage, while getting the band-limiting effect of the RF stage bandpass filters. I believe the point of this is that keeping the signal small reduces the intermodulation distortion and thus reduces the interference from strong stations caused by nonlinearities in the early stages.

These are not receivers with the highest performance in the world. They do not hold a candle to the SP-600, the R-390 and others. On the other hand, they weigh in at maybe 25 pounds rather than 75 or 85. Since they were designed for aircraft use, they are relatively lightweight for a boat anchor. Most of them appear to have been made by Belmont Radio Corporation, but there are some made by RCA as well.

## BC-348 TidBits

Since these receivers were designed to be powered by dynamotors, most of them you see these days have been converted to use 110VAC (or have a hole where the dynamotor was). There is no particular trick to putting a power supply in. The most annoying part of the conversion is that the filaments were wired in series to operate off of 28 volts DC, so they have to be totally rewired to run in parallel. Luckily they are all 6.3 volt filaments. The real problem is that the receiver is not very tolerant of 60 Hz ripple in the power supply, so great care has to be taken to reduce the supply ripple. This is not a big problem with modern components. I haven't tried making a regulated supply, but it should not be difficult with modern high-voltage FETs. The current draw of these receivers is quite modest, so it does not take much of a power supply to get good operation.

I noticed also that they deliberately excluded the MW band from the tuning. I guess they didn't want the fly-boys listening to AM radio en route.

The tuning has a substantial reduction gear that makes precise tuning very easy. On the other hand, it takes 99 turns of the knob to tune from one end of the dial to the other. You can get a serious case of carpal-tunnel syndrome trying to band-cruise with these receivers.

There is a veritable alphabet soup of models of this receiver. E, H, J, K, L, M, N, O, P, Q, R.

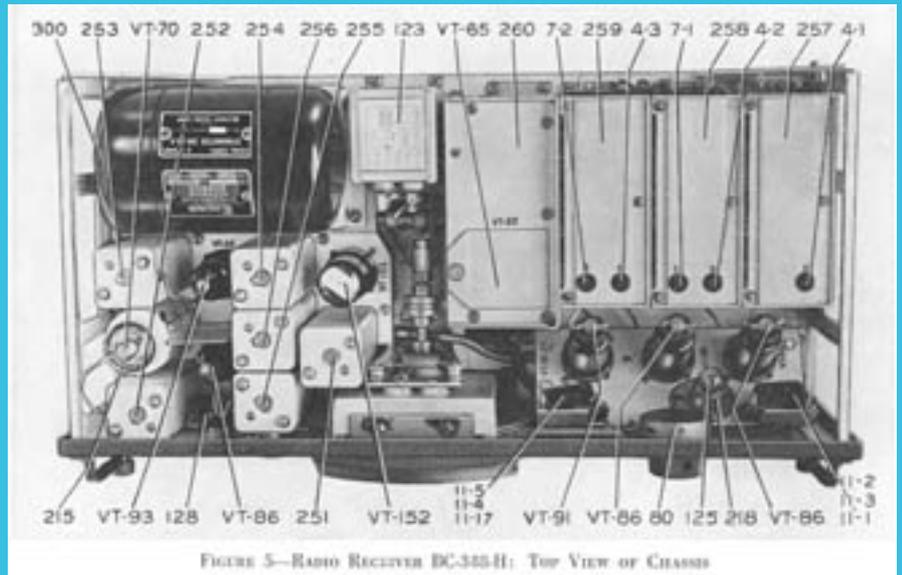
There is also a BC-224 E, F, G, H, K, and L that are basically the same. The BC-348 was designed to operate off a 28-volt supply through an internal dynamotor, although few of them you see today still have the dynamotor. The dynamotor in the BC-224 operated off 14 volts.

The E, H, K, L, M, N, O, P, R represent a straightforward design. There is a separate VFO tube that uses the most marvelous little gas regulator tube, the 2J991. This looks more like a neon lamp than a regulator tube.

The J, N, Q models were different. For instance, they have a combined VFO/Mixer stage where they use a single tube that both oscillates and mixes. There is no voltage regulator on the VFO/Mixer tube. On the other hand, they have an extra stage of IF amplification.

I have not done detailed tests yet to know which one is "better," so watch this space!

**\*\*WATCH THIS SPOT\*\***MORE TO COME\*\*



## Scanned BC-348 Manuals

As noted before, one of the most difficult parts of dealing with these old receivers is finding the appropriate manuals. Without schematics and other descriptions, it is a hopeless task trying to repair these things.

It is fairly easy to get scanned BC-348 manuals. What is hard is finding one that has decent half-tone images. Every scan I have seen just has black blobs where a grey-scale image should be. Plus, original BC-348 manuals are *very* scarce. What I finally ended up doing is buying some original manuals off eBay at an extraordinary price for a piece of paper (over \$100 each). Then I made a deal to sell them to the next highest bidder when I finished scanning them. That way it only cost me about \$20 each to scan them. Of course, I applied my usual scanning techniques to get top-notch scans and so that the half-tone images look as close as possible to the original. I have also annotated the schematics in places.

I learned that there are a number of readers that have no good way to get a printed copy of these manuals. As a service to my readers, I will print out and comb-bind a copy of any of these manuals for you for \$15 each (postage to US included - more for foreign).

<a href="#">Download</a> 50MB	(Watch this spot!)	<p><i>T.O. 08-10-166 "Instruction Book for Operation and Maintenance of Radio Receiver BC-348-S and Radio Receiver BC-224-L"</i> T.O. 8-10-166, dated April 21, 1943. This is a relatively short manual covering these two receivers. Unfortunately, there are some water stains on the pages of this one.</p>
<a href="#">Download</a> 117MB	(Watch this spot!)	<p><i>"Instruction Book for Operation and Maintenance of Radio Receiver BC-348-E, Radio Receiver BC-348-M, Radio Receiver BC-348-P"</i> This manual has a Technical Order number, which is T.O. 08-10-119, dated December 15, 1942. This is one of those extraordinary, beautiful manuals that was printed on glossy paper. I did my best to preserve the detail in the halftone photographs, but it is hard to get all the detail of the originals. There are two 11x17 images at the end - one is the wiring diagram of the manual, which was a fold-out. The other is just a high-resolution scan of the schematics page that has been rotated, magnified and formatted for 11x17 for easy reading.</p>
<a href="#">Download</a> 162MB	(Watch this spot!)	<p><i>"Instruction Book for Radio Receiver BC-348-H. Manufactured by Belmont Radio Corporation, Chicago, Illinois, U.S.A."</i> I couldn't find a date or a Technical Order number on this one. That generally means that it is the preliminary manual written by the manufacturer and issued and used before the military issued their own manual on the radio. This manual is quite complete. It covers the alignment and maintenance of the receiver in some detail. I scanned the schematics at quite high resolution and included them as 11x17 (they were originally 8.5x11 in vertical format) I also include an "annotated" version of the schematics where the part values are shown next to the parts. It makes the schematics a bit busy, but they are much easier to understand.</p>

<a href="#">Download</a> 97MB	(Watch this spot!)	<p><i>"Handbook of Instructions, Radio Receivers BC-224-B, BC-348-B, Radio Corporation of America"</i> T.O. 8-10-25, dated December 20, 1942. This manual looks for all the world like a cheap copy of the BC-348-H manual. The halftone images are nowhere near as crisp as the BC-348-H, and it was not printed on heavy, glossy paper. I did not bother to annotate the schematics, since they are essentially the same. If you downloaded the other one, don't bother with this one (unless, I guess, you happen to have exactly a BC-348-B).</p>
<a href="#">Download</a> 136MB	(Watch this spot!)	<p><i>"Handbook Maintenance Instructions Radio Receivers BC-348-E, BC-348-M, BC-348-O, BC-348-P, BC-348-S, BC-224-E, BC-224-G, BC-224-H, BC-224-L"</i> AN 16-40BC224-3, dated November 13, 1943, <i>revised September 21, 1951!</i>. This is the most recent one I have ever seen. I didn't know they were made this late. The half-tone images in this manual are not great. It was not printed on nice, glossy paper like some of the others. It does seem to be the most complete manual. There are three different sets of schematics and two wiring diagrams. If you can only download one manual, this is probably the one, possibly augmented with one with good half-tone images, like the BC-348-H manual.</p>
<a href="#">Download</a> 87MB	(Watch this spot!)	<p><i>"Instruction Book for Radio Receiver BC-348-J, N, Q"</i> This is a preliminary manual. It is marked as "E.O. 35AB-5BC348-2C." I believe the "E.O." means "Engineering Order." This is before the manual has become a TO (Technical order). I believe this manual became "AN 08-10-112" which was issued February 25, 1942. This manual must predate that one by some amount. I couldn't find a date on it anywhere. The later ones are available below. Note that the J, N, and Q models are the <i>other</i> BC-348 design. It looks just the same from the outside, but as soon as you go inside, you get a surprise. For instance, right on the RF deck, in the place where the first detector (mixer) tube should be, there is an audio output tube(!). Next off, underneath, where the power supply is, there is this great, humongous (sp?) capacitor. It is about a 5" cube! It is all of 8 microFarads at 300 volts - something that would be the size of your little finger now. When restoring one of these, that is the first thing you get rid of . . . it probably leaks anyway. In any case, if you run into one of these radios, you will need this manual. This design doesn't appear in any of the other manuals. You should probably choose one</p>

		of the "release" versions of the manual listed below, though.
<a href="#">Download</a> 77MB	(Watch this spot!)	<i>"Handbook of Maintenance Instructions for Radio Receivers BC-348-J, N, Q"</i> This is also known by it's Air Force designation of AN 08-10-112. This is not the first official printing of the manual, but it is still pretty early. The halftone images are of much better quality (though not as good as the BC-348-H glossy-print manual).
<a href="#">Download</a> 76MB	(Watch this spot!)	<i>"Handbook of Maintenance Instructions for Radio Receivers BC-348-J, N, Q"</i> This is also known by it's Air Force designation of AN 08-10-112. This one is the same as the above manual, but it has a number of revisions that were added in December of the same year. The principal revision was the replacement of the parts list. They seem to contain roughly the same information, so I'm not sure quite what the point of the revision was. This one is several pages shorter than the above manual, but I'm not sure if that means that anything is missing, or if the parts list is simply more compact. Again, this is a relatively good printing.
<a href="#">Download</a> 31MB	(Watch this spot!)	<i>"Surplus Radio Conversion Manual."</i> There are 3 volumes of these books were written in the years after WWII. A great deal of radio equipment came on the market as military surplus. These manuals were for Ham Radio operators and shortwave enthusiasts who might get hold of some of this equipment. Much of it (like the BC-348) ran on 28 volts DC and had to be modified for 110VAC use. Others required more extensive modifications, such as rewinding coils to change the frequency bands to the Ham bands. This document is not the whole conversion manual, but just the pages relating to the BC-348. This is taken mostly from Volume I (by R.C. Evenson and O.R. Beach) and Volume III (by William I. Orr, of "Radio Handbook" fame).

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spot!)

*"Data Sheets for Tubes used in the BC-348 Series."* A number of people have mentioned to me that their tube manuals don't cover the tubes in the BC-348. There are two issues: first is the quaint numbering system the Army used for vacuum tubes, which consists of "VT-" followed by a number (and then sometimes by a letter). Most of these correspond to standard commercial tube types. The second is that some of these tubes date from the 30's and were out of production by the time many tube guides were printed. In this document, I have reproduced (and annotated with the "VT" numbers) the data sheets for all the tubes used in the BC-348 series. These data sheets were scanned from the RCA HB-3 Radiotron Tube Manual. This is a 10-volume loose-leaf set, and is generally considered to be the most complete tube manual that was ever commercially available. I probably overdid the scans, since the tube data sheets don't really need the high-quality reproduction that the manuals themselves require, but I guarantee that every word is as legible as the original (and more so in some cases).

