

The WJ-8711 & WJ-8712 Receivers vs. Ten-Tec RX-340 & RX-331

by Paolo Viappiani, Carrara, Italy

In recent years a renewed interest has grown in regards to the best HF receivers using "first generation" DSPs, typically the HF-1000/HF-1000A, WJ-8711/WJ-8711A and WJ-8712 models by Watkins-Johnson and the RX-340 and RX-331 models by Ten-Tec. Even today, the aforementioned receivers are considered among the best performers of all times; this is a well-deserved fame in the case of the W-Js, a bit less with regard to the units manufactured by Ten-Tec, a firm that once had a good reputation but that has been recently acquired by a new owner (who sold the old facilities by transferring the company and distorting the sales, support and assistance policies of the previous company [2]). I therefore believe that this article serves as a dutiful information for the readers who are potentially interested in these receivers.

A Bit of History

In the years between the last and the present century, two receivers very similar to each other in terms of design and structure were released almost simultaneously by **Watkins-Johnson** of Gaithersburg, Maryland [1] and by **Ten-Tec** of Sevierville, Tennessee [2]: the **WJ-8711** (later upgraded to the A and A-3 versions and followed for a short period by the **HF1000** and the **HF1000A** "civilian" versions [3]) and the Ten-Tec **RX-340**; both of them are shown in Figure 1.



Figure 1: The **WJ-8711A** (above) and **Ten-Tec RX-340** (below). Notice the similarity of the front panels of the two radios.

The *WJ-8712/WJ-8712A* and the Ten-Tec *RX-331* receivers were released by their respective manufacturers in that period also (the latter one was preceded by the *RX-320* and *RX-330* models). All these types were nothing more than "black-box" units, that in all respects corresponded to the *WJ-8711A* and to the Ten-Tec *RX-340* receivers but that had not been provided with true front panels, as they were controlled by special hardware interfaces or from a PC, look at Figures 2 and 3. Looking at the appearance of the *WJ-8711/HF1000* receiver series and of the Ten-Tec *RX-340* units, a relative similarity to each other is evident, and it has led to various speculations regarding the design of both devices.

One of the theories was revealed by James (Jim) C. Garland W8ZR of Santa Fe, New Mexico [4], about which he claims to have obtained information from a Ten-Tec employee directly. James claims that in 1991 the US Government Agency *NSA (National Security Agency)*, which used to purchase numerous HF receivers for surveillance and interception, decided that the current cost of the receivers were too high and formed a special group in order to study how to obtain a possible price reduction.

At that time the high-end HF receiver market was dominated by a few manufacturers: *Watkins-Johnson, Racal, Cubic, Rockwell-Collins* and a few others, and Ten-Tec applied for joining the group.



Figure 2: The *WJ-8712A* (above) and *Ten-Tec RX-331* (below). While the *Watkins-Johnson* model is two rack units high and half wide, the *Ten-Tec* develops less in height (only one rack unit) and more in width (standard 19" rack). However, both receivers are quite deep (more than 20"-50 cm.).



Figure 3: The *Tmate* unit of the *WoodBoxRadio* is shown here; it is one of the possible accessories which, together with a PC monitor, allow using the "black-box" receivers via an RS-232 interface.

According to the information provided by Jim Garland, the Watkins-Johnson and the Ten-Tec designers worked together for about one year in order to agree on the technical characteristics and guidelines of the "radio of the future" which must meet all the requirements that the NSA requested. The team eventually agreed on a common set of specifications to submit to the Government Agency, while both *Watkins-Johnson* engineers and *Ten-Tec* colleagues, who were expecting a consistent number of orders, worked hard in order to develop the technologies necessary for the production of this new "breed" of radios. At the last moment, however, it seems that *Watkins-Johnson*, to *Ten-Tec's* great surprise and dismay, requested that the NSA added an additional specification: an *MTFB* (*Minimum Time Between Failure*, i.e. *minimum interval between two subsequent failures*) of 10,000 hours, a stringent requirement that was normally required for aerospace electronics only. Such a step constituted a real spite on the part of *Watkins-Johnson*, which had a substantial and more than a decade-long background of military and aerospace government supplies (in particular of telemetry receivers): at this point *Ten-Tec*, with its experience carried out solely in the field of amateur and consumer electronics certainly could not meet the new requirements.

Ultimately it seems that the latter gave up participating in the bidding process and that *Watkins-Johnson* won the contract for the supply of the new radios. And James goes on by asserting that, in the absence of competition, *Watkins-Johnson* was able to sell their *WJ-8711s* to the NSA at a much higher price than initially expected. Ten-Tec's reaction, however, was not long in coming: the Sevierville company quickly introduced its *RX-330* model (almost immediately followed by the *RX-331*), a "black-box" receiver without front panel and controllable via RS-232 interface which, despite not meeting the *MTBF* specification, was an instant success both at the NSA and at the agencies of other countries; this was also due to the fact that the *Ten-Tec* "black box" was sold for about a third of the price of a *WJ-8711/8711A* receiver.

After this success *Ten-Tec* decided to release also the *RX-340* model, as a direct competition.

This fascinating story by Jim W8ZR raised doubts and objections by Paul S. Courson WA3VJB and others (see also note [4]).

Another version of the story (where *Ten-Tec* is not mentioned however) is the one that was written by Rick Lober, a former *Watkins-Johnson* employee and that was also published on the *Facebook* group "*BlackRadios*" [5]. In short summary, according to Rick, around 1990 one of *Watkins-Johnson's* largest Government customers asked if it was possible to design a high-performance HF receiver (similar to the well-known WJ-8718, which at the time sold for about \$15,000-18,000 [6]) but with a cost closer to that of the *ICOM* units they were purchasing but were not totally satisfied with. The proposed target was a unit price of \$3,000 for 1,000 units which would be purchased immediately after an initial order of 6 receivers which, however, had to be delivered within 9 months.

Bill Bruff, at the time *Watkins-Johnson's* Division Director, accepted the challenge and formed a dedicated design team, headed by Steve Hedges; Rick Lober himself was part of that team. According to Rick, the only way to achieve the cost objectives was to use a *DSP-based* IF and detection section, that had been already used a few years earlier by *Rockwell-Collins* but that turned out to be problematic due to the power required and the heat developed. In the meantime, however, the technology had advanced and it was finally possible to think of a radio consisting of a fairly conventional RF section followed by an A/D converter and a DSP in which all the functions usually elaborated by analog circuits in the receivers were implemented. The *RF preselector* had to be optional (as in the *WJ-8718* receivers) and the rest of the unit had to include a *switching power supply* and, of course, a *front panel with all the controls* and *the large tuning knob* that was characteristic of the W-J receivers. The W-J team worked day and night to refine the project and to solve the problems that gradually arose, and this also happened the night before the presentation of the first 6 prototypes to the customer. In this regard, Rick reports that: "*The team returned home around 6 in the morning, took a shower, put on a tie and showed up at 9 to meet the client. Three hours later the six units had been sold, despite the persistence of some small problems.*".

In later times the 1,000 units that had been initially agreed on were also sold and other configurations were developed, in particular the *WJ-8712* and *8712A* models (both with a "blind" front panel and PC controllable) and a "consumer" version called *HF-1000* and *HF-1000A*, mainly intended for shortwave listeners.

Which of the two versions of the "history" to believe? Even *Terry O' Laughlin*, one of the world's leading *Watkins-Johnson* experts [7], which I asked some time ago, confessed to being very doubtful about it; so, after hearing various other sources, I got a certain idea... Indeed:

- 1) It is unreasonable to think that two receivers so similar to each other were developed and released almost simultaneously without any contact between the two design teams;
- 2) Neither *Watkins-Johnson* nor *Ten-Tec* have ever mentioned any mutual collaboration, nor have they replied, when asked, on the specific topic. I therefore think that there has been some form of "*industrial espionage*" by one or more people of the two teams, and that the thing has been hushed up in a hurry, having involved Agencies and Government projects. This, however, not without having given some "sop" to both manufacturers: to *Watkins-Johnson* by assuring them good sales contracts on the *WJ-8711* and *8711A* units, to *Ten-Tec* by accepting substantial supplies of their "black-box" radios *RX-330* and *RX-331*.

Should this have been the case, even the similarity in the front panels of the first DSP receivers of the two different manufacturers would not be accidental at all, being the result of a collaboration

that was prematurely interrupted for various reasons... the Military-Government market has always appealed to everyone and is well worth an under-the-table deal!

Features of the WJ-8711 Series (WJ-8711&A, WJ-HF1000&A) and of the Ten-Tec RX-340 Series Receivers

This article mainly concerns the "*direct use*" receivers, i.e. it does not consider the "*black-box*" versions that can be used and controlled via PC and/or by special interfaces (explicit reference will be made to them only when necessary). So let's take a look at their technical characteristics first, then moving on to their construction and to their own particularities.

Both the *Watkins-Johnson's* "*8711 Series*"/"*HF-1000*" receivers and the *Ten-Tec's RX-340* are classic solid-state "*triple conversion*" units, with continuous frequency coverage from 5 kHz to 30 MHz (but tunable from 0 Hz) and with a frequency resolution of 1 Hz.

All the receivers show a fairly conventional RF section that is followed by a "*DSP section*" in which the signal is processed both for what concerns the bandwidth and the demodulation, as well as additional features such as *Noise Blanker, Pass-Band Tuning, Notch Filter*, etc.

In the *Watkins-Johnsons* the first conversion is managed by a first synthesized local oscillator, driven by a very stable 10 MHz frequency reference and generating frequencies from 40.455 MHz to 70.455 MHz in 1 kHz steps, which leads to a first IF of 40.455 MHz. The signal then passes through a filter with a bandwidth of about 30 kHz, then a second and a third synthesizer (always driven by the same reference at 10 MHz) properly inject signals at frequencies of 40 MHz and 430 kHz for the purposes of obtaining "intermediate frequencies" at 455 and at 25 kHz.

A 455 kHz output is present on the rear panel of the radios (for connection to a spectrum analyzer or for other uses), while the 25 kHz signal is digitized at 16 bit with a 100 kHz sampling frequency and sent to the "DSP" for subsequent signal processing.

The signal management carried out by the *Ten-Tec RX-340* takes place in a similar (but not identical) way: after the conversion to the IF value of 455kHz, there is a further conversion (this time not at 25 kHz, but at 16,666 kHz instead). After that, also in the *Ten-Tec RX-340* the digitized signal is sent to the *DSP section* for subsequent signal processing, which in both receivers consist of: *Noise-Blanking, Fine Tuning with 1 Hz resolution, IF Filtering and band-pass adjustment, Notch Filter, Gain adjustment, AGC adjustment, Level and Squelch indication functions, demodulation in various modes*, etc.

Further details about the characteristics and the various differences between the *Watkins-Johnson* and the *Ten-Tec* receivers can be better understood by reading the various *Data-Sheets* and manuals (complete with diagrams), that are available at the addresses that are specified in [8].

As for the reception modes, in practice the ones found in the *Watkins-Johnson* receivers (AM, Synchronous AM, FM, CW, USB, LSB, ISB) are the same allowed in the *Ten-Tec* units (although with different practical results, see later); it should also be noticed that the special *WJ-8711A-3* version (defined by the company as the "*Government version*" [9]) also has the FSK mode in addition to various other options (*preselector, internal loudspeaker, high stability reference osc.*) included.

Yes, because one of the characteristics that differentiates the *Watkins-Johnson* radios from the *Ten-Tec* units lies precisely in the fact that while the former were normally supplied in the "basic" version (for which many options were made available, including the internal loudspeaker and the

preselector), both the **RX-340** and the **RX-331** came already "complete with everything" and for them there were no options available to be purchased later.

The various functions of both the receivers are controlled by software contained in three distinct **EPROMs**: one relating to the "*Front Panel Functions*" (U3 in **Watkins-Johnson** receivers, U4 in **Ten-Tec**) and the other two for "*Processor Control*" and "*DSP Functions*" (U12 and U56 in **Watkins-Johnson** receivers, U12 and U30 in **Ten-Tec** units respectively).

Furthermore, when you turn a Watkins-Johnson receiver on, the lower small display in the mid of its front panel shows the firmware version of the "*Processor Control*" (U12) EPROM only, the *firmware* versions of the other EPROMs (U3 and U56) can be checked by reading the label sticker on top of each IC.

In the Ten-Tec RX-340 receivers the firmware versions of each of the three EPROM (U4, U12 and U30) are all displayed for a while in the two alphanumeric displays that are located in the mid of the front panel, each time you turn the receiver on.

In the first series produced by **Watkins-Johnson**, the task of maintaining the various data (memories, etc.) with the receiver off was entrusted to a "*coin cell*" battery (visible in Figure 6 for what concerns a "first generation" **WJ-8711**), that was later replaced by "*Timekeeping RAM*" ICs (DALLAS-MAXIM "DS1643-100+" or STI MICROELECTRONICS "M48T08-150PC1").

In the **Ten-Tec** units, on the other hand, a lithium battery enclosed in an IC has always been used (STI MICROELECTRONICS "M4Z28-BR00SH1", Figure 9). Obviously the receivers of both manufacturers are equipped with the "BITE" diagnostic function, as well as selectable RF preamplifier and attenuator. In order to compare the main characteristics of the **Watkins-Johnson** receivers with those of the **Ten-Tec** units, in Figure 4 a summary table of the main operating parameters is shown.

Some Notes About Accessing the BITE Functions

In the WJ-8711: Press the front "*Special Function*" button until the message "*BITE Pending*" appears on the display. Then turn (in either direction) the knob that is placed above the button; the 16 BITE tests begin and all front LEDs light up.

The results appear in the receiver display as a decimal number equivalent to a *16-bit binary* and are explained in Table 3-2 of the WJ-8711A Manual (pages 3-47 and 3-48).

In the Ten-Tec RX-340: Press the left and right arrow keys of the *Mode Select* control together, then at the prompt "*Enter BITE Level*" type *1*, *2* or *3* on the numeric keypad in order to choose from the three possible BITE levels you want and start it. More details are found in section 5-7 of the RX-340 Instruction Manual (page 5-11).

Figure 19 shows the WJ-8711 (left) and RX-340 (right) BITE screens.

Constructional Details

Both the **Watkins-Johnson "WJ-8711 series"** receivers and the **Ten-Tec RX-340** are housed in metal cases with *standard rack* dimensions for the front panels (19" - 48.3 cm width, 3 rack units height - 13.4 cm), but they have very different depths: the former are about 20" - 51 cm deep (I would say uselessly), while the **RX-340** has a more reasonable depth of about 12.5" - 32 cm.

	<i>WJ-8711, 8711A (and HF-1000)</i>	<i>Ten-Tec RX-340 (and RX-331)</i>
Frequency Coverage:	0 (5 kHz) - 30 MHz	0 (5 kHz) - 30 MHz
Frequency Resolution:	1 Hz	1 Hz
Int. Osc. Stability:	+/- 0,7 ppm (0° to 50° C) standard +/- 0,2 ppm (0° to 50° C) optional	+/- 1 ppm (0° to 50° C)
BFO:	+/- 8 kHz, 10 Hz resolution	+/- 8 kHz, 10 Hz resolution
Receiving Modes:	AM, SAM, FM, CW, USB, LSB (FSK optional)	AM, SAM, FM, CW, USB, LSB
SAM Mode:	DSB only	selectable sideband
PBT working in modes:	CW	CW, USB, LSB
Notch working in modes:	AM, SAM, FM, USB, LSB, ISB	CW, USB, LSB
Sensitivity (500 kHz – 30 MHz, preamp OFF, AM, 6kHz BW):	103 dBm/1.58 uV	103 dBm/1.6 uV
Selectivity	66 bandwidths from 56 Hz to 16 kHz (58 Hz to 8 kHz in the HF-1000)	57 bandwidths from 0.1 to 16 kHz
AGC Range:	100 dB, min.	90 dB, min.
AGC Threshold:	0.9uV (various AGC parameters selectable in both receivers)	3uV
Noise Figure:	14 dB max (preamp OFF)	19 dB max (preamp OFF)
3 rd Order Intercept:	+30 dBm (typical, preselector off)	+30 dBm (typical, preselector off)
Memories:	100	200
Scan Modes:	various scan modes selectable in both receivers	
used EPROMs		
- “Front Panel”:	A1A1U3 (27C256)	U4 (AT27C25620);
latest versions:	v1.21 (all versions)	v1.10B
- “Internal Control” :	A2U12 (27C010)	U12 (27C010-150);
latest versions:	v04.01.10-v6.00.04(?); v01.00.03 (A-3 model)	v1.10B
- “DSP”:	A2U56 (27C512)	U30 (27C010-150);
latest versions:	v04.02.07; v05.00.00 (A-3 model)	v1.10B

Figure 4: Comparison table of the characteristics of the ***Watkins-Johnson WJ-8711*** Series and of the ***Ten-Tec RX-340*** receivers.

The weights are comparable: 6.8 kg for the "basic" *Watkins-Johnson* models, 5.7 kg for the *Ten-Tec RX-340*. The cabinets of both receivers are undoubtedly well built (the "gold" anodizing of the *Ten-Tec* chassis is very pleasing), but undoubtedly their sturdiness is inferior to that of other "non-DSP" professional receivers (to name a few ones, the "old" *WJ-8718*, the *RACAL* receivers, etc.). Even the front panels, that are built in aluminum and are covered with a glued tactile plastic film (which will hopefully get ruined as late as possible) do not give the impression of being in front of professional receivers, in fact it seems to be dealing with some consumer unit...

Figures 5 to 11 show the internal constitution of the *W-J Series 8711* and of the *Ten-Tec RX-340* receivers, while Figure 12 refers to the internal structure of the "black-box" *RX-331*, in my opinion of a bit exaggerated depth. It should be noted that the *RX-331* is, from a circuit point of view, very similar (but not identical) to the *RX-340* and it does not have an internal loudspeaker.

Further clarification is appropriate here: both the *Watkins-Johnson* and the *Ten-Tec* units are equipped with well-built *switching* power supplies: the one that is fitted into the *WJ-8711 Series* receivers is of the *Condor* brand (model SP1348A, manufactured in Mexico), the one that is used on the *Ten-Tec RX-340* radios is of the *Philhong* brand (model PSA4541, manufactured in China). As it will be highlighted later, both the power supplies are not free from some problems however.

Operation and Various Tests

Even if the main purpose of this article is not to report the results of the operational tests of the different receivers by comparison, but rather to highlight the various *idiosyncrasies* found and to provide opinions and advice on the matter, it is still advisable to briefly address the issues.

I therefore specify that both myself and my friends Mauro Trazzi IZ1GCX of Arizzano (VB, Italy), Ralph Menn of Saarbruecken, Germany and two more users from center Italy proceeded, in a totally independent way, to carry out repeated and prolonged listening tests using both their *WJ-8711As* and their *Ten-Tec RX-340s* in various working conditions (which, not being "standardized", have no absolute value but still represent shared impressions).

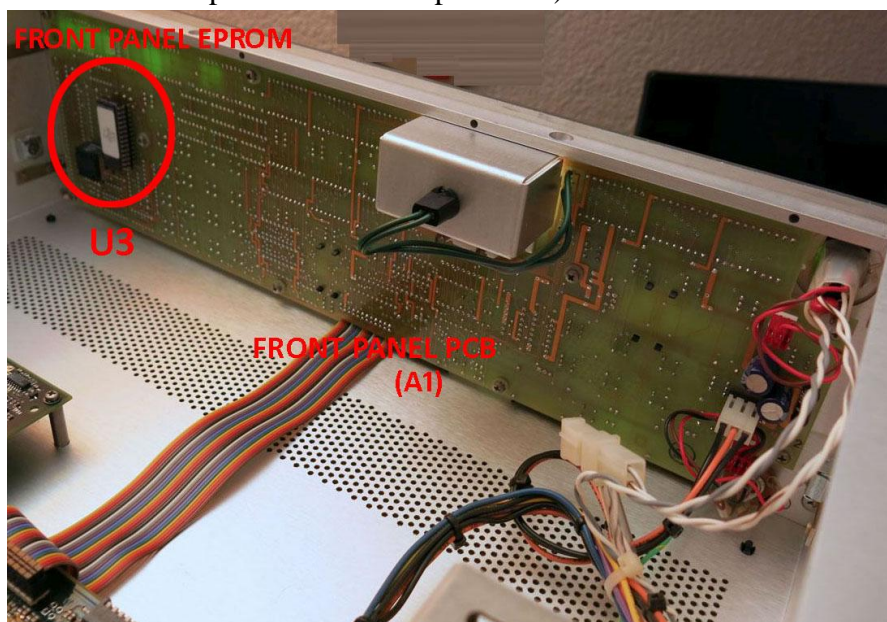


Figure 5: *WJ-8711A* internal view (front panel PCB seen from the rear). In this shot you can see the empty space inside the receiver. Also notice U3, the front panel EPROM.

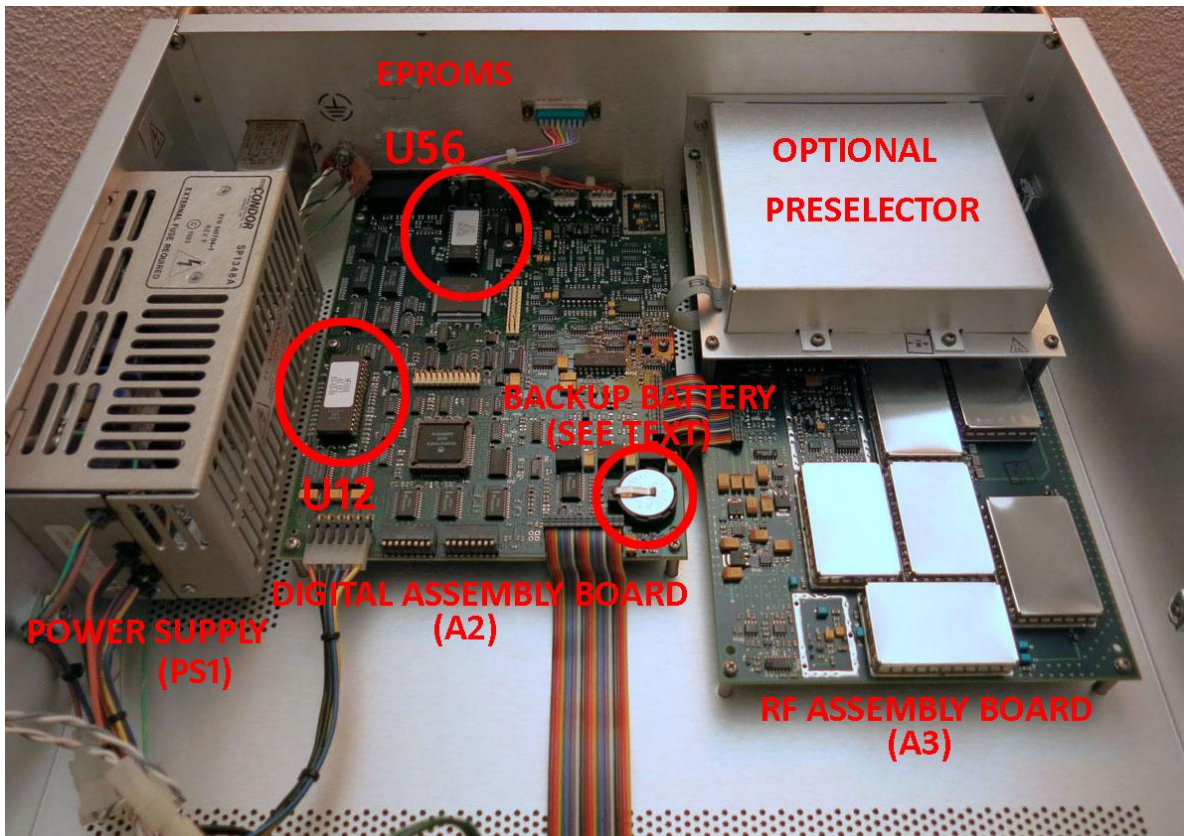


Figure 6: Internal view of an early-version *WJ-8711* and of its component parts, including the “*Condor*” switching power supply, the optional *preselector* and the two EPROMs U12 and U56.

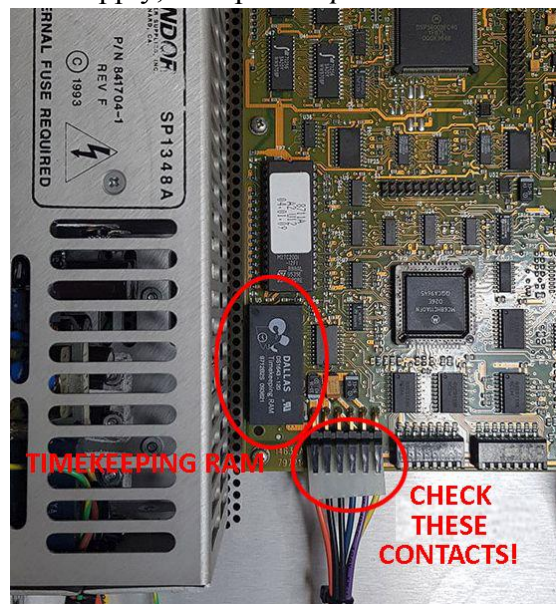


Figure 7: Location of the *Timekeeping IC* in a later generation *WJ-8711A*. Also note the power connector, which is sometimes a source of problems.

In short, we all five “*testers*” found ourselves in almost a complete agreement with each other and with what emerges in the reviews of the two receivers published by the well-known David W. Zantow N9EWO [10]: the *Watkins-Johnson* WJ-8711A shows top performances on most fronts,

even in synchronous AM detection (mode in which it operates only in *double sideband*, while the **Ten-Tec RX-340** allows *sideband selection* but shows poor results due to the continuous loss of the "lock" condition).

Excellent are the results obtained by the use of *Pass-Band Tuning* and of the *Notch Filter* in the **Watkins-Johnson** receivers, which also widely outclass the **Ten-Tec RX-340s** in terms of *processing* and *weak signals reception*. Luckily enough, none of us was faced with a fairly frequent problem that had shown in the **Ten-Tec RX-340**, namely the main fluorescent display (**Samsung** brand) that was used in early units and had segments not uniformly lit (as it was reported in the N9EWO review [10]); however, both Mauro and myself (and unfortunately other friends) have come across other problems that were not easy to solve, see below.

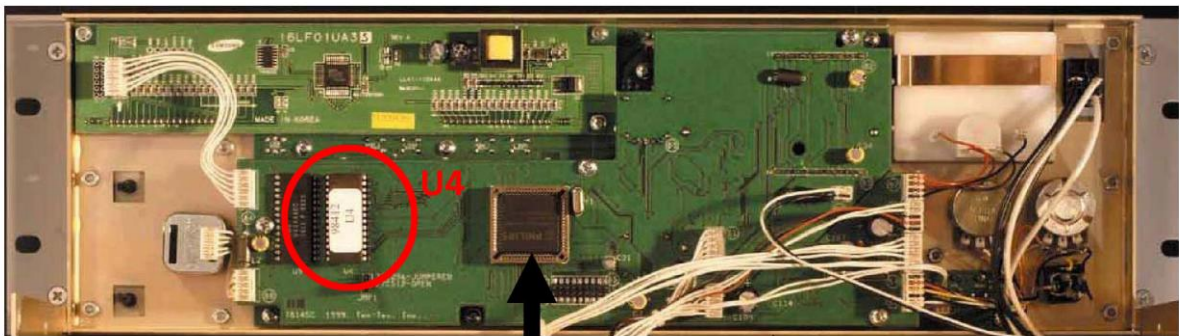


Figure 8: This is the rear of the **Ten-Tec RX-340** front panel: notice the **Philips** CPU and the **U4** EPROM.



Figure 9: The battery IC of the **Ten-Tec** receivers (Data-Sheet at: https://www.mouser.it/datasheet/2/389/m4z28_br00sh-1849863.pdf).

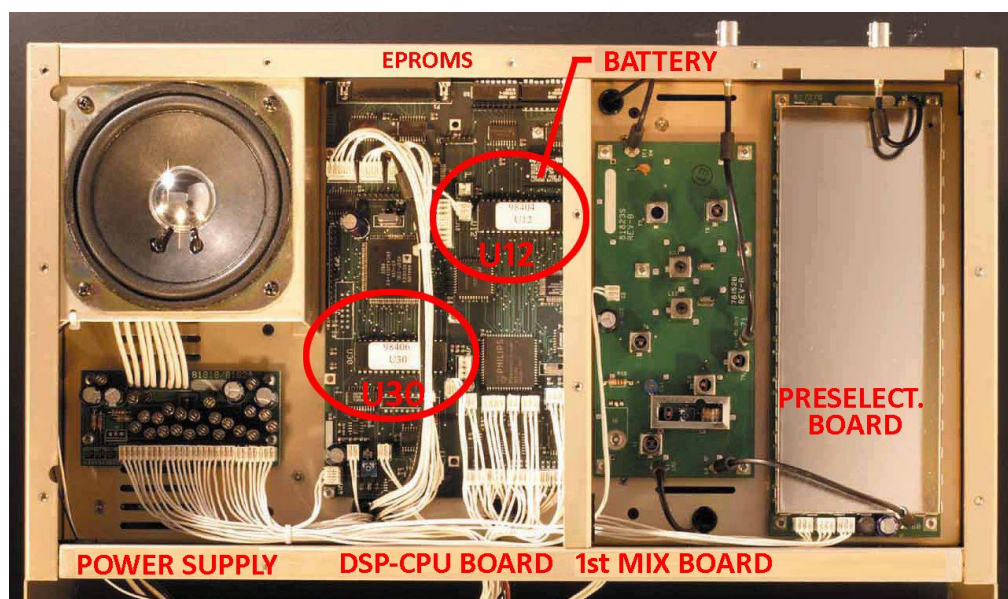


Figure 10: The upper part of the *Ten-Tec RX-340* frame shows a rational use of space and the achievement of a more contained depth for the unit. Note also the two EPROMs U12 and U30.

Problems Found in the Receivers:

- *Watkins-Johnson WJ-8711A*: no problem emerged from Mauro's unit, from mine I had only a problem with the master volume potentiometer of my *WJ-8711A-3* leapt out, but probably it was caused by dirt (the issue was promptly fixed by applying a few drops of *Deoxit-5*).

From Ralph's side some problems emerged in the *Condor* SP1348A power supplies of three of the WJ HF-1000/WJ-8711A units he had on the bench and he was compelled to repair them; the problem was caused by electrolytic capacitor failures however. The acquisition of some of those caps can be a challenge nowadays.

About the W-J power supply, Ralph declares that it is very low in noise and that he was not able to find any additional switching noise in the spectrum; when that PS works properly, it stays quite cool during operation. The only noise that can be heard from the W-J receivers seems to be solely an audio problem: it sounds like a high RPM fan in the power supply section, but the WJ's power supply is *fan-less!*

Ralph also says that he never heard (either directly or from any other Ten-Tec user) about RX-340s having the same kind of problem with their *Philhong* power supplies: there are no strange noises that are emitted into the room indeed.

- *Ten-Tec RX-340*: with these receivers the problems that arose were more serious and certainly they were due to poor checks carried out at the factory. Starting from Mauro's unit, it should be immediately noticed that his *Ten-Tec RX-340* (S/N 10227) had been showing intermittent operation for some time, and that the BITE was continuously indicating problems with the *1st mixer* (so that IZ1GCX had also proceeded to purchase an *RX-331* in order to use it as a possible source of spare parts). But after various tests, measurements and observations, Mauro noticed an important detail: one of the two wires was missing from a connector on the "*1st Mixer*" board (Figure 13).

The problem, certainly due to poor quality control by *Ten-Tec*, was promptly fixed, and after having added the missing wire (Figure 14) the RX-340 started working regularly. There are no

words however! Another issue that was also fixed by Mauro concerns the solderings (ALL were found to be "cold") of the power supply connector to its PCB, Figure 15; also in this case redoing was decisive, but such defects should not occur in high-class devices!

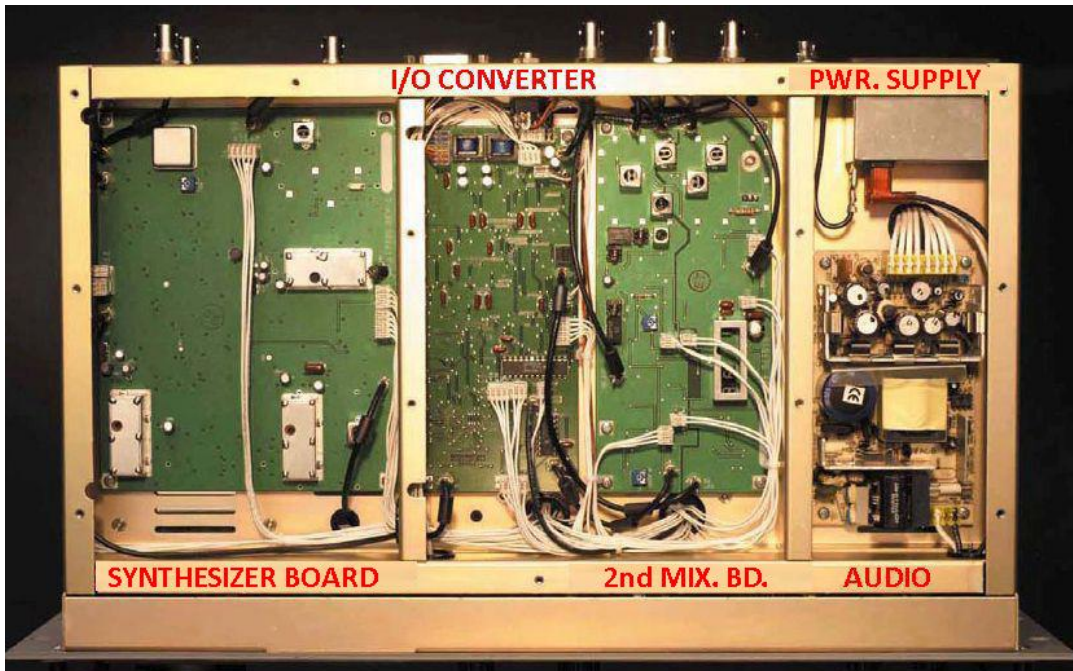


Figure 11: The lower part of the *Ten-Tec RX-340* chassis is shown here.

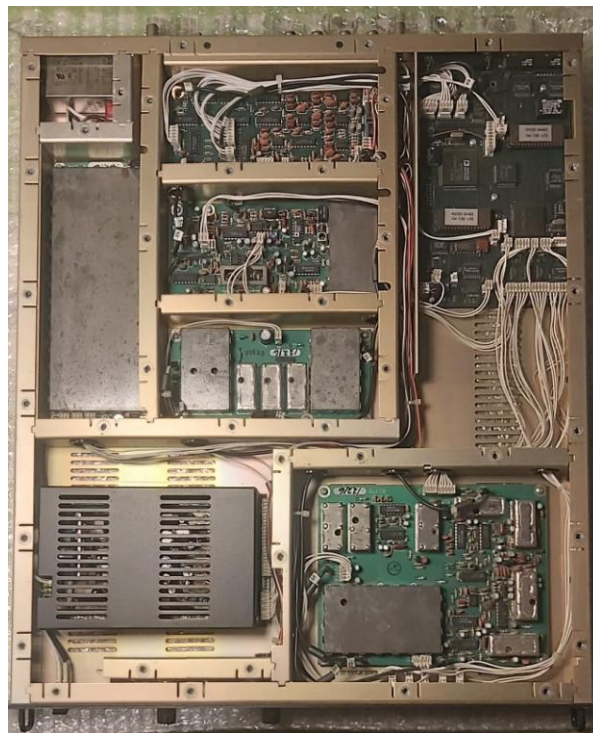


Figure 12: Was *Ten-Tec* "infected by the mania for depth"? Here is the inside of the *RX-331*, a slender "beast" 21"-53 cm deep. Question: couldn't the height of the unit be doubled and its depth halved? Hmm...

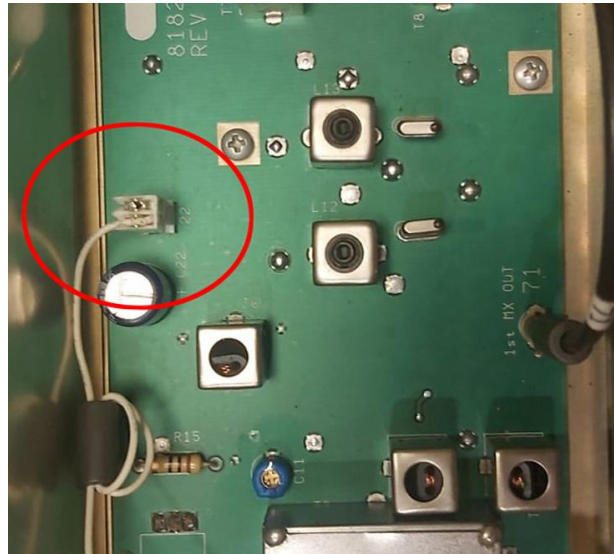


Figure 13: The photo shows the connector without one of the two wires in Mauro Trazzi's ***RX-340***.

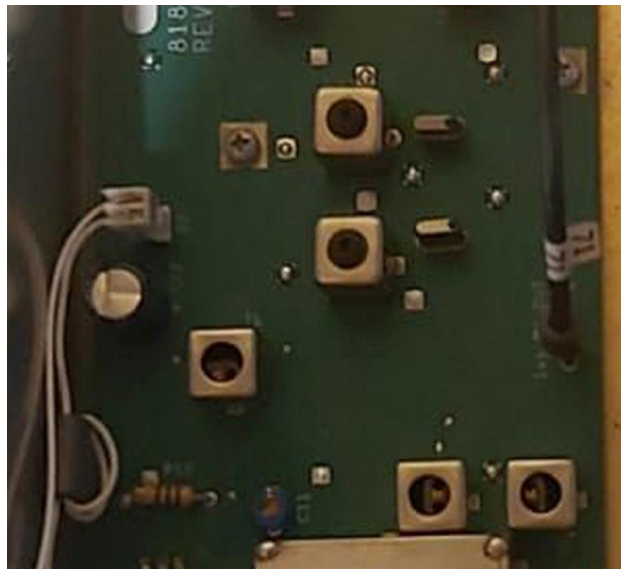


Figure 14: The "repaired" connector with the addition of the missing wire.

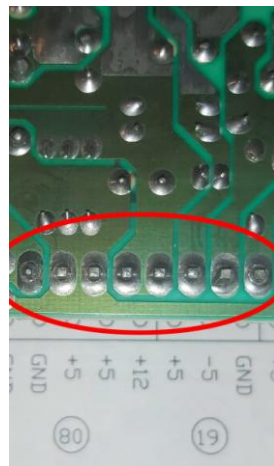


Figure 15: The "cold" solderings in the Ten-Tec ***RX-340*** power supply connector

As for me, I found my **RX-340** (S/N 11194, that worked well after a thorough cleaning of the volume pot by applying some drops of Deoxit-5) plagued by a problem that was found to be common to other **RX-340s**: the two EPROMs of the DSP-CPU printed circuit (U12 and U30) were found not removable from their sockets, as if they had been glued or fastened in some way.

After several attempts with many types of IC extractors I preferred to give up, for fear of damaging those precious EPROMs; for sure I will try again in the future, as I promised myself to copy the related software and make it freely available to anyone who needs it; as I already told, the same situation had showed up both in the **RX-340s** owned by two other hams in central Italy (who still prefer to remain anonymous) and also in the Ralph's unit (S/N 11341). Another drawback found in the **Ten-Tec** receivers consists in the application of useless "warranty tags" (what type of warranty?) which discourage the user from performing sometimes useful operations, look at Figure 16.

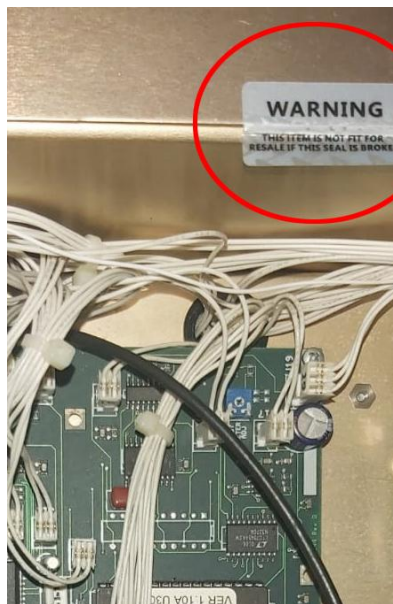


Figure 16: A warning tag applied by **Ten-Tec**.

Other comments:

About the HF-1000s/WJ-8711s Audio Buzz: Ralph also noticed that all the three units he had at hand were characterized by a quite disturbing noise coming from the loudspeaker (just as having a fan running). This annoying noise seems not to come from the power supply, it seems to originate from the processor board instead.

Incidentally, the Ralph's RX-340 does not show such an audio problem.

HF-1000/WJ-8711WJ-IF filter settings: As already noticed, the HF 1000 model lacks some of the IF filter frequency options compared to the WJ 8711 & WJ-8711A, but they can be retrofitted by using U12 IC version 4.01.10 and U56 IC version 4.02.07.

Doing so, the HF1000 can now make use of the 16-kHz selectivity setting too.

The Ten-Tec RX-340 does not have the same amount of IF filter options, but it has a 16kHz filter setting as standard.

It's worth saying that in the W-J line of receivers, the ones fitted with the **preselector** are the most sought after (and the most expensive because it was a costly option), while all the TenTec RX-340 receivers already have a **preselector** built in.

Assistance for the W-J "8711 Series" Receivers and for the Ten-Tec RX-340 and RX-331 Units

Unfortunately, while some source of assistance is still active for the *Watkins-Johnson* units [11], nothing similar exists with regard to *Ten-Tec* receivers, for which it is practically impossible to obtain neither assistance or spare parts from the parent company nor the *firmwares* that are needed for restoring or updating the existing ones.

In recent times, *Ten-Tec* has "closed up" and does not seem to care about assisting old customers; the latest somewhat "aberrant" press releases are reproduced in Figure 17.

If a "markup" of \$140 (plus shipping costs) seems to be right whether your apparatus is repaired or not...

So what can you do? First of all, keep your fingers crossed and hope that your receiver (both *Watkins-Johnson* and/or *Ten-Tec*) never breaks down; as a second instance, hope that any eventual failure involves parts that can be usually found and can be managed by good servicemen (there are good ones all around the world, believe me).

If, on the other hand, the fault involves the EPROMs and their firmware, *Watkins-Johnson* owners will be happy to know that I recently uploaded the latest *WJ-8711A* receiver firmware in the "file" section of some Internet groups [12].

However, I hope to be able to do the same with the *Ten-Tec* receiver software in a fairly short time. The very latest information given on the Ten-Tec website is dated from Nov 2022, so at least somewhat recent, but it specifies only that "***there are some counterfeit press releases on social media***" (look at Figure 20) and there was no more update.

About the current prices of the WJ-8711 Series and T-T RX-340 receivers, they can be sometimes found on the surplus market, but their prices depend also upon the completeness, the conditions and the age of the units. I.e., a bare WJ-8711 or HF-1000 without the *preselector*, the speaker and other options but in good enough condition can be found at around \$1,300 (1,200 Euro), but if you want a recent, like-new and complete unit the prices are as high as about \$3,500 (3,000 Euro) or even more.


Please notice that in October 2019 I paid about \$3,000 (Euro 2,800) for my WJ-8711A-3 S/N 37 (this Serial Number is very late for an A-3 version, see text) in like-new condition and complete with all the specified options (*preselector*, high-stab oscillator, speaker, FSK mode).

On the other hand, a Ten-Tec RX-340 is a more rare item and it is highly priced consequently. But again it depends from the conditions and the age of the units: i.e. a unit in fair conditions and with the V1.10A firmware costs less than a VG unit with the V.10B firmware (and, as far as I know, it is currently impossible to find copies of the software in order one can update the EPROMs!).

Usage Tips

Based on my experiences and those of other users, here are some tricks that could be useful when using the *W-J "8711 Series"* and the *Ten-Tec* receivers:

- Before turning on the units for the first time, check (and if necessary clean) the contacts of the output conductors of the power supplies (multi-pole connectors and relative soldering to the PCB);
- Activate the BITE functions and wait for the response (hope no error is found); otherwise examine the section where the problem occurs. With regard to *Ten-Tec* receivers, bear in mind that the BITE function should only be activated about an hour after switching on the radio and without connections to the antenna and headphone sockets (Figure 18).



Amateur Radio Perfection

☰

Service Policy

Any unit sent in for service incurs a minimum charge of \$140.00 which includes the first hour of labor, even if the unit is deemed un-repairable. It takes the service department one hour to receive, unpack, set up on the bench, evaluate, estimate the repair, repack and box the unit, prepare shipping documents and prepare the invoice. If your unit is repaired during this time period there will not be additional labor charges. If further work is required it will be billed at 125.00 per hour in quarter hour increments. Parts and return shipping is charged additionally. It takes on the average two hours to repair a unit. To clarify this labor structure we have prepared the following chart for your convenience:

TOTAL REPAIR TIME	CHARGE	DESCRIPTION
00-59 minutes	\$140.00	Minimum Charge
60-74 minutes	\$171.25	
75-89 minutes	\$202.50	
90-114 minutes	\$233.75	
105-119 minutes	\$265.00	Two hours
Third or	ADD \$125.00	

The service@tentec.com email is monitored Monday through Wednesday. At this time we are unable to offer extensive telephone or email support for amateur customers. Please do NOT call Dishtronix in Ohio. They can't answer your service question and will refer you to this email contact. We understand you may find this inconvenient, but with the present resources it is the only possible way we can deal with the continuous volume of telephone calls that paralyzed the service department in the past.

Figure 17: One of the latest press releases from the new *Ten-Tec* property.

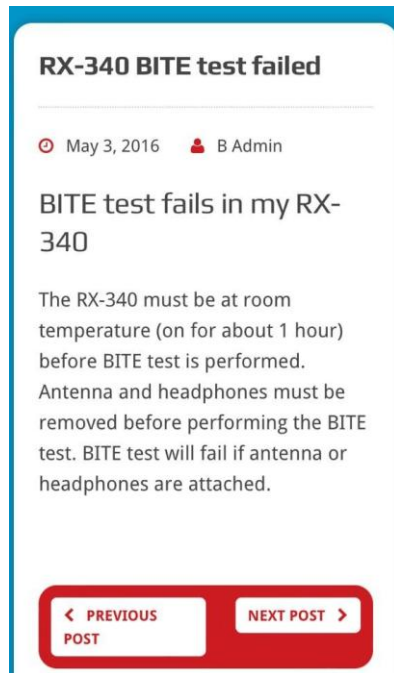


Figure 18: Instructions provided by *Ten-Tec* regarding the *RX-340* "BITE" function.

- If the receiver memories do not contain important data, carry out a "reset" to the factory settings. In the *W-J* receivers, this is obtained by holding down the "CE" (*Clear Entry*) key when switching the radio on, releasing it immediately afterwards; in the *Ten-Tec RX-340* the procedure is almost identical, but the key to be pressed at start-up (and then to be released) is the "C".
- Check the *firmware* of the radios (and if possible update it to the latest version available, suitably replacing the EPROMs of the "Digital Assembly" (*W-J*) or "DSP-CPU" (*Ten-Tec*) boards). Obviously the operation is facilitated in the case of *W-J* receivers due to greater availability of *software* files [12].
- Always keep the antennas in use well away from the receivers and check that they are connected using a perfectly shielded coaxial cable in order to minimize the noise picked up by the internal "switching" power supplies;
- Keep the receiver under observation for a certain period, noting any overheating, smell, component blackening, etc.



Figure 19: The "BITE" screens in the WJ-8711 (left) and in the Ten-Tec RX-340 (right).



Figure 20: The latest statement by Ten-Tec (Nov. 2022).

It's also worth to notice that, due to many Watkins-Johnson changing hands during the years, the WJ-8711A receivers were produced under different brands: *Watkins-Johnson*, *Marconi*, *BAE Systems (British Aerospace)*, *SIGNIA-IDT*, *DSR Technologies (DSR Signal Solutions)*, etc; in Figures 21a/b/c some WJ-8711A Data Sheets of various brands are shown.

Currently the WJ-8711 Receiver Series has been discontinued and the property of *Watkins Johnson* has been in the hands of a major Italian Defense Company (*Leonardo S.p.A.* formerly *Finmeccanica*) since Jan. 2016.

Some notes about the receivers that have survived until now and the WJ-8711A-3 Government Version

As far as I know, the WJ-8711 Series of receivers were produced between May, 1991 and about mid 2007-2009. The latest WJ-8711A in which I stumbled upon is the S/N 8358 of the *Signia-IDT* brand (look at Figure 22); less than 10,000 units in total should have been produced consequently.

It is also worth noticing that around in about May 1996 a very small production of a special version of the WJ-8711A started; it was also called "*Government Version*" and named WJ-8711A-3, look at the Data Sheet in Figure 23.

That version included some useful options: the *Reference Oscillator*, the *Preselector*, the *FSK demodulation mode* and the *speaker* and it is recognizable by the two buttons added on the left of the front panel (look at Figure 24a), that would have served for *Direction Finding* purposes.

The WJ-8711A-3 "*Government Version*" was always produced under the "*Watkins-Johnson*" brand only.

Digital HF Receiver WJ-8711A



Features

- Frequency coverage from 5 kHz to 30 MHz in 1-Hz steps
- High dynamic range: +30 dBm 3rd-order intercept typical
- Digital filtering provides 66 IF bandwidths up to 16 kHz with exceptional shape factors
- AM, SAM, FM, CW, USB, LSB & ISB Detection Modes Standard
- Fast, flexible scanning with 100 memory channels
- Large readable LED displays & user-friendly controls
- 3 variable AGC decay settings
- Noise blanking & passband tuning
- Tunable IF Notch Filter
- Internal switchable preamplifier & attenuator
- Standard remote interface (optional Multidrop RS-232, RS-485, RS-422, CSMA, or IEEE-488)
- Built-in selftest
- Optional Suboctave Preselector
- Optional Digital Data Output

HEIGHT	5.25 in (13.36 cm)	DEPTH	20.0 in (50.80 cm)
WIDTH	19.0 in (48.26 cm)	WEIGHT	15 lbs (6.78 kg)

For more information contact:

BAE SYSTEMS
700 Quince Orchard Road, Gaithersburg, Maryland 20878-1194
Phone: 301.948.7550
Fax: 301.921.9479
Web: www.signalsurveillance.com

BAE SYSTEMS

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Figure 21a: A Data Sheet of a WJ-8711A of the **BAE Systems** brand.

TECHNICAL DATA SHEET

The WJ-8711A is a fully synthesized, general-purpose HF receiver for monitoring RF communications from 5 kHz to 30 MHz with 1-Hz tuning resolution. By combining analog and digital signal processing (DSP), the WJ-8711A achieves high performance at low cost.

DSP techniques accomplish functions such as noise blanking, IF filtering, AGC, demodulation, Beat Frequency Oscillator (BFO) and passband tuning. Filters with superior amplitude and group delay characteristics are achieved with digital stability and repeatability. The receiver has 66 standard selectable IF bandwidths. Available detection modes are AM, SAM, FM, CW, USB, LSB and ISB. An operator can adjust the tunable BFO in 10-Hz steps over a ± 8000 Hz range, and the available passband tuning further enhances the reception of CW signals. Gain control is manual or automatic, with fast, medium, and slow AGC modes. An operator can adjust the squelch threshold from 0 to -135 dBm, or disable it. Enabling the noise blanking feature effectively eliminates the adverse effects of impulsive noise.

In addition to fixed-frequency tuning, the WJ-8711A provides fast, flexible scanning in three modes: channel scan, F1-F2 scan and F1-F2 scan with lockouts. Dwell times are available for all scan modes from 0.5 to 20 seconds or infinite. The channel-scan mode provides 100 programmable memory channels. The operator can specify sectors of memory for individual channel scans, allowing the subdivision of available memory into multiple search scenarios. Operators can specify that the receiver skip certain channels without deleting them from memory. Memory channels can also be single-stepped manually. In both F1-F2 scan modes, the step size is user-selectable from 1 Hz to 25 kHz. The receiver can store up to 100 independent frequency lockouts.

An operator can control the WJ-8711A locally via the front panel or remotely via the serial interface. Measuring 5.25 x 19 inches, (13.34 x 48.26 cm), the microprocessor-controlled front panel provides a user-friendly operator interface with dedicated, logically arranged controls and large, easy-to-read LED displays.



FEATURES

- Frequency coverage from 5 kHz to 30 MHz in 1-Hz steps
- High dynamic range: +30 dBm 3rd-order intercept typical
- Digital filtering provides 66 IF bandwidths up to 16 kHz with exceptional shape factors
- AM, SAM, FM, CW, USB, LSB & ISB Detection Modes Standard
- Fast, flexible scanning with 100 memory channels
- Large readable LED displays & user-friendly controls
- 3 variable AGC decay settings
- Noise blanking & passband tuning
- Tunable IF Notch Filter
- Internal switchable preamplifier & attenuator
- Standard remote interface (optional Multidrop RS-232, RS-485, RS-422, CSMA, or IEEE-488)
- Built-in self test
- Optional Suboctave Preselector
- Optional Digital Data Output

HEIGHT	5.25 in (13.36 cm)	DEPTH	20.0 in (50.80 cm)
WIDTH	19.0 in (48.26 cm)	WEIGHT	15 lbs (6.78 kg)



p: 301 948 7550 f: 301 921 9479

Figure 21b: A Data Sheet of a WJ-8711A of the *Signia-IDT* brand.

DRS's WJ-8711A DIGITAL HF RECEIVER

Features

- Frequency coverage from 5 kHz to 30 MHz in 1-Hz steps
- High dynamic range: +30 dBm third-order intercept typical
- Digital filtering provides 66 IF bandwidths up to 16 kHz with exceptional shape factors
- AM, SAM, FM, CW, USB, LSB and ISB detection mModes Standard
- Fast, flexible scanning with 100 memory channels
- Large readable IED displays and user-friendly controls
- Three variable AGC decay settings
- Noise blanking and passband tuning
- Tunable IF notch filter
- Internal switchable preamplifier and attenuator
- Standard remote interface (optional Multidrop RS-232, RS-485, RS-422, CSMA or IEEE488)
- Built-in self test
- Optional suboctave preselector
- Optional digital data output
- 5.25 H x 19.0 W x 20.0 D inches (13.36 x 48.26 x 50.80 cm)
- Weight, 15 lbs. (6.78 kg)



Description

The WJ-8711A is a fully synthesized, general-purpose HF receiver for monitoring RF communications from 5 kHz to 30 MHz with 1-Hz tuning resolution. By combining analog and digital signal processing (DSP), the WJ-8711A achieves high performance at low cost.

DSP techniques accomplish functions such as noise blanking, IF filtering, AGC, demodulation, beat frequency oscillator (BFO) and passband tuning. Filters with superior amplitude and group delay characteristics are achieved with digital stability and repeatability. The receiver has 66 standard selectable IF bandwidths. Available detection modes are AM, SAM, FM, CW, USB, LSB and ISB. An operator can adjust the tunable BFO in 10-Hz steps over a ± 8000 Hz range, and the available passband tuning further enhances the reception of CW signals. Gain control is manual or automatic, with fast, medium and slow AGC

modes. An operator can adjust the squelch threshold from 0 to -135 dBm, or disable it. Enabling the noise blanking feature effectively eliminates the adverse effects of impulsive noise.

In addition to fixed-frequency tuning, the WJ-8711A provides fast, flexible scanning in three modes: channel scan, F1-F2 scan and F1-F2 scan with lockouts. Dwell times are available for all scan modes from 0.5 to 20 seconds or infinite. The channel-scan mode provides 100 programmable memory channels. The operator can specify sectors of memory for individual channel scans, allowing the subdivision of available memory into multiple search scenarios. Operators can specify that the receiver skip certain channels without deleting them from memory. Memory channels can also be single-stepped manually. In both F1-F2 scan modes, the step size is user-selectable from 1 Hz to 25 kHz. The receiver can store up to 100 independent frequency lockouts.

Public Release IAW 22 CFR (ITAR) 120.11(7). Export of DRS SIGNAL SOLUTIONS, INC. products is subject to U.S. export controls. Licenses may be required.

DRS SIGNAL SOLUTIONS, INC.



Figure 21c: A Data Sheet of a WJ-8711A of the **DRS Signal Solution** brand.

The WJ-8711-A3 was provided with A2 U12 and A2 U56 special *firmwares*, *i.e.*:

- A2 U12 (Processor Internal Control): V01.00.03;
- A2 U56 (DSP): V05.00.00,

while the A1 U3 (Front Panel) *firmware* V1.21 was left unaltered instead.

For the rest, the WJ-8711A-3 “Government Edition” is almost identical in performances to the stock WJ-8711A, even if it is a rare beast and it also carries a separate numbering system: the latest WJ-8711A-3 which I saw is the S/N 41 that was sold on eBay some years ago (look at Figure 25), so I argue that no more than 50-60 WJ-8711A-3 units have been ever produced.

As for the Ten-Tec RX-340, their production years should range from 1991-1992 to about 2004-2007 for the latest units.

In Figure 24b my Ten-Tec RX-340 S/N 11194 is shown complete with its outer metal case [13].



Figure 22: The latest WJ-8711A in which I stumbled upon is the S/N 8358 of the Signia-IDT brand

As the Ten-Tec firmware files seem to be really unobtainium, I am asking to all the willing users who have their RX-340 provided with V1.10B firmware version to remove the three EPROMS (U4 Front Panel, U12 Internal Control and U30 DSP) and to copy them to three files by an EPROM reader/programmer. The three files have then to be RENAMED (not converted!) into .pdf extensions and can be sent via mail as normal attachments; the recipient will have to RENAME the received files into to the original extension in order they can be flashed into new EPROMS and used for firmware updating.

Of course I will refund the time and the work costs of willing users in advance, please contact me at: pviappiani@tin.it

In the case, I will share the three files FOR FREE and at my own risk and responsibility. Thank you!

Technical Update		WATKINS-JOHNSON
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December 1996

Digital HF Receiver WJ-8711A

WJ-8711A-3 Configuration

Specifications

The WJ-8711A-3 configuration is the same as the standard WJ-8711A with the following exceptions:

- Options** REF & PRE standard
- Detection Modes** includes FSK
- IF Rejection** -90 dBm
- Operating Temperature Range** -5 to +50°C

In addition, an operator may use the RS-232 remote interface to output the string message AXXXXXXXXX + BXXXXXXXXX + CR (where XXXXXXXX is the receiver frequency) upon activation of the A or B front-panel button. These push-button functions become especially useful when the WJ-8711A-3 acts as an RF front end for certain DF applications.

WATKINS-JOHNSON COMPANY 700 Quince Orchard Road, Gaithersburg, Maryland 20878-1794 Phone: (800) WJHELPS or +(301) 948-7550 FAX: +(301) 921-9479 Email: wj.helps@wj.com Website: www.wj.com	<small>All International sales of WJ equipment are subject to USA export license approval. This material provides up-to-date general information on product performance and use. It is not contractual in nature, nor does it provide warranty of any kind. Specification subject to change without notice.</small>
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Printed in the U.S.A.

Figure 23: In December 1966 a special “Government Version” of the WJ.8711A (named WJ-8718A-3) was released, it was Factory provided with special firmware and some interesting options (see text).



Figure 24a: My WJ-8711A-3 S/N 37 (see text).



Figure 24b: My Ten-Tec RX-340 S/N 11194 complete with a metal case by *AllMetalParts Co. UK* (see Ref. [13]).



Figure 25: The latest WJ-8711A-3 which I saw is the S/N 41 that was sold on eBay some years ago.

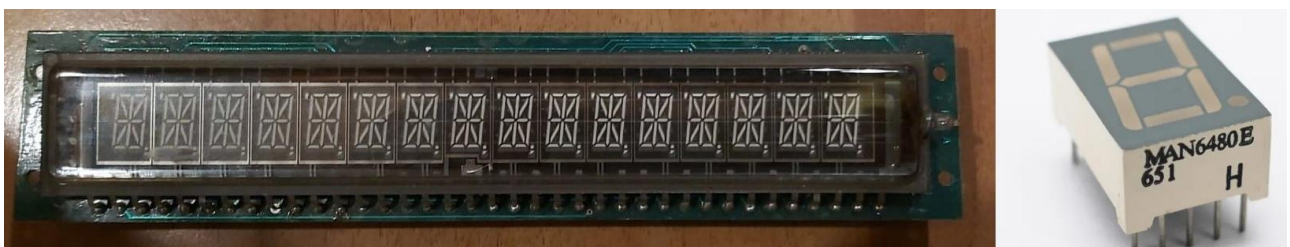


Figure 26: The SAMSUNG fluorescent display used on some early Ten-Tec RX-340's (left picture) and the single 7-segment green LED displays (MAN6480) used in the W-J receivers (right picture).



Figure 27: A cheap but very effective EPROM reader/copier/programmer that is easily found on the Internet. It can be used for programming NEW (or completely cancelled BLANK) EPROMs.

Final Considerations

At the end of this analysis I allow myself to make some personal considerations. If **Watkins-Johnson** hadn't been forced to reduce costs and had been able to freely design and build a receiver with the same qualities, sturdiness and reliability as the previous **WJ-8718** Series, a device still at the top of the current range of HF receiver would really have been born.

And in my humble opinion, relatively little efforts would be enough: a chassis and a front panel with a sturdy structure (similar to that of the previous W-J models), a conventional and "proper" power supply (certainly of the "non-switching" type and provided with an adequate filtering circuits). Sure, you can't have everything... but it's a real shame!

As for Ten-Tec, the manufacturer should certainly be invited to adopt fewer "jealousies" and a much better quality control. However, I am a bit skeptical about the promises and the declarations of the new ownership regarding the production of new devices and the restoration of the assistance functions: too many years have passed in which the site does not show updates and remains in practice in a steady state.

Again, it's a real shame: the **RX-340**, once the various highlighted idiosyncrasies have been eliminated, is a nice receiver in appearance and, albeit with slightly lower performances, a little more intuitive in operation than the corresponding **Watkins-Johnson** unit. What to say then?

Ralph finds it worth mentioning again that albeit the RX-340's slightly weaker RF performance, the unit comes more complete than the HF1000/HF1000A. Meaning that there is no question if this is the "**preselector**" version of the radio, as it is often asked on trade shows when a HF1000 or WJ-8711 Series receiver is up for sale.

Also considering that in the RX-340 there is no need for an EPROM swap to get access to a 16 kHz filter and that that radio is always the **preselector** version, my German friend is convinced that the RX-340 is the more modern and complete package, and that its SYNC-AM Detector is capable of good performances too.

For sure the addition of a Sherwood SE-3 Synchronous Detector (now discontinued) will improve both receivers performances, but it also adds about \$1500 to the bill... but this is another story!

So, even if personally I don't consider the RX-340 purchase too convenient (unless you find a real opportunity at a low price), I advise those who already own it to avoid any tampering or modification, to keep their fingers crossed and to follow literally what a world-known Italian song by Orietta Berti suggests:

“As long as the boat goes...let it go!” (“Fin che la barca va...lasciala andare!”).

And that's all for now, good listening!

Paolo Viappiani, Carrara, Italy

Article V2.5 - March 2023

References, Thanks and Notices

[1]: ***Watkins-Johnson*** was a major supplier of radio surveillance and interception equipment to various government agencies and the military of the United States and NATO countries. More details about the history of the company can be found on the website: <http://watkins-johnson.terryo.org/>. After 1999, ***Watkins-Johnson***, which was coveted by various industrial groups (mainly European) due to growing business volumes, was first sold to ***Marconi***, then to ***BAE System*** (*British Aerospace*), then to ***Signia-IDT***, to ***DRS Technologies*** (*DRS Signal Solutions*) and finally, in January 2016, to the Italian company ***Leonardo*** (formerly *Finmeccanica*). Currently ***W-J*** is therefore an Italian company that operates in the shadow of the ***Leonardo S.p.A.*** Group. The various "changes of hands" also explain why the ***WJ-8711/8711A*** receivers are found on the used market today under different brands.

[2]: ***Ten-Tec*** (abbreviation of *Tennessee Technologies*) is a company that has produced various equipment for radio amateurs over the years (among the many models we must certainly mention the Paragon, Omni, Argonaut, Patriot transceivers, the ETO Alpha amplifiers , etc., welcomed by users with mixed success). ***Ten-Tec***, unlike ***Watkins-Johnson***, had no dealings with government agencies and the US military prior to the release of their ***RX-340*** and ***RX-331*** receiver models. Unfortunately, ***Ten-Tec*** found itself navigating bad waters and the old asset (including the old address *ten-tec.com*) was put up for sale several times, until the acquisition (around the year 2017) by ***Dishtronix***, an Ohio-based firm whose President and CEO is Steven M. Dishop N8WFF. Unfortunately, despite the many promises of the new management regarding the continuation of the production of old and new models, the only fact is the sale of the old factory in Sevierville, TN and the acquisition of a two-room apartment in a shopping center in Dayton, Ohio. Uhhh... *honi soit qui mal y pense!*

[3]: The ***HF-1000/HF-1000A*** model was produced by ***Watkins-Johnson*** in a limited period of time around the turn of the century (between the years 1994 and 2000 approximately). Similar in appearance to the ***WJ-8711*** and the ***WJ-8711A***, the ***HF-1000***, for reasons that are not well understood yet, it was missing of the 16 kHz selectivity position (the widest available was in fact 8 kHz) and had a slightly lower selling price than the other models. The HF-1000 and the WJ-8711

firmwares can be upgraded to the latest versions (V04.01.10 for U12 and V04.02.07 for U56) as specified in the text of the article anyway.

[4]: See: <http://amfone.net/Amforum/index.php?topic=23042.0;wap2>

[5]: See: <https://www.facebook.com/groups/174047703539572/search/?q=Rick%20Lober>

[6]: See: Paolo Viappiani, "The Watkins-Johnson receivers of the WJ-8716/8718 Series", in: *RadioKit Elettronica* (an Italian magazine published by Edizioni C&C - via Naviglio, 37/2 48018 Faenza (RA), Italy), #12/2015, page 65.

[7]: <https://www.facebook.com/groups/174047703539572>

[8]: All documents and manuals of the **WJ-8711**, **WJ-8711A**, **HF-1000** and **HF-1000A** receivers can be found on the site: <https://watkins-johnson.terryo.org/document-index.htm>. I recommend not to overlook the various versions of the manuals and options, as well as the interesting Data-Sheets. As for the **Ten-Tec RX-340** and **RX-331** receivers, the relative manuals and diagrams can be found at the addresses: https://www.tentec.com/wp-content/uploads/2016/05/RX-340_Tech_Manual.pdf, https://www.tentec.com/wp-content/uploads/2016/05/Model_RX-331_Receiver_Manual_1.pdf.

I also recommend taking a look at the related Data-Sheets at the addresses: <https://www.tentec.com/wp-content/uploads/2016/05/rx340Brochure.pdf>

[9]: See: <https://watkins-johnson.terryo.org/documents/catalogs/1997%20Electronic/RECACC/1HFREC/8711A.PDF> on page 9.

[10]: See: <https://www.qsl.net/n9ewo/wj8711.html> and: <https://www.qsl.net/n9ewo/rx340.html>. Other interesting reviews can be found at: <https://www.eham.net/reviews/view-product?id=466> ed: <https://www.eham.net/reviews/view-product?id=3757>. Incidentally, additional Figure #26 (left) shows the early Samsung fluorescent display used on some early RX-340 and the green 7-segment LED display used in the WJ-8711 Series receivers (right)..

[11] From **Head Italy** of Rome - Viale dell'Arte, 85 - 00144 Rome, tel. +39 06.5744642 and +39 06.57284549, email: info@head-italia.com, <https://head-italia.com/>. The company, which replaces the former **Watkins-Johnson Italiana**, can provide assistance to all **Watkins-Johnson** receivers and generally has all the necessary spare parts. Unfortunately, **Head Italia** is used to dealing with government and military bodies, so their interventions are not too cheap... but desperately, it is better to try to ask, they are kind and helpful people.

[12]: Look at: <https://www.facebook.com/groups/174047703539572> and: <https://groups.io/g/WatkinsJohnson/files/>. The ".pdf" file must be RENAMED (not converted!) to a .zip extension, so it can be unzipped in order to obtain the *firmware* files (WJ_8711A_U12_04_01_10.hex, 361 kB and WJ_8711A_U56_04_02_07.hex, 181 kB) that can be

"flashed" quite easily into the EPROMs by using a cheap USB programmer as the one shown in Figure 27. Obviously the file is available to everyone absolutely free of charge.

Please notice that if you want to use already used EPROMS you have to completely erase them via an U-V device before re-flashing.

[13]: Look at: <http://www.allmetalparts.co.uk/> (AllMetalParts.Co.UK, Unit 4B, Pond Farm New Years Green Lane UB96LX Harefield, Uxbridge, UK) - Phone: +44-01895633570 (*between 9-4 Mon -Fri*). They produce two case models, both suitable for the T-T RX-340A receiver:

1) 3rack unit 19" Flat top stackable bottom cabinet 300mm deep (AMP05002F);

2) 3rack unit 19" Stackable top and bottom cabinet 300mm deep (AMP05002).

You can contact them by writing to: info@allmetalparts.co.uk and/or to: steve@allmetalparts.co.uk.

As it seems that in this period there are some difficulties in contacting them via mail, I warmly suggest to try to call them instead.

Important Notices:

a) - Many special thanks to my friends Mauro Trazzi IZ1GCX of Arizzano (VB, Italy, mauro.trazzi@alice.it), to the Dipl.-Ing. Ralph Menn of Saarbruecken (Germany) and to the two quoted "anonymous" Italian volunteers: without their help and hard work I couldn't have written this article.

A warm thank also to my Belgian friend Joseph Bozzer (joseph.bozzer@skynet.be), who in the past years sold me his precious and rare WJ-8711A-3 S/N 37 complete with its original Hammond case and to my dearest friends Dr. Roberto Mazzitelli of Monteforte d'Alpone (VR, Italy, roberto1212@libero.it) and Antonio Gema of Berzo Demo (BS, Italy, antoniogema2019@gmail.com): both of them helped me so much in finding a good Ten-Tec RX-340 at a reasonable price and in purchasing it.

b) - Despite the addition of many new figures to the article, I decided not to alter their original numbering order and just to add the new ones here and there This was for more clarity and in order to prevent any possible confusion, of which I apologize eventually, Thanks again for your attention!

c) - Any comments, critics or suggestions from readers are very welcome.