

Ten-Tec Orion "On-the-Air" Test



Test Environment:

QTH: A hilltop location in Franken, Germany, with a clear take-off in all directions

Operators: DJ0IP & DL8OH

Rigs: - Ten-Tec Orion with optional 1.8 kHz and 250 Hz roofing filters.
- Elecraft K2
- Icom IC-746 ~~PRO~~ [Note: it was just a 746, not a "PRO"]

Antennas: - Force12 "C-31XR" (3-ele. Yagi 20/15/10m)
- Cushcraft "XM-240" (2-ele. Yagi 40m)
- Horizontal Loop (80m long for 80/40m)
- Vertical (160/80m)

Date: Friday/Saturday, October 17/18, 2003

Test Methodology:

The primary testing was done on the Orion's receiver. Comparisons were made with the K2 on Friday night and with the IC-746 ~~PRO~~ on Saturday. The IC-746 ~~PRO~~ was not available for comparisons on Friday.

First Impressions:

- The Orion is BIG. (See Picture)
- The Orion is **very** DIFFERENT
- Very few knobs for so many features
- It is not possible to learn to use the Orion without the manual

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Using the Orion:

With so few knobs and so many features, my biggest fear going into this test was that I would find a rig with complex software menus (i.e. like IC-706 MK II G or FT-817). Personally, I find it very difficult to work with software menus, especially for adjusting common stuff like CW keyer speed.

Although the knobs on the upper right appear to be concentric (two function per knob), they are not. Each knob adjusts just one function (at a time). The two knobs associated with passband bandwidth/tuning ("High & Low Cut", and "Bandwidth & Tuning") can each be toggled between its two functions simply by pushing it. There are LED indicators to inform the operator which function is being adjusted. Initially, it looked a bit complex, but after a few hours of operating, it was very easy to use, and did not require operator time to "think" about how to use it.

Although the Orion has countless features and adjustments (especially using the Multi knob), most are intuitive, quick to find and easy to adjust. More on this later.

All-in-all, the rig required several hours of practice to learn to use. It was very slow at first. If you wish to take advantage of all of the Orion's features, it is relatively complex to set up for each mode, but once the multitude of adjustments have been made, the settings can be saved (for different users/operators) under "Profiles" and then the rig is as easy to use as most other rigs.

There are two quarter-inch (6.25mm) phone jacks (Klinken) on the front panel - one for the CW paddle and one for headphones. The labels for these are printed in black and are nearly impossible to read. If you mix these two, you might cause damage to the RX audio amplifiers.

What's Different?

- The Orion has two totally independent (and very different) receivers.
 - The MAIN receiver is a ham-band-only receiver, thus enabling the frequency of the roofing filter to be significantly lower than that of a general coverage (100 kHz to 30 MHz) receiver. This is a main contributor to the Orion's excellent weak signal reception/performance.
 - The SUB receiver is a general coverage receiver with its roofing filter at 45 MHz. It shares the same advantages and disadvantages that all other general coverage receivers share. However, it is probably one of the best-built general coverage receivers currently on the market. See manufacturer's specs.
- The two large tuning knobs on the right are dedicated to the two VFO's (VFO-A & VFO-B), NOT to the two receivers! This requires a bit of practice to get used to.

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- The push buttons under the S-Meter (on the left) assign antennas "ANT-1", "ANT-2", & "RX-ANT" to the MAIN RX/Xmtr, and to the SUB RX. Any of these antennas may be assigned to one or both receivers.
- The push buttons under the S-Meter on the right assign the VFO's to the MAIN & SUB receivers AND also to the Transmitter. **If you forget to assign a VFO to the transmitter, you will not be able to transmit.** However, if you intentionally do not assign a VFO to the transmitter, you will not unintentionally transmit during receiver comparison tests! You may also assign one VFO to both receivers so that they track each other. This is necessary for diversity receive.
- It is possible to separately lock and unlock the two VFO's. This is very convenient when working split frequency.
- The Orion's MAIN receiver has seven (7) roofing filters at 9 MHz. Four are standard and 3 are optional. The rig we tested had 6 roofing filters installed. These filters may be manually or automatically selected. With a roofing filter as narrow as just 250 Hz and all other RX parameters being close to as good as the technology currently permits, close-spaced IP3 is just as good as wide-spaced IP3. There is currently no other ham transceiver on the market that has this roofing filter concept. (Note: the new IC-7800 will have two (2) roofing filters at 64 MHz - one with 20 kHz bandwidth and one with 6 kHz bandwidth).
- The other filters used for selecting the primary bandwidth are DSP filters. There are 590 DSP filter bandwidths to choose from. This sounds like a nightmare. It is not. In fact, in practice it is easy to use. Selection is done by rotating a "Bandwidth" knob which sequentially selects the individual filters. The selected bandwidth is displayed on the main display. To the operator, it seems that the Orion has just one big continuously variable filter - not 590 different ones. In Automatic Mode, the roofing filter selection tracks the bandwidth of the DSP filter and automatically selects the proper roofing filter. If desired, the roofing filter may be manually selected. What "sounded" like a complex filter arrangement turned out to be very simple and easy to use - once it was understood.
- When multiple selections are available, they are typically NOT sequenced. Instead they are selected by pressing one or sometimes two push-buttons located on the perimeter of the huge display screen. Sometimes the selection is indicated by the printing on the buttons and sometimes the selection is indicated by printing on the screen, directly next to the buttons. It was confusing at first (because it's different), but you quickly learn this simple concept of use. Once you have learned to use one function, all of the other functions' selections/adjustments work exactly the same way and are just as easy to use. Exceptions: The AGC is sequenced through FAST, MED, SLOW, OFF and the Attenuator (ATTN) is sequenced through 6dB, 12dB, 18dB, OFF. These are usually set once per mode/band and then left alone. Yes, this is true for the ATTN too because the receiver is so good that you typically do not need it.
- There is a CW "SPOT" button which enables you to easily zero-beat the other station.
- The frequency response of the audio is controlled by DSP and adjustable independently for both TX and RX.

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- Finally, using narrow filters, whether DSP or roofing, did not appear to reduce overall receiver sensitivity.

DSP Filter Test:

The **Noise Reduction** <NR> is adjustable (9 settings). We did not "play" with this much. We simply used it. Subjectively, it works at least as good as the <NR> on my other rigs (and I use this feature most of the time with all rigs that have it).

Because this was my first time to operate a rig whose primary bandwidth is determined by **DSP filters in the IF stage**, I was anxious to see (and hear) if the selectivity would be better, worse, or the same as a conventional solution using cascaded crystal (quartz) filters. For me, this was one of the most important features tested.

I used the IC-746 ~~PRO~~ for this comparison test because it has the ability to cascade two crystal filters. The K2 has a totally different filter arrangement.

--> NOTE: The IC-746 was not a "PRO".

How I tested:

- I set up the IC-746 ~~PRO~~ for 2.4 kHz bandwidth in each of its two IF's (i.e. two crystal filters cascaded).
- I manually selected the 2.4 kHz roofing filter and 2.4 kHz DSP filter on the Orion (i.e. one crystal filter cascaded with a DSP filter).
- I set the Passband Tuning (PBT) to Zero (off) on both rigs so that I was sure to hear the full 2.4 kHz bandwidth.
- I tuned to several 40m SSB stations. Subjectively, using my ears as well as the two S-meters as indicators, I monitored the "duck-talk" (splatter) which was due to QRM from adjacent channels. **The results were awesome.** Often, the duck-talk was S5 to S7 on the IC-746 ~~PRO~~ and completely inaudible on the Orion. There was also no sign of the Orion's receiver desensitizing or AGC pumping due to neighboring QRM.

In each of the several instances that I tested, it was possible to adjust the IC-746 ~~PRO~~'s passband tuning to significantly reduce (often, totally eliminate) this duck-talk. However, this method, though effective, also highly reduces the audio fidelity of the received signal. Until now, I thought that was the price one must pay to receive SSB without QRM. Now I know there's a better way (albeit an expensive way).

Notch Filter:

Like on my Omni VI+, the **Automatic (DSP) Notch Filter** works very effectively on SSB, though at first I thought it was not working at all! On the Omni, the filter is either on or off, with instant attack. The Orion has a much more intelligent automatic notch filter whose attack time is adjustable to be more or less aggressive. The theory of how this works and how to use it is explained well in the manual, but we did not spend much time playing with it (I only

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realized it was working after reading the manual which informed me that a slight "wait time" was required). Again, we just used it when needed it and it worked superbly.

In addition there is also a **manual Notch Filter** which works on the IF stage (at 9 MHz). This manual notch has adjustable width and depth and is excellent for CW use. It's excellent for SSB use too, but it's easier to simply press the <AN> button for automatic notch when in SSB Mode!

Comparison Test: K2

The IC-746~~PRO~~ was not available Friday night so we focused on CW mode and used the K2 for comparison. The K2 is reputed to have one of the best receivers currently on the market.

With its single conversion IF, the K2 does not have passband tuning (PBT). Until now I have considered PBT to be a necessity for SSB use and have therefore viewed the K2 primarily as a CW rig. Therefore we only compared it to the Orion on CW. (The K2 comparison test was before I tested the Orion's DSP filters for splatter).

The feature which is praised the most on the K2 is its ability to hear weak signals in the presence of strong (unwanted) signals.

Though both receivers are indeed excellent, on 40m at night, we had several occasions that it was possible to read a very weak CW signal "Q5" on the Orion whereas it was barely decipherable on the K2 (R3 or less).

Comparison Test: IC-746~~PRO~~

Saturday morning we easily worked several VK's on 20m running the Orion barefoot. We used a **Heil HC-5** microphone. We got excellent audio reports, but we never tried to use the DSP to adjust our audio frequency response. In my opinion, DSP adjustments on TX need to be made with a good (local) friend on a dead band because the other station will need to be very patient with you.

We quickly stopped telling people we were running an Orion because they always asked too many questions and we only had limited time for the tests.

We compared the two receivers to several VK's (some which we worked and others which we simply heard). At first we got some very *"interesting"* results:

08:30 GMT: With the first VK coming in RS 59 and S9+20dB QRM just 800 Hz higher, we were not able to adjust the Orion such that it had better quality of reception. Indeed, subjectively, the Icom was distinctly better. (?)

10:45 GMT: Very similar situation but this time the Orion was distinctly better in reception. (By better, I mean fidelity which contributes to the quality of reception).

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**Two tests and two totally different results!
And we had absolutely no idea why!**

11:30 GMT: We found another situation where the Icom again had a distinctly better quality of reception.

This time I was determined to find out why.....!

Troubleshooting the Quality Problem:

- I noted the Icom's filter settings + PBT settings
- I set the Orion exactly the same
- I then "tweaked" the adjustments on the Orion
- The reception on the Orion was distinctly better than on the IC-746 ~~PRO~~

What did we learn?

Because the Orion has more opportunity to enhance reception, it also has more opportunity to completely mess it up (especially when you have two operators eagerly twisting knobs on the Orion simultaneously)!

There are two things which help in this situation:

1. First of all, if you entirely mess up the settings, there's a <RECALL> button just below the screen on the left which will reset the receiver to its factory default settings.
2. Second, the <RECALL> button may also be used to reset all settings to a previously user-defined profile instead of the factory settings. These profiles include a multitude of settings and can be defined differently for different modes or operators.

Altogether there are five profiles available and I highly recommend using this feature, at least until you become accustomed to working with the Orion.

Miscellaneous:

In the limited period of time available, we were not able to test all of the features of the Orion. Some of the features not tested:

- Diversity Receive
- Panoramic Stereo™ Receive
- Programmable AGC hang and threshold
- Automatic Notch programmable aggressiveness
- DSP options on TX (bandwidth and frequency response)
- CW TX options (programmable rise/fall times)
- And probably several others that we have yet to discover

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In addition, we only spent a limited amount of time playing with DSP Noise Reduction and audio equalization on RX. Using audio equalization has a similar effect on RX as a speech processor has on TX - it improves the punch!

Summary and Conclusion:

Clearly the transceiver likes and dislikes of ham radio operators vary dramatically. This is seen in the lengthy discussions on this topic on our *Bavarian Contest Club's* reflector. Everyone wants excellent receiver performance but not everyone wants to twist a lot of knobs to get it! I belong to the second category and strongly believe in *"Keep It Simple!"*

Without a doubt, users will have to pass their "Orion Driver's License" before they obtain good results with this transceiver. In my opinion, it will take the average operator about 10 to 20 hours of "playing" before (s)he learns to work with the Orion's multitude of features without wasting too many brain-cycles on its adjustments.

Ten-Tec has successfully combined the two concepts, "lots of features" and "ease-of-operation" into a rig that gives users the best of both worlds. To do this, they have implemented simple, intuitive "push-button-driven" software menus, user profiles, and as a last resort, (user-definable) <RECALL>.

In this author's opinion, within a very short timeframe, a large percentage of the world's top contesters will switch from "KenYaCom" to the Orion. Other factors beyond Ten-Tec's direct control will help (or deter) this transition (e.g., contest software support, 3rd party TX bandpass filters or antenna switches directly compatible with the Ten-Tec remote bandswitch information, etc.).

DXers will clearly benefit from the excellent receiver, but many probably do not need all of the bells and whistles (i.e., 2nd receiver and 7 roofing filters).

Casual users and rag chewers will probably find the Orion simply too expensive for their specific needs. In addition, the casual users might get frustrated with the Orion because they constantly have to retrain themselves on the Orion.

Bottom Line:

Ten-Tec has taken a giant leap in re-defining "Software-Definable Radios". Once users get over the initial shock of having so many adjustments, they will be able to personalize the Orion for their own particular operational needs, save the settings into their own profile, and enjoy both excellent performance and ease of operation.