The Icom IC-756PRO
Advanced Operating Guide

The Icom IC-756PRO truly represents a new generation in DSP based transceivers. The flexibility of Digital Signal Processing gives you the power to extract elusive contacts from QRM and QRN as well as the capability to tailor your transmissions from 'broadcast quality' to a highly compressed, frequency-shaped DX pileup breaking signal.

The IC-756PRO out-of-the-box experience is fantastic. But as is typical with a next generation product, to maximize performance, you need to use the product a little differently than you did your old rig.

This guide is a collection of suggestions on how you can maximize the performance of your new IC-756PRO. But don't stop with what we suggest, go ahead and experiment. Set up the rig to your operating preferences. Experiment with the ideas below and try some of your own.

To illustrate the differences between the IC-756PRO and previous rigs, let's take a short quiz.

1) The IC-756PRO has 41 IF DSP filters available in SSB and CW. How do you select the filter you want?

a) Use Twin PBT
b) Push the Filter button
c) Push and hold the Filter button

2) How do you get 41 filter bandwidths in each mode when there are only 3 filter selections?

a) Plug in any 3 of the 41 optional filters
b) Just push the 'Filter' key

3) How do you tune in a CW signal?

a) Peak the S-meter
b) Tune by CW pitch

4) Why can I sometimes hear clicks from nearby CW transmitters?

a) Because a next generation receiver can hear much more
b) Because the transmitter is sending on your frequency
c) Both a) & b)

5) How do you set the SSB frequency response of the receiver?

a) Use the treble and bass settings on the Set Menu
b) Select a wider filter and use Twin PBT

6) How do you receive the highest quality audio?

a) Use an external speaker
b) Use headphones
c) Either a) or b)

7) How can you receive RTTY "signals" that aren't even there?

a) Set the Threshold Adjust/Squelch too sensitive
b) What's RTTY? I've never used this mode.

8) How can you receive PSK31 signals?

a) Use USB-D mode
b) Use the 50 Hz filter

9) How can you use the spectrum scope to tune in interesting signals?

a) Slowly tune the rig and watch the scope update
b) Push 'hold,' 'marker,' and tune the VFO

10) Which sounds better?

a) vinyl records
b) CDs

Think you know the answers? Well let's see how well you scored.

Filters

1) The IC-756PRO has 41 filters available in SSB and CW. How do you select the filter you want?

Certainly the most unique feature of the IC-756PRO is the huge number of receive filters built into the rig. At first, 41 filters in CW and SSB may seem an overkill, but most operators soon find that they cannot do without the wide range of filters offered standard in this product.

While you could create a filter using Twin Passband Tuning (Twin PBT), it is not the best way to select filters in a next generation DSP rig like the IC-756PRO. Filters selected with Twin PBT do not yield the best rejection of adjacent signals. To get maximum performance, use the Filter button. Pressing the 'Filter' key rotates through your three favorite filter selections for the mode you have selected.

2) How do you get 41 filter bandwidths in each mode when there are only 3 filter selections?

Each of the three filter selections in CW, SSB and RTTY can be user defined from a large menu of possible bandwidths. Pressing the 'Filter' key for two seconds displays a graphic to help you pick the filters. This graphic displays the filter center frequency and bandwidth. It also shows the effect of the Twin PBT setting on the filter.

Another very nice feature of this receiver's IF DSP filters is the Twin PBT. The radio not only remembers the three filters you selected for each mode; it also remembers the Twin PBT setting you used.

CW Operation

3) How do you tune in a CW signal?

If you use a wider filter, there is no need for precision tuning because the digital filters have a very flat top. However, if there is an interfering signal nearby, you can use the power of the IF DSP filtering. Go ahead and narrow down the bandwidths as described above. But you must be a little more careful when tuning narrow filters. If you mistune the signal, the sharp filter may remove some of the CW sidebands you need for clear reception. So be sure to center that signal. One way to center the signal is by reducing the bandwidth even further, tune for maximum S-meter reading and then pop back to your desired bandwidth. Finally, adjust the CW Pitch control for the desired tone. From now on, if you tune to your desired pitch, the signal will be centered.

4) Why can I sometimes hear clicks from nearby CW transmitters?

The excellent sharp filters and the low phase noise of the IC-756PRO mean that you can pick out small signals much closer to large signals than ever before. So close, in fact, that you can hear the CW sidebands that fall onto the frequency where you are trying to listen while completely rejecting the nearby CW carrier. So no matter what you do, you can not completely eliminate the effects of the undesired signal. However with the IC-756PRO, this undesired effect can be reduced as far below the desired signal as possible by using the sharp narrow filters.

Why haven't you heard this effect before? Actually, you probably have, it has just been masked by carrier leakage from the undesired signal. Analog filters leak the adjacent carrier and in doing so mask the clicking sounds. But if you listen carefully to a good analog rig as you tune away from a CW signal, you will hear clicks as well as the carrier.

Another CW operating hint: Some CW operators want to hear, at very reduced levels, the adjacent signals. This is easy to do with the IC-756PRO. Just pick a wider BW and use Twin PBT to narrow the bandwidth. We suggest that 1 kHz BW adjusted down to 300 Hz closely approximates an analog receiver with two 250 Hz filters. As noted before, the IC-756PRO will remember your Twin PBT settings, so you can easily use your custom filter shape at any time.

SSB Operation

5) How do you set the frequency response of the receiver?

First, did you catch the trick answer? The bass and treble only control the transmitter, not the receiver.

The IC-756PRO has extremely selective filters, much sharper than analog filters that allow interference from nearby signal components. But if you select too narrow a DSP filter, the frequency response of the desired signal will be cut off. Analog filters roll off so slowly that you can still hear the high frequency components of the desired signal. Digital filters have a flatter frequency response in band and then roll off more quickly. But the IC-756 PRO filters are deliberately designed to reject adjacent interference on our crowded bands. For example, if you use the 1.8 kHz filter, 1.9 kHz will be inaudible. So unless you have strong adjacent interference, use a wider filter than you would use on an analog receiver. The huge selection of filters in 100 Hz bandwidth increments makes it easy to select the best compromise between frequency response and rejection. To extend or reduce the bass response, use the PBT controls. Moving these controls together moves the total filter shape up or down in 50 Hz steps.

6) How do you receive the highest quality audio?

Ok, so this question was a freebie. But the audio quality of this rig is so high that the built-in speaker is the limiting factor. The built-in speaker is convenient, but to enjoy the audio fidelity of this rig, use a high quality headset or external speaker.

RTTY Operation

7) How can you receive RTTY "signals" that aren't even there?

'I've never used RTTY' is probably the most common response. But now that you've got a rig with RTTY decoding, why not give it a try? Just put it in RTTY mode, turn on the RTTY filter and select the decode display!

Because so many users are likely to be new to this mode, a few words of explanation are in order.
RTTY operation with the IC-756PRO uses twin APF (audio peak filters.) These filters are so effective at eliminating QRM/N before the decoder that they can deceive your ear. To the inexperienced RTTY operator, noise going through this filter sounds like a RTTY signal. If the threshold is not set properly, the decoder will also be deceived and will put random letters on the screen. However, with no signal, the tuning indicator will just randomly flicker. A real signal, properly tuned, will illuminate both indicator arrows.

PSK31 Operation

8) How can you receive PSK31 signals?

The narrow spectrum of PSK31 and the narrow bandwidths of the IC-756PRO are a natural combination. To operate in PSK31, first use the USB digital mode (USB-D.) This mode turns the microphone off to prevent it from picking up shack noises. However, it does not disable any transmitter audio filtering or compression you may have been using. By the way, you should also use the digital selection with any other digital modes you might be using (e.g. HF packet and SSTV.)

Second, use a narrow filter of your choice. You might want to start with a 250 Hz bandwidth. Using a narrow filter like this eliminates QRM before the limited dynamic range of your PSK decoder (e.g. sound card or DSP board). Then set the tuning step for one Hertz frequency resolution. Yes your PSK decoder can probably provide AFT, but this doesn't help if the signal is falling outside of the receiver bandwidth.

If you hold the 'Filter' key for two seconds, you will see that the filter you are using is centered at 1.5 kHz. You can use the Twin PBT to change the center frequency, but with this narrow bandwidth, it is not possible to move the center frequency down to the usual 1 kHz tone used in PSK31. The narrowest filter you can use and still center on 1 kHz has a 1 kHz bandwidth. So either use the sharp 1 kHz filter or if you really want to dig a signal out of the mud, change your PSK software to 1.5 kHz instead of the usual 1 kHz. (In Peter Martinez' PSK31SBW software, this is done in the setup menu.) Remember if you are tuning to the standard calling frequencies these are now 500 Hz off.

We encourage you to use the power of this new rig to experiment. You will probably find that in almost all cases the 50 Hz filter is too narrow for PSK. The filter is so narrow that it interferes with the shaping done in the PSK software. What you might see is that if you have good copy at say 200

Hz, as you reduce the bandwidth, you will begin to have more errors. What is happening is that with very narrow filters, you get the previously sent bits interfering with the bit you are trying to decode. This phenomenon is called Intersymbol Interference (ISI). However, if you have very bad QRM very close to the signal, the super sharp shape of the IC-756PRO's narrower filters may improve your copy. You may find that using the Twin PBT you can create a narrow filter with wider skirts that gives better ISI.

By the way, when operating PSK or other digital modes, it is better if you turn the key confirmation beeps off when using PSK. Otherwise the PSK software gets confused every time you push a key.

Spectrum Scope

9) How can you use the spectrum scope to tune in interesting signals?

Of course, the rapid update rate (some even call it real time) of the IC-756PRO spectrum scope allows you to easily tune to steady signals. But how can you capture that intermittent signal you can see down the band before anyone else jumps on him?

One way is to push the 'hold' key to freeze the spectrum scope. Now the display will not be updated as you tune in on the signal. Next, press the 'Marker' once or twice until the display reads 'Tx Marker.' Finally, tune the VFO until the marker is on top of the desired signal and fine tune until you hear the signal.

While we are on the subject of the Spectrum Scope, you may have noticed a new control, the spectrum scope attenuator. This controls the magnitude of the scope display without affecting the actual gain of the receiver.

Digital Sound

10) Which sounds better, vinyl records or CDs?

Have you heard of the audiophiles who still claim that vinyl records sound better than CDs? Or that swear by the 'warm sounds' of vacuum tube hum compared to transistor amplifiers? This time the debate is digital versus analog amateur radio sound.

If you prefer the hiss and pop and poor frequency response of vinyl you probably do not want to consider any DSP radio. The audio from a DSP-based radio is noticeably different than from an analog radio. You hear less of that wearing analog hiss; the background noise sounds more like a low rumble. While this rumble has been called "distortion", it is just the sound of noise passing through the sharp digital filter, just like a hiss is the sound of the same noise passing through an analog filter.

The previous generation of DSP amateur radios in this price class had some shortcomings compared to the best analog radios. However, DSP technology has been improving very quickly. A few years ago, only the military could afford DSP rigs with more than 16 bits. But 16-bit ADC and DSP just do not have enough dynamic range to provide the performance needed on our crowded HF bands.

The difference of a few years is dramatic. The IC-756PRO's 24-bit ADC gives 48dB more dynamic range than previous amateur HF 16-bit designs. That's over 50,000 times more power handling capability. How big a difference is that? Well, consider the length of a football field. The distance from Seattle to Miami is about 50,000 times larger than a football field!

Another dramatic technology improvement is the use of a 32-bit floating-point Digital Signal Processor. Compared to the previous 16-bit, fixed point DSPs, it completely eliminates noise and distortion generated by the digital processing. This is equivalent to a perfect analog final IF that has no noise or distortion.

Final Words: Enjoy your next generation HF rig and be sure to experiment with all the new possibilities. But most of all have fun with your new rig!

73, Icom America