THE ICOM IC-R70

A DXers Review, Technical Description and Modifications

Kevin Atkins   John Tow   Jerry Strawman

●OVERVIEW AND OPERATION   by Kevin Atkins

Life with an R70 is a love-hate relationship. The whispered condemnations you've heard about its tuning scheme are deserved, and the selectivity of the stock version is only fair. Still, with a few mods and a lot of practice, you can overcome Icom's design flaws and hear anything that's hearable.

This receiver is the "point of diminishing return" in terms of receiver-dollar ratio. In the last year I've seen R70s selling at hamfests for $300-400 U.S., and it's difficult to imagine more receiver for the money. More expensive receivers, with features like memory, inboard clocks, and timers, certainly contribute to more efficient operation. But in terms of ultimate "hearability," the R70 compares favorably with the most expensive rigs on the market, and thus merits serious consideration by the DXer whose budget won't allow any extra-cost conveniences.

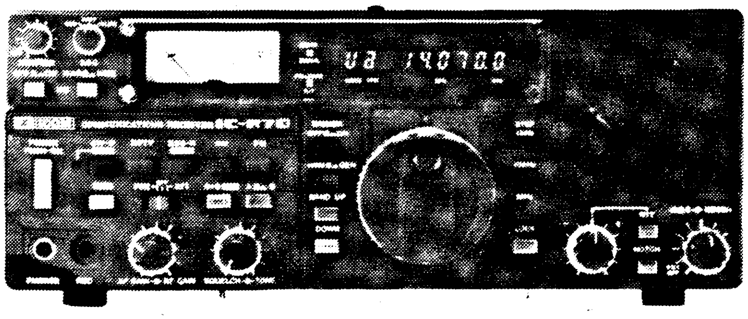
SENSITIVITY AND DYNAMIC RANGE

A three-position slide switch and a continuously-variable gain adjustment provide control of the R70's RF section. The 3-position switch controls the preamp and attenuator, with "off," "on," and "attenuate" positions. With the 10 db preamp on, there's plenty of sensitivity for detecting the weakest tropical band signals. Near very strong signals (i.e. Mayak 4766, Rebelde 5025) the front end tends to overload unless the preamp is turned off. In the international bands—particularly 49 meters at night, or near WYFR anywhere/anytime—overloading can be a real problem. It involves stations within 20-30kHz of the tuned frequency, so a broad-banded antenna tuner or similar preselecting device is not much help unless carefully peaked. Fortunately, the 20db attenuator eliminates most overloading.

The stock R70 automatically disables the preamp when mediumwave frequencies are tuned. There is a simple mod to alter this well-intentioned but ill-advised default in the "Modifications" section of this review.

SELECTIVITY

The stock R70 has two 2nd IF bandwidth filters of 2.3kHz and 6kHz for CW-wide/SSB and AM respectively. The filter choice is *not* independent of mode, so there is no "narrow" AM filter. The 6kHz filter is too wide for most DXing applications, leaving ECSSB as the only choice for a narrow bandwidth. These are crystal filters with good skirt selectivity—a good thing, since the 2nd IF is in the 9MHz range, and substitute filters are not common (though some are available; see "Modifications").



Instead of a narrow filter, the R70 offers a "passband tuning" arrangement to tighten selectivity. The circuit is incorporated in the 3rd IF, and includes another 6kHz AM filter and a 2.3kHz SSB filter. These may be shifted through the passband of the 2nd IF filters via the front panel "PBT" control. The passband can thus be effectively "narrowed." According to Icom's specs, AM is continuously variable to 2.7kHz (an optimistic figure), and SSB to 500 Hz (Figure 1).

The choice of filters in the 3rd IF stage is disappointing. Instead of crystal filters like those in the 2nd IF, Icom saved money by using cheap ceramic filters. The skirt selectivity of the 6kHz filter is so poor that the circuit is of limited use in AM. At best, it will remove minor adjacent-channel splatter or a weak het. At worst, its effect is unnoticeable. The SSB filter is somewhat better; you can adjust the circuit for just the amount of selectivity you need while losing a minimum of audio clarity.

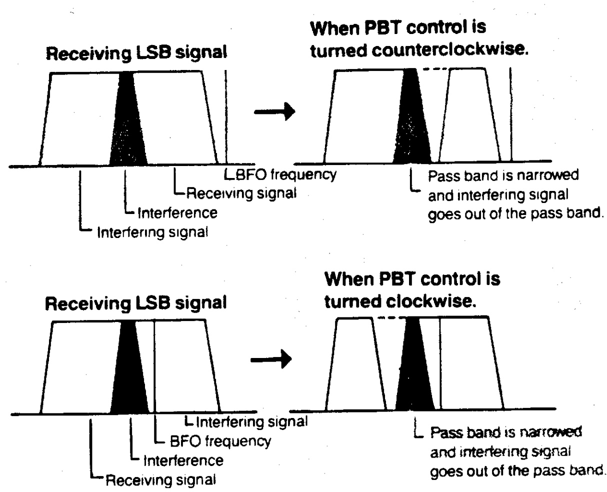
Given the less-than-satisfactory selectivity performance of the stock R70, it's not surprising that many of the publicized modifications for this receiver have to do with improving selectivity. Most Icom dealers who marketed this receiver to to the SWL/DX community offered these modifications as extra-cost options, so there's a good chance that a used R70 is more than it seems.

The simplest modification allows the use of the 3rd IF SSB PBT filter in AM mode for a true "narrow AM" bandwidth. This is really a "must have" mod for any AM DX work. The AM performance of the PBT circuit is greatly enhanced (Figure 2).

Don Moman of Shortwave Horizons offers a 4kHz replacement for the AM PBT filter. I haven't tried it, but it would have to be an improvement over what's there. The 3rd IF is 455kHz, so there are probably many alternative filter possibilities for the experimenter.

While the SSB PBT filter seems to have a better shape factor than its AM counterpart, it could stand considerable improvement. Such improvement is available in the form of the Icom FL-44A, a 2.4kHz eight-pole crystal filter with a diamond price tag (current list is around $180 U.S.). It is an outstanding filter, and quite worth the investment. Thus configured, the R70 is a joy to use in SSB, and the "narrow AM" mod is similarly enhanced. The FL-44A is still available from Icom dealers, as it is also the SSB "upgrade" filter for the R71A.

FIGURE 1. R70 (stock) passband tuning.



Several dealers offer mechanical filters as a less-expensive SSB upgrade option. While I have not tried one, a good mechanical filter seems a viable and less costly alternative to the FL-44A.

STABILITY

Quite simply, the R70 is as solid as a rock. There is no measurable drift after the first few minutes of operation. The only exception I have noted is a susceptibility to extreme cold. During a recent outdoor DXpedition, with temperatures in the high 'teens and a zealous wind whipping the chill factor well below zero, I observed a 300Hz readout error. Fortunately, the cure is simple. There is an adjustment accessed via a "trap door" on top of the receiver; simply tune and zero-beat WWV. At home, where radio and related activities have been relegated to the basement, I've occasionally had to tweak the adjustment on particularly cold mornings.

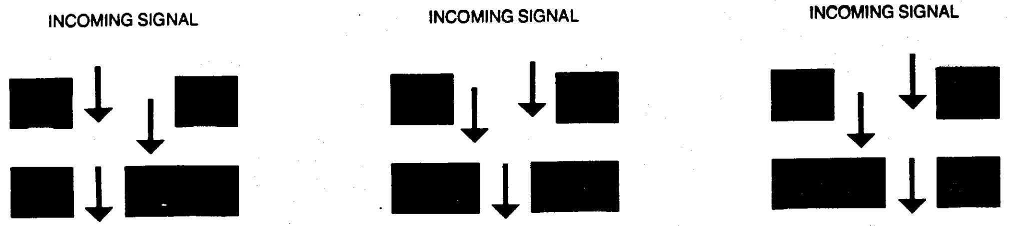
TUNING

The R70's greatest strengths and worst flaws are in its tuning scheme. Its ham transceiver ancestry is evident here, and apparently the designers felt there was no room in the budget (or perhaps no demand from the marketplace) to correct the problems.

Coverage is in 1Mhz band segments, with "up" and "down" pushbuttons to select the desired range. One minor annoyance is that you cannot hold the button in and "run;" you must press the button for each 1MHz increment. For the ham, there's a handy switch that allows one to bypass all but the ham bands. With the switch in the "GEN" position, each push of the button steps the MHz counter by one; in the "HAM" position, it skips to the next ham band.

Kilohertz change is via the main tuning dial. Tuning rate is selectable, with three pushbuttons controlling the options: 1kHz steps for rapid movement, 100Hz for fast bandscanning, and 10Hz for fine tuning. One knob revolution is equal to 100 steps. The 10Hz rate gives all the resolution required for ECSSB. The slow, lazy feel of the dial is perfect for zero-beating a carrier, allowing more physical

FIGURE 2. R70 passband tuning (PBT) using narrow AM modification.



A. PBT at 1:00 to eliminate highside QRM.

B. PBT at 12:00; narrow filter is centered in passband.

C. PBT at 11:00 to eliminate lowside QRM.

control over tuning than the smaller, more critical RIT controls on some receivers. As a bonus, there are analog tick marks around the outer dial ring for reference. The R70's readout displays the frequency to the nearest 100Hz, but readout within 10Hz is possible with practice by using these marks. The manual implies that each mark is equivalent to 10Hz, but 20 kHz is the correct figure.

The R70 does have an analog RIT circuit, but the tuning is very critical. In addition to the tuning knob, there is a switch for turning the circuit on and off. If you try it and don't like your results, just turn off the circuit and you're back where you began. Any shift in tuned frequency is reversed when the circuit is turned off.

RIT shifts are not displayed on the main dial; the only non-audio indication that RIT is in effect is a small red light near the frequency display. A slide switch under the bottom panel allows the option of manual control of the RIT via the front panel switch, or "auto-off" of the RIT whenever the main tuning dial is moved. The circuit's range is +/- 800Hz in SSB, and +/- 3kHz in AM.

When tuning with the main dial, there's a readout glitch at the end of each MHz range (or the beginning of the next range). In AM mode, for example, tuning upward through 60 meters in 100Hz steps and approaching WWV, the readout displays 4999.8, 4999.9... then 4000.0. The received frequency, however, is 5000.0. Continue tuning, and while the readout shows 4000.1, you're receiving 5000.1. When you reach 4001.5, the synthesizer catches up with the readout; WWV disappears, and you receive 4001.5. In LSB, the effect is the same, but in USB, the anomoly shifts to the lower side of the MHz change. If, for example, you want to hear Greenland on 3999.0 in USB, you must tune 4999.0. The received frequency shifts 1.5kHz *before* the displayed frequency.

Aside from the readout quirk, tuning the R70 in AM is straightforward. But in sideband, mannerisms that don't adversely affect hams are a plague on the broadcast DXer. Most of these are related to the sideband default—USB above 10MHz, and LSB below.

A single pushbutton puts the R70 in SSB mode; the receiver chooses upper or lower sideband based on the tuned frequency. If the 10MHz threshold is crossed in either direction, the sideband default will switch automatically. To override the default (i.e., to use USB in the 60-meter band), you must press a "function" button, then the sideband button—and *manually retune the signal.* Switching sidebands offsets the tuned frequency by 3kHz. AM is treated like LSB when determining the frequency offset. Thus switching from AM to sideband below 10MHz causes no offset, since the default in this range is LSB. Above 10MHz, the AM-to-SSB shift leaves you in USB, 3kHz below where you started from.

The R70 has a dual VFO arrangement that amounts to a one-channel memory. It is useful for checking parallels, or for "watching" one frequency while logging a station on another. Unfortunately, it does not remember mode or tuning rate, and is therefore subject to the same SSB defaults and frequency offsets as manual tuning. AM operation is simple, but effective use in SSB requires a great deal of practice.

Most of the R70 owners I've met agree that with such practice (and some wailing and gnashing of teeth), the procedures become second nature and aren't a serious liability. The key is to supplement the R70's memory with your own. For example, if you tune a 60 meter band frequency in USB (where the default is LSB), return to LSB before switching to the second VFO. When you return to the first VFO, you need only switch to USB again to return to your stored frequency. If you switch VFO's without first switching to LSB, the R70 will do it for you—and offset the frequency by 3kHz—when you try to return to it.

Similarly, if you carefully tune a SSB signal in 10Hz steps, then switch to the second VFO and do some rapid bandscanning in 1kHz steps, remember to switch back to 10Hz steps before returning to the first VFO. If you don't, the R70 will truncate your carefully tuned frequency.

OTHER FEATURES

The R70 is equipped with an effective notch filter. Like its successor in the R71, it works only on the selected sideband. Unlike the R71, it does work in AM, but only in half of the passband. There's a pushbutton to turn the circuit on and off, so you can adjust the notch for intermittent utes, then switch it in or out as needed without readjustment. The notch adjustment is on the outer ring of the "PBT" knob, which makes critical notching physically more difficult than it should be, but it is an effective het-killer. Still, the R70 is improved by the addition of an outboard AF notch filter such as the Autek QF-1A; not only because of the effectiveness of the unit's notch against a wide range of hets, but because it helps overcome another of the R70's shortcomings—boomy, bassy audio.

The R70's single tone control should be welded into the maximum treble position. Even then, it's bassy. The addition of an audio filter is one solution; another possibility is a graphic EQ. A particularly effective setup is a combination of the two, taking the R70's signal from the front-panel record-out jack (thereby bypassing the audio amp altogether), feeding it into a graphic equalizer with a gain control, and then into the Autek. The Autek's amp is suitable for driving headphones or a small speaker, and the EQ gain becomes your volume control. For taping, connect your recorder between the R70 and the EQ.

The R70's noise blanker is the best I've used. It is effective against many types of noise, including the power line variety. It is subject to the normal limitations of such circuits; it is most effective when the signal is weaker than the noise level, and marginally effective when signal and noise are equal. A nearby strong signal not only limits the effectiveness of the blanking action, but can actually overload the circuit and introduce splatter. Still, it is capable of lifting a weak and isolated signal (such as RRI Serui) out of a nasty mess of power line noise.

The AGC circuit may be set for fast, slow, or defeated entirely. There is a slight boost in apparent sensitivity with the AGC off, but proximity to a strong signal will cause overloading.

A squelch control is included, presumably for use with the FM option (though it works in all modes). There's no real DX application for this, but it might be useful for casual SWLing.

A dial lock is provided to allow the operator to electronically disengage the main tuning dial. On a receiver that's not exactly easy to retune, this is a valuable feature. My only complaint about the R70's dial lock is that it's uncomfortably close to the main dial. It's just too easy to bump the dial while attempting to lock it, especially when hampered by a late-night static hangover.

The R70's readout and S-meter light are painfully bright. Fortunately there is a dimmer switch which cuts the intensity roughly in half. I suspect component life expectancy is improved by using the "dim" (though still plenty bright) setting. Conversely, the vision-impaired might find the bright lights to be an advantage.

●TECHNICAL DESCRIPTION by John R. Tow

The R70 is a quadruple conversion superhetrodyne receiver utilizing up-conversion. The first IF of 70.4515 MHz is followed by a 9.010/9.01115 MHz IF, a 455 kHz passband IF, and finally a return to the 9 MHz IF. This is followed either by a diode AM detector or a product detector for SSB/CW/RTTY. An optional FM board is available to permit FM detection. It takes its signal off at the third IF. AGC circuitry, a noise blanker, and the frequency synthesizer are also provided.

Signals above 1.6 MHz are coupled into the selectable RF bandpass filters through the Lo-Z antenna input (50 Ohms). Below this frequency, a back panel switch permits the selection of either the Lo-Z input or a 1k Ohm Hi-Z input. Eight separate 3- to 5-pole bandpass filters cover the LF to HF range quite adequately with no need for preselector "tweaking" as in earlier receivers. The RF bandpass filter is selected by switching diodes driven by logic signals. Most modern receivers do not have the larger number of filters or the physical isolation and shielding (which offer more isolation and out of band attenuation) that the R70 has.

The RF bandpass filter is followed by a diode-switched selection of either a grounded gate balanced jFet wideband RF amplifier, a straight through connection, or a 20db attenuator. The RF amplifier, labeled a "Preamp" on the receiver, seems to offer an honest +10 db gain from 30 MHz down to about 350 kHz, where its gain continues to roll off to unity by 200kHz or so. The ability to use the pre-amp below 1.6 MHz is inhibited in the stock R70 by a logic signal—a "fault" easily remedied by snipping a wire. The signal next flows to the first mixer, a packaged doubly balanced diode mixer. The RF bandpass filter followed by the higher sensitivity combination of a grounded gate balanced jFet mixer followed by a diode DBM yields a zero net gain but quite stout front end. It's quite crunch-proof by today's standards.

The first mixer is followed by what appears to be a 4-pole crystal filter at 70.4515 MHz. A better quality and narrower filter at this point would have aided in IM/CM distortion reduction. This design trade-off was made to enable a more useful noise blanker circuit—and to save money. (A narrower selectivity before the blanker lengthens the width or time of the noise pulse, making the pulse more difficult to blank.) The minute signal level at this point is amplified by a dual gate MOSFET 70 MHz AGC-controlled IF amplifier. In comparison, the R71A utilizes a balanced jFET mixer in lieu of the diode DBM and IF amplifier. The signal then exits the front end board and travels via coax cable to the main board.

The first stage on the main board is a discrete diode DBM beating the 70.4515 MHz IF with the 60.44 MHz 2nd local oscillator signal to bring the 70 MHz IF down to 9.0115/9.015 MHz, the 2nd IF. This is followed by a balanced diode switch or gate controled by the blanker IF amplifier, peak detector, and pulse width selecting circuitry comprising the noise blanker circuit. The relatively low level signal is then amplified by another AGC-controlled dual gate MOSFET before being applied to one of the diode-selected 9 MHz IF crystal filters. These filters have different center frequencies, making it difficult to replace them as well as making it difficult for the notch filter in the fourth IF (the same frequency) cover the entire width of each filter's bandpass. The signal is amplified by another AGC-controlled MOSFET stage before being applied to the third mixer.

The third mixer, a dual gate MOSFET, mixes a 9.4665 MHz +/- 1.8 kHz LO signal on SSB/CW or a 9.465 MHz +/- 3.3 kHz LO signal on AM with the 9 MHz IF to produce the third IF of 455 kHz. This signal is then fed to either a very poor quality 6 kHz ceramic filter on AM or a fair 2.3 kHz ceramic filter (or the optional and excellent FL-44A crystal filter) and then to the fourth mixer, a linear integrated circuit balanced mixer, a uPC1037. This mixer uses the same LO injection as the third mixer, permitting the IF passband of the third IF filter (455 kHz ceramic) to be 'tuned' through the passband of the earlier 9 MHz crystal filter. The common LO is a variable crystal oscillator (VXO), a crystal oscillator whose output frequency can be rubbered over a narrow range without losing the inherent stability of the crystal oscillator. The LO frequency is varied by a varactor diode whose variable voltage is supplied by a voltage divider including the PBT potentiometer. The fourth IF is 9 MHz, the same frequency as the second IF.

The signal then passes through a 9.0115 MHz crystal remotely tuned by a varactor diode, controlled by the variable voltage supplied by the notch potentiometer and associated circuitry. Unfortunately, the parallel resonant frequency of the crystal cannot be rubbered enough to enable it to effectively notch the lower sideband of the 9.010 MHz AM IF; i.e., it covers only the USB of the IF on AM and both SBs on SSB. This, when combined with the poor quality 3rd IF AM filter, leads one to believe that AM was an afterthought in the minds of the R70 (and R71A) engineers. From here, the signal passes through an additional two stages of AGC-controlled dual gate MOSFET 9 MHz IF amplifiers and thence to the uPC1037 IC product detector for SSB/CW, the diode AM detector, and the diode AGC detector.

The product detector is fed a BFO signal of 9.010 for LSB, 9.0098 for CW, 9.08475 MHz for RTTY, or 9.013 MHz for USB; all crystal controlled. The detected AM signal or SSB/CW signal is then gain adjusted for the signal path and supplied to a remotely gain-controlled audio amplifier including a rather crude tone control circuit via a squelch switch and then to a follower circuit to the record output. The poor audio response and heavy distortion of the audio power amplifier lead one to wonder where the R70's engineers were at lunch when they designed it. (The committee was still out to lunch when the R71A was designed—it's nearly identical!) The AGC circuit has its basic cut-off voltage adjustable on the front panel RF gain control. The 'action' can be switched from "off" to "fast" or "slow" with a moderately fast attack time being constant. The S meter is driven from an IC voltmeter circuit from the AGC line.

The PLL circuit which produces the 61.44 MHz 2nd LO injection signal as well as the 70.4515-100.4514 MHz 1st LO signal is quite complex. Let it suffice to say that it only contains two crystal oscillators—a 20.48 MHz oscillator which can be rubbered by a trimmer capacitor, and a 10.24 MHz VXO controlled by the RIT control. Step wise (MHz) control is logic controlled as is the up-down vernier tuning. The main tuning knob is actually an optically encoded wheel and a photo detector/logic circuit. The steps can be adjusted to 10, 100, or 1,000 Hz per slot yeilding 1, 10, or 100 kHz per revolution. Backlash is adjustable on this knob for a customized feel. Only one memory is provided. The rather 'dumb' 4 bit microprocessor in the R70 does not know to offset the 1st LO signal when changing from USB to LSB or reverse. (The engineers didn't let progress get in the way of tradition—the R71A doesn't switch either.) At least the dedicated program in the R70's micro is hard—no backup lithium cell to die and take with it the operating system for the whole receiver like the R71A.

The power supply includes a 'memory' backup power supply (remember—a 'memory' of 2!) as well as the main AC power supply. The entire receiver is operable at 13.6V for emergency or field use. The construction of the receiver is quite commendable, being sturdy and well compartmented for stage shielding and isolation. The front panel is actually cast, and has a nicer main tuning knob than its newer sibling.

Aside from some obvious design flaws, the R70 is a well-built performer that excels at pulling in weak, QRMed DX signals, particularly in ECSSB.

●R70 MODIFICATIONS by Jerry Strawman

Over the past several years, a number of worthwhile modifications have been devised that can enhance the performance of the Icom IC-R70. The following is a summary and brief description of these modifications.

POST PURCHASE QUALITY CONTROL. The Japanese have produced many fine radios for the shortwave hobbyist, but their track record on quality control is certainly less than perfect. With the many complex circuits employed in today's electronic equipment, it is vital that proper electrical grounds be employed. It is a known fact that Icom equipment can come from the factory with circuit board screws that are not fully tightened. All R70/R71 owners should remove the top and bottom covers of their rigs and carefully tighten down all circuit board screws. Problems such as interference and intermittent operation have been linked to loose screws.

ENABLING PREAMP ON MEDIUMWAVE FREQUENCIES. Look at your parts layout diagram; specifically at the RF unit board diagram. Locate a small G and an arrow at grid coordinates D-E 1 (above bottom edge of board). Then locate a corresponding G and arrow at coordinates F2 (just above part L80). On the radio RF unit board, there is a red wire running between these two points. Cutting the red wire will enable the 10 dB preamp below 1600 kHz. By putting a small jumper between resistors R18 and R19, and clipping the top of R20 (these resistors to left of L57), about one S-unit of sensitivity is gained. This mod is easily reversed if desired.

ALIGNMENT. Icom radios sometimes come from the factory with less than optimum alignment. Locate IF transformers L2, L3, L4, L10, L14, L15, L23, and L24 on the main board. Use a non-conductive alignment tool and peak these transformers for highest S-meter reading when tuned to a stable signal source. These transformers have broad peaks, so a slip of the tool does not mean you will spend the rest of your life trying to set them correctly. On all three R70's I have owned, at least two of the transformers were not peaked. A noticeably higher S-meter reading resulted from this alignment.

AM DETECTOR MODIFICATION. AM fidelity can be enhanced by replacing the half-wave detector with a full wave AM detector. Locate resistor R126 on the main board (4.7k ohm; location 2G on layout diagram). Cut the very top of R126 and scrape away paint from each lead. Solder a 1N60 type diode cathode to the free-standing lead. Solder the diode anode to R126. This mod results in a higher volume level for the same setting, and is easily reversed.

HIGH PERFORMANCE CRYSTAL FILTERS. I was lucky to acquire a new FL-44A filter for $90 some years ago. I can attest to the improvement it yields, but the current $178 (U.S.) list price would discourage me from adding it to my current R70. There is, however, good news—International Radio and Computers, Inc. (757 S. Macedo Blvd., Port St. Lucie, FL 34983, 407-879-6868) has imported and sold drop-in replacement crystal filters for Icom equipment for a number of years. Replacements are available for both the 9011.5 kHz 2nd IF and the 455 kHz 3rd IF filters. They are narrower (2.1 kHz) than the originals, and have a better shape factor of 1:6. They are priced at $60 and $99 respectively, or $150 when purchased as a pair. Installation is straightforward, requiring only removal of the existing filters and soldering in the new. I have not used these filters, but have heard numerous hams extol their virtues.

IMPROVED AM SELECTIVITY. This modification allows the use of the SSB PBT filter in the AM mode. Refer to your parts layout diagram. Locate filters FI4 and FI5 on the main board. Further locate R81/R79 and R75/R72. R72 and R79 are near the filters, while the other two resistors are some distance away. They are joined by wires. Cut the SSB (R75/R72) control wire near R72, and install a 1N914 diode between R72 and R75 (cathode end to R72). A second 1N914 diode (cathode end) is joined at this same junction point. Cut the other wire (AM control wire) between R81 and R79. The anode end of the second diode goes to one side of a SPDT switch. The wire from R81 goes to the center lug of the switch, while the wire from R79 is soldered to the other end lug. The new switch can be mounted on the rear panel. Others have used an unused section of the existing noise blanker wide/ narrow switch. I never seemed to use the dial lock switch, and have used it for this mod on my rigs.

ADJUSTABLE NOISE BLANKER. While the R70 noise blanker performs well in many situations, its action can be improved. Locate resistor R13 on the main board (lower left hand corner). By chaning R13 from 180k ohm to 150k, the blanker threshold is improved to the point where RF signals can be detected by the blanker. The monitor control is unused by shortwave listeners, and may be employed to control the blanker threshold. The monitor pot is attached to a small board at the upper left corner of the front panel. Do not ground the end of R13 (when replacing with the 150k value) but connect a small diameter wire to the free end. Locate a blue wire going to the board on which the monitor control is attached. Strip away some insulation on the blue wire and attach the other wire (from R13). With the monitor control set at 9 o'clock, adjust noise blanker pot R204 (sometimes labeled R104 on diagram of layout) so that you hear distortion and garble on a crowded ham band. Check for garble at other frequencies. The distortion means that the noise blanker is detecting RF signals. Adjust the monitor control for best performance without distortion. This modification was devised by WA9FVP.

TRUE PASSBAND TUNING. Icom's version of passband tuning doesn't tune the passband but widens or narrows it. In the 9 May 1986 edition of *Enjoying Radio*, editor David Newkirk describes a simple revision that allows the user to switch between the variable band pass tuning and true passband tuning. A miniature SPDT switch and small diameter wire is needed. Locate components D45 and R42. R42 is standing on end. Scrape the brown paint from the top lead of R42. Cut the top lead carefully, and separate leads one-half inch apart. Solder a wire from the center lug of the small switch to R42. Extend a second wire from one end lug of the switch to the R42 wire (that goes to the circuit board). The third wire is attached between the remaining switch lug and the exposed lead of D45 where it passes into the circuit board. While soldering to D45, put a heat sink on the diode to prevent heat damage. When the switch is set so that R42 is connected to D45 you have true passband tuning. Reversing the switch gives you the variable passband scheme. Regardless of the selection of USB or LSB, the "PBT" control will now select USB when turned to the left, and LSB when moved to the right. There is a catch to this good fortune—switching from VBT to true PBT removes the better 9 MHz filter from the I.F. chain. This leaves only the 455 kHz filter to provide selectivity. Under high signal conditions this arrangement can lead to filter leakage as you tune away from a strong signal; it can also lead to degraded dynamic range. The mod is easily reversible, and I found it useful to have this added capability.

PBT WIDTH MODIFICATION. This mod was devised by the folks at International Radio and requires the use of a frequency counter. No parts are needed. The mod involves retuning several potentiometers and one inductor. I have not performed this modification, but the procedure appears to be easy. When going to one of the pots that are to be adjusted, I found that it was sealed with wax and did not want to risk damage to the pot. Anyone desiring procedure details may feel free to contact me.

IMPROVED VLF PERFORMANCE. This is another modification that I have not tried. It was developed by an Austrian ham. It is a fairly involved procedure that includes removing a number of components that limit VLF sensitivity. I simply did not want to risk getting in over my head, but I will provide details on request.

REDUCING DIGITAL NOISE. I came across another modification that was designed to reduce digital noise that is generated within the radio and picked up by diodes D1, D2, D3, and D4. The remedy was to fabricate a small aluminum bracket and solder it to IF transformer cans L1 and L3 (all on main board). I tried this modification and could detect no difference, so I leave it to you to try and see. Also described was a procedure by which a thin metal cap was soldered in place over the top of components enclosed by metal shields. These component groups include X1/Q9/Q10/L13 and X3/X4/L18/L20. This also yielded no noticeable change.

After digesting these modification descriptions, you may be saying to yourself, "There's no way I'm gonna do surgery on *my* R70!" Never fear—great technical expertise and a full laboratory of test equipment is not needed. What is required is a willingness to take the time to carefully study the radio and its parts layout. When dealing with small parts located in cramped spaces, the best way to procede is to take your time and be patient.

For those with an interest in the technical aspects of radio operation/repair/improvement, ham radio operators who use Icom equipment get together Sunday mornings at 1700 UTC on 14317 kHz, plus or minus interference, to discuss repairs and improvements of Icom gear. Similar groups of Kenwood and Yaesu users meet later on Sunday afternoons on the same frequency. Much valuable information has been gleaned from listening to these nets over the years.

● IN CONCLUSION by Kevin Atkins

What makes a receiver a "classic"? The ability to flush out DX—at least relative to other receivers of its day—is one requirement, and the R70 certainly meets it. Availability is another; there must be enough in circulation to gain broad appeal, and there's no shortage of R70s. Ease of operation? I'm not so sure about that one. If anything, the Icom's outlaw tuning scheme may actually add to its mystique.

While wandering amongst the fleamarket tables at numerous hamfests, I've noticed an involuntary reflex that draws my hand to my wallet when I spot Hammerlunds, Drakes and the like. The ability of a receiver to trigger that reflex is my own definition of "classic." I don't believe I'll ever experience that reflex over an R70, though—mainly because I don't think I'll ever part with the one I have. I may relegate it to a secondary role, but it doesn't make much sense to sell such a receiver for $300-400.

Fortunately for would-be owners, there are those who will. As with any piece of used gear, check it out carefully; don't take ANYONE's word for its condition. If it has stock PBT filters, plan on spending another $100-200 for an upgrade. And take some time to get to know it. Your investment and your patience will be rewarded.

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