Receiver Modification

TRF MODIFICATIONS

Due to the enormous popularity of Radio Shack's "TRF", a number of modifications to this fine portable have appeared in the DX press. What follows is a compendium of modifications appropriate to TRF Model 12-655 and, in most instances, TRF Model 12-656. Modifying the TRF is a good way to begin modifying receivers. If you make a big mistake, it doesn't cost too much to buy another radio! However, mistakes should be rare if you follow directions closely.

I. Getting inside the TRF case

1. Unplug the AC cord; remove the cover to the AC cord storage compartment and the cover to the battery compartment. Remove batteries.
2. Remove the screw at the back of each compartment and remove two screws on the back of the handle, as well as the two screws at the top corners of the cabinet back--six screws in all.
3. Carefully pry apart the two halves to the cabinet. There may be some glue between the handle halves; use a razor blade or knife blade to break the seal. Watch for the AC cord catching as the two halves are pulled apart. Wires run between the two halves of the case, so don't pull too vigorously. The component side of the circuit board is now exposed.

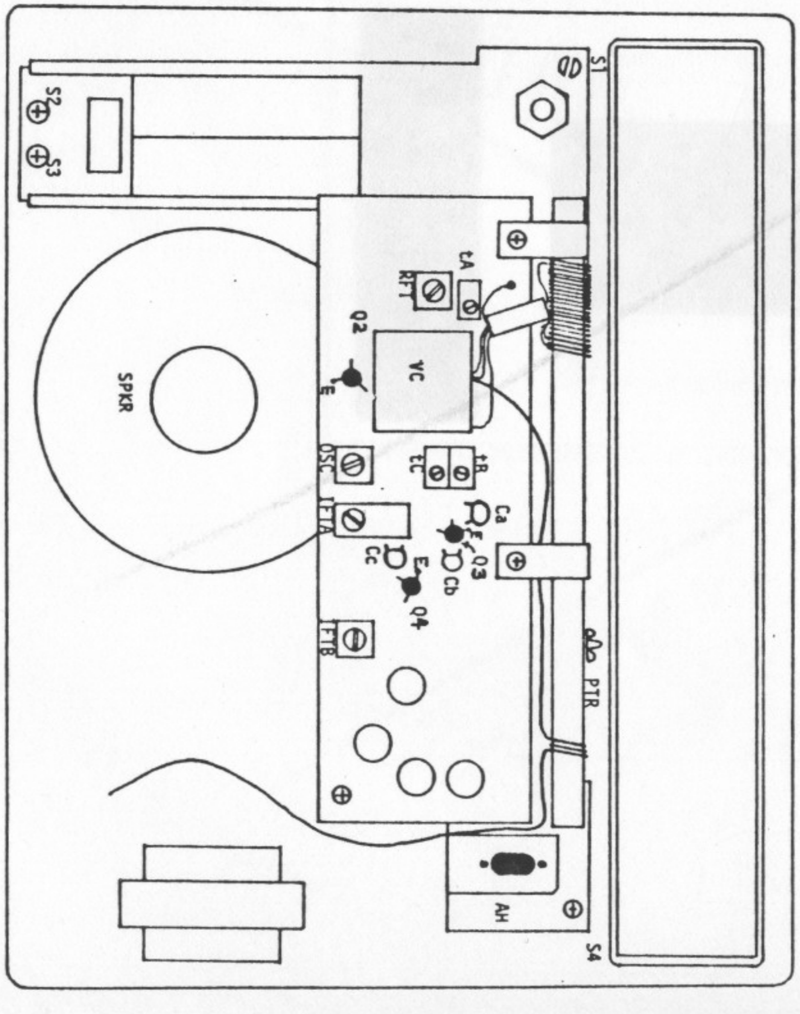


Figure A

II. Alignment by Gerry Thomas

IF Stage

It is unfortunately the case that most consumer-grade radios, especially the portables, come off the assembly line aligned according to a "ball park" criterion. Rare is the off-the-shelf radio that is optimally aligned for DX'ing.

What follows is a procedure for aligning the IF stages of the TRF-655, although the basic procedure would be the same for the TRF-656, the General Electric Superadio, etc. It is assumed that people with the equipment required to align a radio on a test bench are already familiar with alignment procedures. Therefore, the following procedure is written for those who lack the proper equipment and therfore have to align their radios "by ear".

1. Locate weak stations adjacent to stronger stations on the low-end and the high-end of the band. These weak stations should be steady in their signal level, so distant daytime domestics are your best bet.

2. After selecting the two target stations, remove the back of the radio and locate the IF transformer cans on the circuit board. On the TRF-655, these are labelled IFTA and IFTB in Figure A. The circuit boards of the TRF 656 and the GE Superadio have their components labelled (so no figures are provided) but the appropriate designations for the TRF-656 are IFTA, IFTB, and IFTC; for the Superadio they are T4, T5, T6 and T9 (located on the board with the volume and tone controls).

3. Once you've located the appropriate transformers, it's always a good idea to mark the position of the slugs in the can so you will have some idea of how far you've deviated from the factory setting.

4. Either plug in the AC cord or replace the batteries so that you are able to switch on the radio. Try not to touch any metal parts, for safety's sake.

5. Tune to the low-band station you have selected

6. Using a non-conductive alignment tool (available at electronics stores) or, if you must, a conventional screwdriver (don't let the shaft touch the metal of the transformer can!), adjust in turn and in order (alphabetical or numerical, whichever is appropriate) the transformers for optimal reception of the weak station.

Note: Here I'd like to take a minute to discuss the "optimal" setting of the slugs. The standard method for aligning the IF stage of a radio involves tuning the transformer for "peak response." By doing this, one obtains the gain and selectivity the manufacturer has designed into the radio. It is possible, however, to very slightly de-tune (i.e., more loosely couple) the primary and secondary windings of the transformer for, admittedly a sacrifice in gain, but an improvement in selectivity. Note that this de-coupling is slight, a matter of only a couple of degrees of slug rotation from the peak response point. Too much de-coupling results in a radio much more prone to such undesirables as cross-modulation etc. It is tempting to continue de-coupling because the weak station will continue to show less interference from the nearby stronger station, but remember the gain trade-off and the fact that undesirable sede-effects result from excessive de-tuning...find the best compromise point.

7. After one "run through" of transformer alignment, continue repeating the process until no further improvement is noted.

8. Tune to the high-band station and check to see if the setting is optimal. Adjust if necessary, and re-check low-band station.

You should notice, after aligning the IF's properly, a slightly "darker" audio and perhaps a more apparent "shooshing" sound as you tune past a station.

RF Stage

To align the RF stage, tune to a station on 1400 kHz (approximately) and adjust tA (in Figure A) for maximum output. (On the the TRF-656 this trimmer is located in the same place; on the Superadio, adjust C1J and C1K). Then, tune to a station on about 580 kHz and adjust RFT (in Figure A) for maximum output. (On the TRF-656, this transformer is similarly located; on the Superadio, adjust T10 and L6).

III. Improving Frequency Read-out by Gerry Thomas

One of the principal shortcomings of the Realistic TRF is its dial calibration and frequency resolution (or lack thereof). Several possible schemes have been used/suggested to correct this problem and they are described below.

A. Pointer adjustment

Gross calibration errors due to pointer misplacement on the dial string can be readily corrected by removing the back of TRF (see Section I) and re-positioning the pointer. To reposition the pointer simply pry apart the three-pronged grip ("PTR" in Figure A), re-position the pointer for best overall accuracy and re-pinch the prongs. Pry apart the prongs just enough to allow the pointer assembly to slide along the guide; excessive prying can eventually preak the prongs.

This procedure does nothing for frequency resolution but does improve gross calibration. It appears that the overall calibration of the newer TRF-656 is far better and more consistent than that of its predecessor, the TRF-655.

B. Logging scale

The logging scale printed on the face plate of the dial can be used to help determine tuned frequencies although the markings on the TRF-655 are so coarse that this calibrating method is of only limited use (i.e. low band). The scale on the TRF-656 is smoewhat finer, but still less than satisfactory. A far better logging scale can be created by the DXer himself and affixed to the face plate (see below).

C. Calibrated tape

This is by far the simplest procedure of improving the read-out of the TRF. Basically all this involves is affixing to the front of the face of the dial a piece of tape, or a cellophane tape-covered paper strip, which has been custom calibrated by the DXer. By using a fine-tipped pen (e.g. Papermate Ultra-fine Flair, Sanford Expresso etc.) or a razor-sharp pencil, it is possible to tune down the dial at night, when all the channels are filled, and mark channels every 20 kHz apart (10 kHz resolution is attained via interpolation). The dial pointer on the TRF-655 is so broad that it is recommended that its edge be used as the indicator line. The pointer on the TRF-656 is significantly narrower, which obviates this procedure.

D. Custom-calibrated dial face

This technique involves a complete re-working of the dial face and, if properly done, results in an aesthetically appealing, reasonably accurate analog dial. The original procedure was outlined by Gerry Thomas and Charlie Barfield and has since been improved by suggestions from such people as Chris Bobbitt, Brian Sherwood and others. Following is the revised procedure:

1. Remove back of TRF (see Section I)

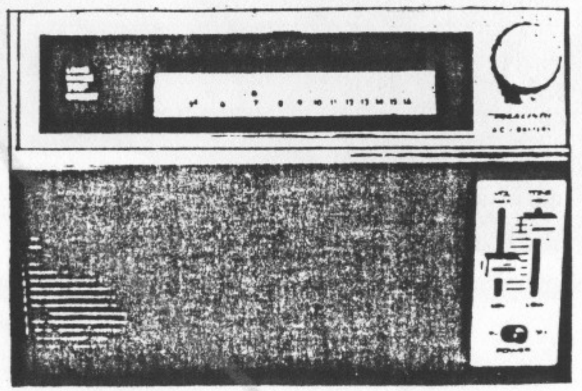
2. Align IF stage (see Section II)--optional, but recommended.

3. Remove face plate--(TRF-655)--Lay the front of the TRF on a book or table top so that the tuning knob overhangs the surface and the face plate frame is flush against the surface. With an unsharpened pencil, the blunt end of which has been wrapped with a handkerchief, a firm downward push on the face plate (through the face plate access hole --labelled "AH" in Figure A) with eraser end will release the glue holding the face plate to the face plate frame. If necessary, after freeing one end of the face plate, take something akin to a popsicle stick, and with it wedged under the face plate, slide it along the edges, releasing the remainder of the glue. On the TRF-656 the face plate access hole does not exist. Therefore, in order to remove the face plate, it is necessary to drill a hole of sufficient diameter to accomodate the pencil shaft. Care must be taken not to scar the face plate when drilling this hole.

4. Prepare custom-calibrated dial--The new dial will be a horizontally-oriented strip of paper measuring about 6-5/8" long by 11/16" wide and positioned under the dial pointer and against the "back wall" of the dial face cavity. The strip of paper should be a fairly high density, medium gloss (to prevent ink feathering) poster board (white or colored) although several different kinds of paper have been reportedly used with success. This strip of paper can be slid under the dial pointer and held in place with pieces of masking tape. Two methods for the calibration of this new dial can be used. The first involves very carefully marking (with a small dot) the position of the selected channels by using a very sharp pencil and the edge of the dial pointer as a guide. The strip is then removed and properly inked. The second procedure involves directly inking the strip while it is mounted in the cabinet. That is, as each channel is carefully zeroed-in, the edge of the existing dial pointer is used as a straight-edge and the frequency marks are drawn in ink. If the latter procedure is chosen, it is helpful to, beforehand, lightly pencil in the proper lengths that the frequency marks should be, otherwise an uneven, saw-tooth effect is achieved. The choice of pen used to ink the frequency marks is very important. The width of the line will largely determine the ultimate resolution of the dial, so the smallest width line (that is visible) is preferred. By far, the best pen for the job is an India ink drafting/mechanical drawing pen (e.g. Rapidograph, Faber-Castill, etc.). These cost between $6 and $10 and are available with hair-width points. That point width found to be most desirable is about .1 to .3 mm. If the expense of this kind of pen is excessive, creditable results can be attained through the use of razor-sharp pencils (the light lines can be difficult to see, however) or some of the new ultra-thin, fiber point pens (e.g. Flair Ultra-fine etc.). The ink width of these pens is in the .3 to .5 mm range when used with light pen pressure and create acceptable results in this dial calibration application.

Whichever marking procedure is chosen, allow the radio to warm up for 20 to 30 minutes and exercise extreme care in zeroing-in the the selected channels. This is especially true when attempting to mark the center of a channel that is adjacent to a strong local. That is, the adjacent channel's center frequency position will appear to be more displaced from the "broad-tuning" local's position than it actually is...correct for this error. To locate the center of any channel, a signal generator with precise frequency read-out is the method of choice, but since few DX'ers possess such equipment, it is necessary to center-tune by ear. Probably the best way to do this is to set the tone control on "high pass" (or maximum treble), tune to a medium strength station on the channel (or null a strong station to medium strength), and rotate the tuning knob back and forth across the station so that the skirts of the receiver's passband can be located (the skirts produce a "shooshing" sound). Assuming that the skirts aren't too asymmetrical, it is then a matter of estimating the midpoint of the skirt "shooshes". A TRF that has been modified for improved selectivity is easier to accurately calibrate--see Section IV.

When marking the center frequency of a channel, it is helpful to keep the angle of the pen constant for all marks and to press the dial pointer (that is being used as a straight-edge) against the back wall or the paper strip so that it doesn't twist or shift. Also, although it is possible to mark every 10 kHz channel, it isn't necessary (and on the high end, it isn't desirable---difficult to read). Try marking every 10 kHz channel up to 700 or 800 kHz, then mark every 20 kHz up to 1600 kHz. This gives you 5 kHz readout on the low end of the band and 10 kHz on the high band. Double and triple check all frequencies for accuracy, then, after marking and inking the selected channels, label them with dry transfer numbers about 1/8" in height. Some Radio Shacks and electronics stores carry Markit Jr. Dri-Transfer Lettering at around $1 a set; office and artist supply stores carry similar lettering at $2 to $5 a sheet. If you want to protect the new dial strip or add some tinting to reduce eye strain, you can apply some dry transfer color shading. This is available at artist/office supply stores under the name Zip-a-Tone for about $2 a sheet. It comes in a multitude of colors but "cool grey" (#2702) and "yellow-green" (#2662) work well as dial scale tints.



5. Replace dial pointer. The pointer on the TRF-655 is far too wide for precise frequency read-out. Snip off the stock point with a pair of wire cutters about 1/8" from the top and glue a new, thinner point to the remaining pointer nub. The new pointer can be a ½" length of #28 to #30 gauge wire, a straight pin, or a map pin with a small ball on the end. Painting the new pointer a fluorescent orange improves visibility. The stock pointer on the newer TRF-656 is far narrower than the pointer on the TRF-655 and may not require replacement.

6. Mount the new dial scale. Coat the back of the dial scale with rubber cement, a clear silicon sealer, or any other easily breakable glue. Tune the TRF to a center-tuned station of known frequency and carefully slide the new scale under the pointer and into position. Remember that the edge of the pointer was used as a reference point so the final dial scale position will not be identical to the calibrating position unless the dial pointer is re-positioned on the dial string. While the adhesive is setting, check the frequencies for accuracy. If the glue sets before the dial can be accurately positioned, either break the glue and try again or, if the error is constant, re-position the dial point on its string (see Part A of this section).

7. Remove markings from dial face plate--Using nail polish remover (or acetone) and Q-tips, swab off the old frequency markings and logging scale from the inside of the face plate. Leave the descriptive labels if you choose. Note: Some TRF's markings come off very easily while other TRF's markings are more difficult...try acetone if conventional nail polish remover fails.

8. Final touches. To cover the old/new pointer connection and "frame" the new dial scale, you might want to mask off (3/4" masking tape is about right) that area of the inside of the dial face plate that corresponds to the dial scale and paint the face plate with 3 to 5 light coats of black spray paint. Remember to position the masking tape about 1/8" above the bottom edge of the stock black border in order to prevent a shadow from being cast on the new scale.

The preceding procedure, though somewhat tedious, can result in a good-looking, easier to use TRF.

E. Oscillator Alignment

After you've improved the frequency read-out of your TRF, you may notice, after a time, that the dial is losing its accuracy. To get the oscillator coil/trimmer re-aligned, follow this procedure:

1. Remove the back of the TRF (see Section I)

2. Locate OSC and tC in Figure A. (On the TRF-656 circuit board these are labelled "OSC COIL" and "(trimmer) C3"; on the Superadio, "L5" and "C1L".)

3. Tune to 1600 kHz and adjust tC (TRF 656..."trimmer C3"; Superadio "C1L") for maximum output. Make sure a station assigned to 1600 kHz shows at this position.

4. Tune to 540 kHz and adjust OSC can ("OSC COIL" on the TRF-656; "L5" on the Superadio) for maximum output. Again make sure that the station heard is assigned to 540 kHz.

5. Repeat steps 3 and 4 until set will tune accurately from end to end.

F. Crystal Calibrators

Crystal calibrators are described elsewhere in this manual so they won't be discussed here. Suffice it to say that some BCB DXers prefer this method of determining tuned frequencies of the TRF.

G. Digital Frequency Read-outs

The ultimate in accurate frequency determination is the digital frequency counter. Such a device can be hooked up to the local oscillator of the TRF and frequency measurements made. Digital frequency counters are described elsewhere in this manual, so this section will be limited to a counter's use with a TRF. The following procedure comes from Mark Connelly:

There have been numerous articles about re-drawing the dial scale of the Realistic TRF to enhance frequency readout accuracy. It seems to me that using a frequency counter (now available for $100 or less) is a better method, as any DXer with even a moderate interest in electronics should have a counter in the shack. The easiest method for measuring the received frequency is to put the counter on the local oscillator (L.O.) signal in the receiver. The frequency of the L.O. is the frequency of the station received plus the intermediate frequency (455 kHz for the TRF). Therefore, if you are tuned to 1030 kHz, the L.O. will be operating at 1485 kHz and so on. Some counters made specifically for SWL/Ham use automatically subtract the IF from the L.O. frequency, thus enabling direct readout of received frequency.

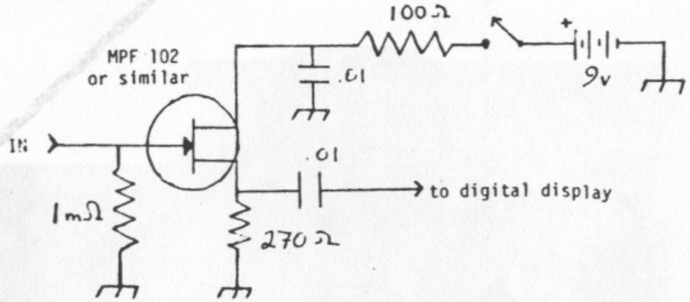
To connect the counter to the L.O. of the TRF, mount two screw terminals on the back cover of the TRF. To one terminal, bring a ground lead; this is wired from the lower minus battery terminal. The L.O. signal can be obtained by the following procedure: Using figure A as a guide, locate transistor Q2. Strip 1/8" of insulation from one end of a piece of thin stranded hook-up wire. Tin this with solder, then solder it quickly to the transistor lead "E". This is the emitter of the converter transistor. Bring the other end of this lead to the second screw terminal you have mounted on the back cover. The signal level from this terminal to ground is about 300 millivolts peak-to-peak RF riding on a +0.6 volt DC level. This should be enough to drive most counters; if it is not adequate for a particular counter, a small battery-powered RF pre-amplifier can be built inside of a shielded box to be installed in a coaxial line between the TRF and counter. The counter should be used for spotting a frequency or for a quick measurement; it shouldn't be permanently tied in to the receiver as it will couple in considerable levels of noise.

Further thoughts on digital readout for the TRF

I used Mark's idea to connect a Radio West DD-2-S display (455 kHz offset) to my TRF, using a shielded cable, and noticed a number of birdies across the dial. The same thing happened with my Heath IM-4100 counter. Switching off either display didn't seem to help much, but disconnecting the line to the counters did. Rather than use the screw terminals that Mark did, I used an RCA phono jack. If you must disconnect the counter, the RCA jack is faster. The DD-2-S LEDs emit noise if the TRF internal loop is too close to them, but this noise did not come into the TRF via the connecting cable. The tuning of the TRF shifts badly at the top end of the band when the counter is disconnected, thus destroying any advantage of using the counter at the top end of the band.

The problem was nearly solved by putting a 130 pF (value approximate) capacitor between the emitter of Q2 and the line to the display. This capacitor cuts the output voltage considerably, but it was still enough to drive the DD-2-S and the IM-4100 at its most sensitive. A few weak birdies were still apparent at the top end of the band however, and a 5 kHz shift in tuning was noted if the counter was disconnected with the the TRF at a high-band station.

A buffer amplifier between the L.O. of the TRF and the display solves the problems. No noise is coupled into the radio using the circuit below, and it can be placed in a metal mini-box in the shielded line between the TRF and the display. Some amplification is provided, but the circuit's main use is its isolation properties. Disconnecting the display/buffer amp causes little noticeable shift in the TRF's tuning if the buffer is close to the TRF. A .01 uF capacitor can be used between the L.O. and this amp rather than the 130 pF one. ---NHP



IV. Improving Selectivity by Gerry Thomas

For a $30 radio, the Realistic TRF possesses quite good selectivity. However, significant improvements in the characteristics of the IF passband can be realized by incorporating a few, relatively simple, changes.

A. Alignment

Careful alignment of the IF section should be the first step in your quest for improved TRF performance. Rare is the off-the-shelf TRF that can not be improved by IF alignment. The apparent differences that one sees between stock TRF's (differences, by the way, that can be enormous) are largely due to differences in IF transformer efficiency. See Section II for IF alignment.

B. Transfilters

This is a relatively well-known technique for improving the shape of the IF passband and details for performing this modification have appeared in both the DX Monitor (2/24/79) and DX News (3/3/80).

While the claims of improvement by satisfied users are almost universally enthusiastic, the effectiveness of this transfilter technique may have been overstated by some. You will notice an audible difference in the selectivity of the TRF, a difference that represents a definite improvement but one that falls somewhat short of "overwhelming". Nonetheless, considering the cost involved (about $5) and the effort, the modification is definitely worthwhile. Following are the details of this modification:

1. Remove back of TRF (see Section I)

2. Locate ceramic disc capacitors labelled "Ca" and Cc" in Figure A. (On the TRF-656, these are labelled C11 and C15 on the circuit board.)

3. Snip off (with wire cutters or such) the ceramic part of each capacitor, leaving the leads (the longer, the better) protruding from the top of the board.

4. Solder the transfilter leads to the protruding capacitor leads (polarity not important). Note: Use a low wattage soldering iron (e.g. pencil type) and do not excessively heat the leads because OVERHEATING CAN CAUSE COMPONENT DAMAGE. Because working space is

a little cramped (making heat sinking difficult), the easiest thing to do is to abandon good soldering technique just this once and apply a drop of solder to each transfilter lead, then briefly heat the solder while the transfilter leads are touching the protruding circuit board leads.

5. Replace back of TRF.

The two transfilters required for this modification are available from either of the following sources:

Gilfer Associates, Inc.---Transfilter type BFB455D; $2 each. Inquire about the better quality BFU-455-K2 transfilters

Radio West--Transfilter type TF-01A; 2 for $5

C. Regeneration by Mark Connelly

Regeneration is intentional RF feedback utilized to increase selectivity. For example, suppose a station of 548 kHz is causing a 2 kHz heterodyne of the 550 kHz channel but, because it is 15 dB lower in level than the station of 550 kHz, it is being swamped and is inaudible. Using a regeneration technique, it may be possible to "perk up" the selectivity of the TRF sufficiently to get audio on 548 kHz. Here's how:

1. Remove back of TRF (see Section I)
2. Locate pin "E" of the transistor labelled Q4 in Figure A
3. Solder the tinned lead of a length of #26 stranded wire to pin "E" (solder quickly with a low-wattage iron...excessive heating can cause damage)
4. Run the other end of the wire to a terminal that has been mounted on the back half of the TRF cabinet.
5. Install a second terminal on the back of the TRF and solder one lead of a .01 uF capacitor to the terminal and the other lead of the capacitor to the yellow external antenna jack wire.
6. Remove the black external antenna jack wire that runs to the variable capacitor (VC)
7. Replace back of TRF
8. Attach a 2 kilohm potentiometer across the two terminals.

Operation:

Tune the TRF to a split frequency station and slowly adjust the potentiometer setting until squealing or "motor-boating" occurs. Back off (i.e. increase resistance) the potentiometer setting slightly and improved selectivity should be the result. Optimal selectivity for a given frequency will be attained if trimmer tB (in Figure A) can also be adjusted. This however, requires drilling a hole in the back of the TRF to allow access to the trimmer with an adjustment tool.

If the the 2 k potentiometer is too difficult to fine tune, try a 1 kilohm or lower value. If "squealing" cannot be stopped with the 2 k resistance, try a 10 kilohm potentiometer.

D. IF Bandpass Filters by Gerry Thomas

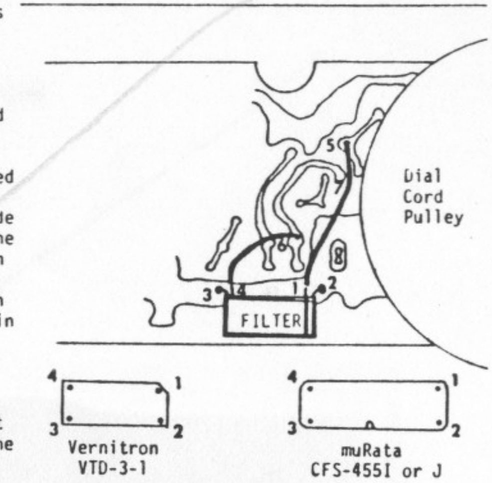
These devices, at the present time, represent the ultimate method of improving selectivity in the TRF. Although bandpass filters can be of the ceramic, mechanical, or crystal types, the procedure described below incorporates the ceramic, primarily because of its ease of installation and relative economy. Narrower bandpass filters with steeper skirts are available but these types of filters would probably represent a degree of "overkill". To properly realize the benefits of an excellent mechanical filter in the TRF, for example, it would be necessary to mount the filter and matching network on a separate board away from the main circuit board to reduce leakage across the input and output points. It would also be advised to add another stage of IF amplification to offset the insertion loss of the filter. While all of this is well within the realm of technical possibility, the wisdom of installing a $60-$100 mechanical filter in a $30 radio must be considered. The procedure described below uses ceramic filters in the $30 price range (which is still a little high), but the results are such that the cost seems warranted.

The filter called for in this modification can be any of the following: the Vernitron VTD-3-1 (4 kHz at -6 dB; 10 kHz at -60 dB) available from Radio West; the muRata CFS-455I (4 kHz at -6 dB; 10 kHz at -60 dB) or the muRata CFS-455J (3 kHz at -6 dB; 9 kHz at -70 dB) available from muRata. The muRata filters can be ordered directly from muRata but there is a minimum order of $100, so banding together for a club purchase would be necessary. Gilfer is now making available to U.S. residents its modification kit for the FRG-7 which uses the muRata filters; write them for a quote on the 4 kHz or 3 kHz filter. The Vernitron filter is the same one Radio West uses in its modified FRG-7's and FRG-7000's where Collins mechanical filters are not required.

The installation of one of the preceding filters is quite straightforward largely because they all require input and output impedances of 1 to 2 kilohms which is the characteristic on either side of the capacitor coupling the TRF's two IF stages. So installing the filter simply involves substituting for capacitor C15 on the TRF-655. This technique has not yet been tried on the newer TRF-656...watch the IRCA Technical Column for further information.

1. Remove back of TRF (see Section I)
2. Locate capacitor C15 (labelled Cb in Figure A.
3. Remove circuit board to allow access to the underside. Remove screws S1, S2, S3, and S4 (see Figure A) and use a thin blade screwdriver to pry prongs holding dial point (PTR) to dial string. Peg the dial pointer at either the high or low end of the band before removing the pointer); pull off tuning, tone, and volume control knobs. The circuit board can now be tilted away.
4. Locate solder points on the underside of the circuit board that correspond to the leads of C15. These are points 5 and 7 in Figure B at right.
5. Grasp the body of capacitor C15 with pliers and, while heating leads 5 and 7 (in turn) with a low wattage soldering iron, lift and remove C15.
6. Solder a length of wire (preferably shielded, e.g. RG-174U, but unshielded leads seem to work just fine) to the input pole of the filter (point 1) and solder the other end to point 5 on the circuit board.
7. Take another length of wire and solder one end to the output pole of the filter (point 4) and the other end to point 6 on the circuit board.
8. Solder poles 2 and 3 of the filter (and the ground tab of the filter can too, if you are using a muRata filter) to the ground of the circuit board as illustrated in the figure.
9. The filter should be mounted so that it is lying on its side on the underside of the circuit board, as shown in the figure.
10. Replace the circuit board, the dial pointer assembly, and the back of the TRF.

Figure B---underside of TRF circuit board



1 = Input pole
2 = Ground pole
3 = Ground pole
4 = Output pole

5 = Output of 1st IF
6 = Input of 2nd IF
7 = C15 lead
Connections = 5 to 1; 4 to 6

You should now notice a tremendous improvement in selectivity in the TRF. Because the impedance match is so close, insertion loss is close to specifications and additional IF amplification was judged to not be needed. The slight drop in gain is especially unimportant if you are using a Radio West Shotgun or an efficiently coupled external antenna.

It is definitely possible to mount a switch on the TRF so that a choice between stock and improved selectivity can be made and this has been done with a muRata filter. However, when it was tried with the Vernitron, a slight re-tuning of the frequency was required when switching back and forth. Whether this was due to some oddity in the Vernitron sample tried or is symptomatic of the brand/model isn't known.

V. External Antenna Connections for the TRF

The TRF-655 has an external antenna input jack, but it is of little use. By hooking the center conductor of the coax lead from an amplified loop to the "ground" side of the external antenna jack, one can get a good deal of boost in signal strength on the TRF when the loop is peaked. A longwire can also be connected to the "ground" side of the external antenna jack, but preferably through a tuner to avoid overload. Another possibility for coupling a longwire into the TRF is outlined on page 49 of this manual.

An improved antenna connector for the TRF by Mark Connelly

There seems to be a desire among many DXers to make their Realistic TRF's compatible with loops and external wire aerials. I have arrived at a solution which works well for me. Remove back of TRF and observe the inside of the back cover piece. Drill two holes adjacent to the external antenna jack and put two screws through the case. Remove the black lead that runs from VC (Figure A) to the external antenna jack. On the inside at one screw install a spade lug with a wire soldered to it; solder the other end of the wire to the black ground lead on the side of the earphone jack. This is "real ground"--

it can also be obtained from the low side speaker lead or from the lower minus battery terminal. One lead from a .01 uF capacitor should be soldered to a spade lug on the other screw (inside back); the other capacitor lead should go to the yellow lead connection at the external antenna jack. Note that the yellow lead is that which is wrapped a few turns around the ferrite rod inside the TRF. The capacitor isolates the radio and the loop amplifier from any DC.

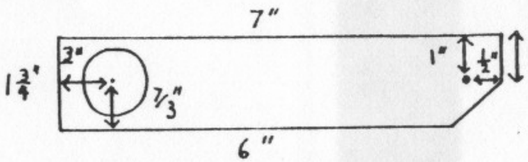
Connect the loop to the "high" and "ground" terminals just installed; adjust the loop tuning capacitor for peak signal strength on a weak station. If feedback or regeneration occurs with an amplified loop, first move the loop away from the TRF, at least two feet. If the loop has been moved the greatest practical distance away and regeneration is still a problem, add a potentiometer in series between the loop high lead and the corresponding TRF screw terminal input. Adjust the resistance to the point at which regeneration stops and a good signal results.

Connecting a longwire directly to the "high" antenna input may cause overloading and "spurs" at urban locations. Try a simple tank circuit with a standard BCB variable capacitor (365 pF) in series with a ferrite loopstick; this should be inserted between the wire aerial and the TRF "high" input screw. The ground terminal may be connected to a good ground or to a second aerial, tuned or untuned. Or, try the loopstick and capacitor described above connected in parallel from antenna to ground across the terminals.

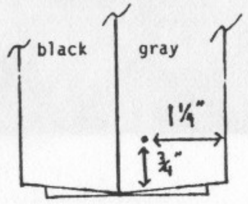
THE "PI-BAR" COUPLER

The Radio West "Shotgun" loop antenna (see review p. 59) has a clip for connecting an external antenna, but unless it's a very short antenna, the radio that the Shotgun is attached to will often overload. On the Realistic TRF, it is possible to create a "pi-bar" so that the Shotgun can be swung away from the TRF; it can then be used as a longwire coupler without overloading the radio.

Cut two pieces of ½" thick plywood 7' x 1 3/4". Drill a 13/64" hole at one end of each piece, and a 1" hole at the other, according to the diagram below. Cut one corner off each piece of plywood as indicated.



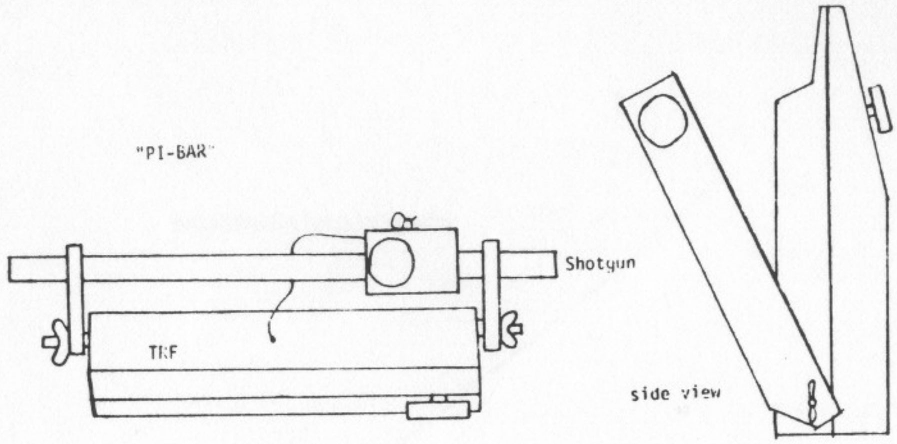
side view of TRF



hole is 13/64"

Unscrew the gray back half of the TRF and drill a 13/64" hole in each side according to the diagram. Be careful you drill clear of the battery holder. Put a 1" x 3/16" stove bolt through each hole with the head of the bolt inside the TRF case. Secure each bolt tightly with a suitable nut. Disconnect the black wire from the external antenna jack and run it out through a hole in the TRF case near the top. Put the TRF together again, and slide the plywood pieces onto each end of the Shotgun, using the 1" holes. Now mount the plywood pieces onto the stove bolts which are poking out from each side of the TRF; the cut corners on the plywood pieces should be towards the back of the radio. Put a washer on each bolt followed by a suitable wingnut. Let the assembly slide back so that the Shotgun is resting as far back as it will go, and solder the black wire running from the radio to the black wire from the Shotgun. If you want, glue the Shotgun to the plywood pieces using "silicone seal" or a similar product. Connect a longwire to the clip on the Shotgun and peak for the best signal, swing the Shotgun up towards the radio until overloading is noticed, swing it back slightly and tighten the wingnuts. In some positions, the "pi-bar" will overbalance so that the radio will tip back to rest on the assembly.

The Shotgun can still be used on its own of course, and can be swung up against the handle of the radio for carrying. Those with an inventive turn of mind could place a ½" inside diameter piece of PVC pipe in a similar assembly, put a ½" diameter ferrite rod (125 permeability from Amidon Associates) inside, wind an appropriate coil outside the pipe, and resonate it with a 365 pF variable capacitor, with a connector for the external antenna. This would save investing in a Shotgun, if all you wanted was an antenna coupler with a swing-away facility. (NHP)



top view

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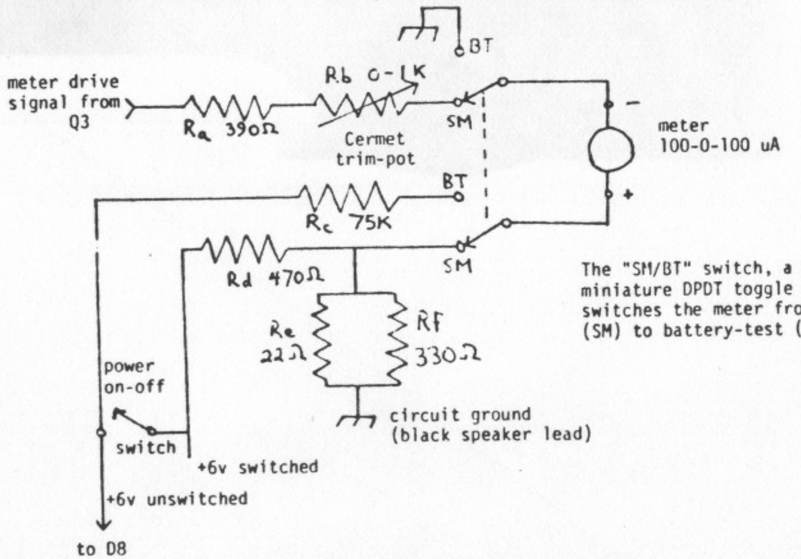
VI. An S-Meter for the Realistic TRF / an initial attempt by Mark Connelly

A signal-strength meter (S-meter) has many useful properties to the DXer. It may be used to compare levels of groundwave stations, to observe fade characteristics of skip signals, to analyse sub-audible heterodynes (SAH's), and to accurately peak or null a station.

I had a zero-centre "AM-FM Tuning Meter" scavenged from an old Sharp multiband portable lying around in my "junk box". Its small size made it a "natural" for use on the Realistic TRF. The meter movement is -100 microamp for a full-scale-left deflection and +100 microamp for a full-scale-right deflection.

To obtain a voltage which varies with signal strength, I tapped the transistor lead shown in Figure A as pin "E" of Q3. The meter-drive-signal measures approximately +0.5 volts for zero signal and about +0.2 volts for full-scale signal (a strong local). After some experimentation, I came up with the scheme shown below:



The "SM/BT" switch, a micro-miniature DPDT toggle type, switches the meter from S-meter (SM) to battery-test (BT) mode.

The trim-pot is used to adjust for a full-scale-left deflection on the meter with zero-signal received. Tuning the receiver above 1600 kHz will provide a nearly zero signal level under most conditions.

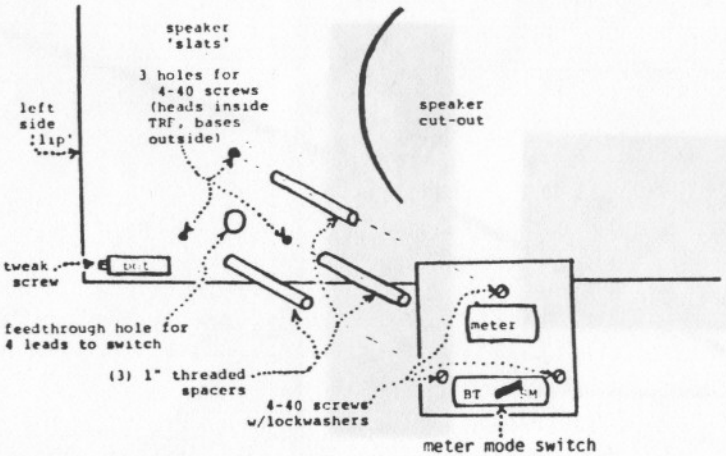
R_d sets the full-scale-right deflection. I found that 470Ω will yield a 3/4 scale deflection on a strong local. 430Ω may be used if you want a more "generous" meter reading. Alternately, you can keep R_d 470Ω and increase the value of R_f (nominally 330Ω) which shunts R_e (22Ω). The receiver's operation will be adversely affected if you use an R_3 value much less than 390 Ω.

In the "BT" mode, the battery voltage is read whether or not the receiver is turned on. A good set of batteries will provide about a 3/4 scale (right) meter deflection; full-scale-right is 7.5 volts in this mode. A useful battery check is to monitor the battery voltage under unloaded (TRF off), lightly-loaded (TRF on, but volume down), and fully-loaded (TRF on, volume high) conditions. A centre-reading in the battery-test mode indicates zero volts: batteries are either dead or not installed. A left deflection would indicate that the batteries have been installed backwards. With the TRF plugged into mains, the AC to DC power supply takes over; a nearly-full-scale-right meter should be observed as the power-supply DC output is about +7.3 v (loaded)

Mechanical assembly:

Fixed resistors were mounted inside the TRF. The 0-1 k Cermet/Bournes type trim-pot was mounted on the lower left corner of the front of the receiver (see below). Trim-pot leads were fed directly through small holes drilled in the cabinet. A few drops of rubber-cement ("RTV") were applied with a cotton-swab to secure the pot.

The meter and the switch were mounted on a 1 - 5/8" by 1 - 5/8" square piece of epoxy-glass (G-10) printed circuit board stock. This assembly was then attached to the left-front side (above, and somewhat to the right of, the trim-pot) by using three 1" long threaded metal standoff spacers and 4-40 hardware (screws, lockwashers). The 4 leads to the switch from inside the TRF were fed through a hole drilled in the front grille. This hole should be fitted with a rubber grommet to reduce wear on the insulation on the four lead wires. The figure below gives an overview of the exterior mechanical assembly:



Concluding comments:

I have found that the S-meter is particularly useful in nulling and peaking applications; the meter shows changes in signal strength much more readily than audio output does.

My S-meter/battery-meter project was an unsophisticated first stab at this idea. Others will undoubtedly come forward with considerable refinements and improvements. As years have passed with no significant articles about S-meters for the TRF, I felt that the least I could do was to get the ball rolling.

An active meter-drive circuit with an operational-amplifier chip was contemplated, but I opted for a simpler approach which all DXers could implement. Others are hereby encouraged to write of their designs using meters of different movements (such as 0-1 ma, 0-100 ua etc.). A design utilising a linear LED level meter similar to those on some modern cassette decks and stereo receivers would be of interest to many. Also desirable: S-meter circuits for the GE Superadio.

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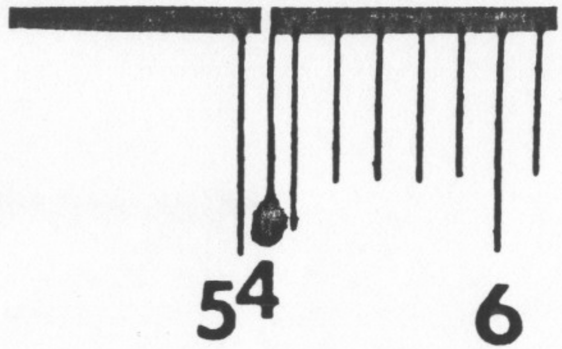
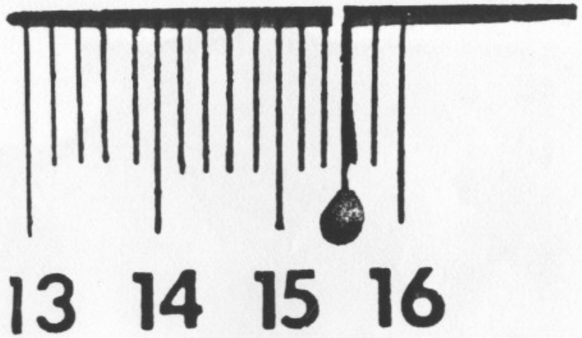
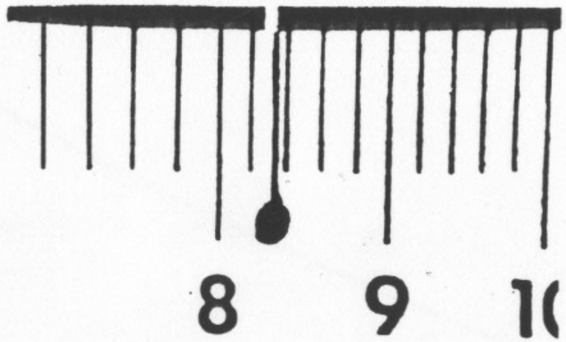


R. JUMBO, DOMINICA — 545 KHZ



R. CAYMAN, CAYMAN ISLANDS - 1555 KHZ



R. BELIZE, BELIZE - 834 KHZ