Mega-Loopstick Transplants

Portable DX Sensitivity On Demand

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Most AM-DX enthusiasts started their lifelong radio fascination as kids with transistor portables, thrilling to the reception of distant stations on radios powered by tiny loopstick antennas. As our fascination deepened, many of us eagerly sought out the best DX portables, and made the obvious discovery that the most effective DX portables had longer loopstick antennas, generally around 6" or 7" long. We discovered that serious DX required a seriously long loopstick, at least in the decades of the 60's and 70's, when most of us became confirmed AM-DXers. We purchased and compared our Realistic TRF's, Superradios, ICF-S5W's and RF-2200's, and enjoyed the start of a lifelong hobby.

My own experience was typical, settling on the ICF-2010 as my favorite DX portable, content that its generous 6.25" loopstick (and sensitive circuitry) was giving me the best in portable AM-DX. But then late last year, I accidentally stumbled upon an amazing radio with a very tiny loopstick, which had DX performance seemingly impossible for its size. The discovery was not only destined to start the explosive interest in pocket radio ("Ultralight") DXing, but was also going to set in motion a fascinating series of large loopstick transplant experiments, with the potential to make any medium-wave portable a sensitivity superstar.

The Sony SRF-59 Walkman has only a miniscule 1.75" loopstick antenna, but its innovative CXA1129 chip gives the tiny radio superb sensitivity, adequate to receive multiple TP contacts in stock form. The author was astonished at this capability, which opened up a fascinating question… how would this CXA1129 chip perform with a serious, mega-sized DX antenna? With competitive sensitivity, selectivity and image rejection already engineered into this incredible IC chip, why not transplant a generous loopstick of proven DX performance directly into the SRF-59's circuitry, and see if this revolutionary CXA1129 "radio on a chip" could compete in sensitivity with classic DX portables such as the ICF-2010, E1 and ICF-S5W? Although I knew absolutely nothing about loopstick transplants, I was determined to learn all I could, and find out the answer to my question!

Loopstick Transplant Theory Like most AM-DXers, I had many misconceptions about loopsticks, which could only be corrected by actual failures in experimentation.. A long loopstick, in itself, is no guarantee of DX sensitivity. Winding fixed coils on a ferrite bar, even with an LCR meter, will almost never provide optimum sensitivity for a loopstick. And finally, without a careful alignment of both the 600 kHz (on the loopstick) and 1400 kHz (on the radio's tuner) peak adjustments, the transplant is probably doomed to mediocrity. Education in these simple concepts came the hard way—by botched experiments.

To ensure success in any loopstick transplant, a hobbyist must use an LCR meter to measure and record the inductances across all the windings on the radio's stock loopstick, observe and record all the connections between the stock loopstick and the radio, and create a longer but electrically identical "copy" of the stock loopstick, with at least one movable coil to obtain the perfect match of the total inductance of the stock loopstick (during the alignment process). Once these simple precautions are taken, loopstick transplants become very routine, and the hobbyist can essentially "order up" as much DX sensitivity as he desires, in any portable radio design he wishes to "supercharge." Is this concept really so easy and exciting? The answer is an emphatic "Yes!"

SRF-39FP—the "DXer" version of the SRF-59

Original plans to modify an SRF-59 were quickly superceded after receiving an SRF-39FP "Prison Radio" from Kevin Schanilec.
This CXA1129-possessing model is identical to the SRF-59 in schematic circuitry, but has four supreme advantages over its analog sibling: a much larger tuning thumbwheel, a very convenient mounting slot for a large antenna-securing post, slightly superior sensitivity, and slightly superior audio quality (presumably due to different RF and AF components).

Early Transplant Experiments Provide Significant Sensitivity Boosts In an early February experiment documented in an article posted on dxer.ca., a 6.25" loopstick from an ICF-S5 was successfully transplanted into the SRF-39FP by surgically altering the coils to resemble those of the tiny stock loopstick. Although this model was constructed without using an LCR meter, by pure luck the transplant managed to work with moderate effectiveness, simply because the total inductance (after alignment) barely matched the total inductance across the original stock coils. The inductance ratios between the coils were less than optimum (resulting in less than optimum sensitivity) , but this model did have definite alignment peaks (at 600 and 1400 kHz), and provided sensitivity superior to the ICF-2010 on the lower frequencies (although not on all frequencies).

Following up on the SRF-39FP success, two 6.25" loopsticks were successfully transplanted into a couple of Sangean DT-200VX digital Ultralight radios. Again without the benefit of an LCR meter, recycled ICF-S5 coils were doctored to resemble the stock "piggyback" coil orientation, and again by pure luck, the alignment process enabled the transplants to work with moderate effectiveness (by matching the total inductance of the stock coils). This points up the fact that the 600 kHz alignment process is critically important, to the extent that its proper performance can often "bail out" an experimenter who has carelessly constructed a large loopstick without using an LCR meter!

LCR Meter Makes Loopstick Transplants Routine After a couple of experimental duds convinced the overconfident transplant "surgeon" that he was indeed all too capable of miserable failure, a high quality BK Precision model 875B LCR meter was purchased from

Mouser Electronics (for about $190.00). From that point on, not only were failures a thing of the past, but every loopstick could be created with complete accuracy, to ensure maximum sensitivity in every project. The seven-step plan for absolute success is:

1) Observe and record the number and orientation of the stock loopstick coils (i.e. tapped, piggyback, etc.), and alignment system. These will all be duplicated in the new loopstick.
2) Disconnect the stock loopstick from the radio, observing and recording all connections..
3) Measure and record the stock coil inductances across all windings, as well as total inductance.
4) Collect all material required for transplant loopstick, including an extremely long ferrite bar!
5) Using either recycled or newly-wound coils (on movable forms!), create a loopstick with coil orientation and inductances identical to the stock loopstick. Use an LCR meter to adjust inductances on the new coils, and secure these new coils temporarily with tape.
6) Connect the new loopstick to the radio, carefully observing the connections recorded in step 2.
7) Align the new loopstick by sliding the coil(s) along the long ferrite bar to peak a low band (usually 600 kHz) weak signal. Secure the coil(s) in this position with tape. Align the high band by adjusting the radio's appropriate trimmer capacitor to peak a 1400 kHz (or thereabouts) weak signal. Repeat these alignment steps until no further improvement is noted, then secure the new loopstick's coils with wax, or small spots of woodworking glue. .

New SRF-39FP Transplants Provide Astonishing Sensitivity

The use of an accurate LCR meter made loopstick experimentation quick, accurate, and exciting. The first project was to repeat the earlier 6.25" transplant into the SRF-39FP, this time using coils with optimum inductances measured on the LCR meter. This transplant provided a huge boost in performance over the previous model, and after alignment, enabled the sensitivity of the tiny "Super Prison Radio" to

edge out the classic ICF-2010 on all frequencies (although the 2010 retained a large advantage in selectivity and spurious rejection). This "SPR2" model was constructed of both an ICF-S5 recycled 6.25" loopstick, and also a 7" antenna from the Channel Master "Super Fringe" 8-transistor model (more later, under "Construction Sources").

A carefully constructed "SPR2" with full alignment should be more than competitive in sensitivity with the ICF-2010 on all frequencies. However, this does NOT mean that it will exceed the ICF-2010 in total DX performance. The 2010 has superior selectivity, SSB capability (extremely important for 9 kHz split reception, and checking carriers), a synch function, etc. My own experience has been that the SPR2 can outperform the 2010 whenever a DX signal is completely isolated from adjacent QRM-- a situation which is actually not so common in TP-DXing. Fortunately, the SPR2 has enough nulling ability to give it a fighting chance at TP's even when adjacent domestic QRM is present, such as the 972-HLCA and 828-JOBB receptions here on the west coast, only 2kHz away from domestics.

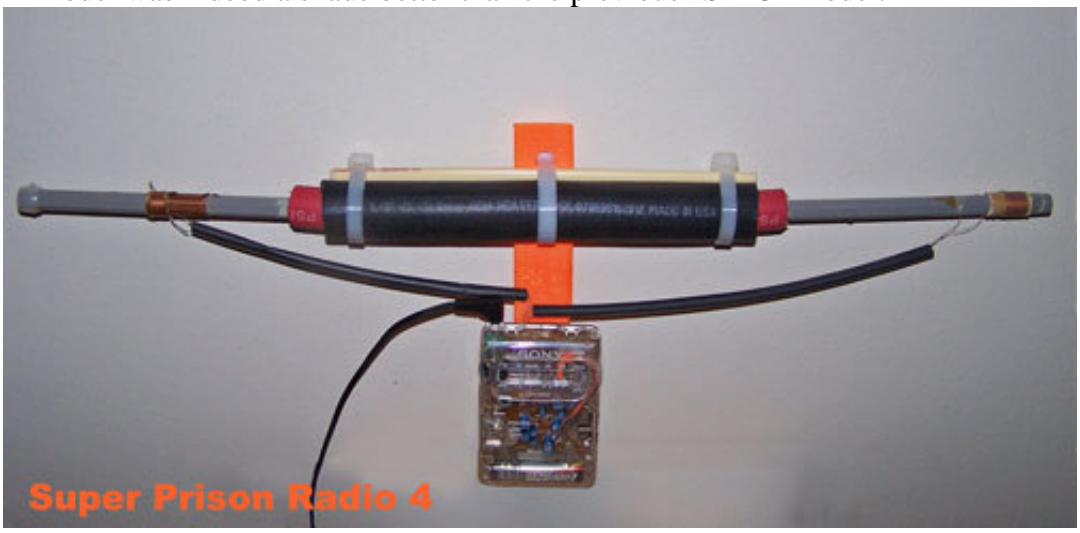
First 14" Composite Ferrite Bar Transplant—the "SPR3" After the above SRF-39FP 6.25" and 7" transplant models were tested in actual TP-DXing and found to be highly sensitive, the obvious decision was to create and evaluate a 14" model. Two 7" loopsticks from the "Channel Master Super Fringe" were tightly taped together with heavy-duty wrapping tape, then reinforced at the center with thick rubber air hose. The existing coils on one of the "Super Fringe" loopsticks were found to be almost identical in inductance to the SRF-39's larger stock coil (including even the tap), which made the entire process an easy half-day job. The only difference in aligning a composite loopstick like this is that the optimum inductance of the smaller (alignment) coil is always different than on a single-bar model, and the trick is to create two new coils that match the total inductance across the two stock coils together (a process that will compensate for inductance losses across the tiny air gap between the two ferrite bars).

The sensitivity performance of the "SPR3" really starts to pull away from the ICF-2010, to the extent that mp3 comparisons are striking. The ICF-S5W (the most sensitive stock portable here) can stay pretty close to the SPR3 on the lower frequencies, but cannot equal its sensitivity performance. During actual TP DXing, the SPR3 was receiving audio from the TP carriers well before the ICF-2010, so

that the 2010 was no longer useful as a "spotting receiver." In fact, on the open (QRM-free) frequencies, the SPR3 was acting like a "spotting receiver" for the classic ICF-2010!

Again, this does not imply that the SPR3 exceeds the 2010 in total DX capability. Extreme sensitivity in a portable makes everything much stronger—DX, locals, and any spurs or images. Fortunately, the SRF-39FP (and SRF-59) has a relatively high stock resistance to spurs, and immunity from AM-band images. But the few spurs that do exist are stronger, and the huge increase in the locals' strength has a slightly detrimental effect on the apparent selectivity of the transplant units. However, in a moderate-RF environment such as the author's suburban location, neither of these issues significantly detract from the SPR3's overall DX capability. For urban DXers, they may be of more concern.

The Fanatical Final Loopstick—a 20.25" Monster! The 14" model had already fulfilled the experimental dream of creating an SRF-39FP antenna which could exceed any stock portable in sensitivity, but since adequate material was still available to create an even larger model, the opportunity was irresistible. Using two "Channel Master" 7" loopsticks and one 6.25" ICF-S5 blank ferrite bar in the middle, a huge 20.25" composite loopstick was created with generous amounts of heavy-duty wrapping tape and two different types of reinforcing rubber air hose. Since ferrite is actually a quite brittle material (as anyone who has accidentally dropped a bar will confirm), ensuring the mechanical security of this huge loopstick was far more challenging than optimizing DX performance. As a composite bar, the alignment was a routine repeat of the 14" loopstick experience, and the final sensitivity of this "SPR4" model was indeed a shade better than the previous "SPR3" model.



Unfortunately, the extreme sensitivity of this monster model was not handled well by its first recipient, and overloading occurred next to strong locals. Substituting a different SRF-39FP solved most of the problem, which points out another discovery of the transplant experimentation: not all CXA1129 chips are created equal. Some handle the challenge of extreme RF levels better than others, and whereas some will perform well even at the 14" and 20" antenna levels, others may not. At the stock level, they all perform equally well, but the extreme RF levels delivered by a 14" or 20" loopstick are far from the normal design parameters, and some chips handle the challenge better than others.

After replacement of the SRF-39FP "host," however, the 20.25" transplant model has performed like a DXer's dream. Ultra-sensitive but with a very quiet noise floor, it has a slight but definite edge over the "SPR3," and pretty much runs wild over the ICF-2010 in sensitivity. Created only a week ago, it missed out on the best of the recent "spring season" TP propagation, but often can produce weak audio on TP's that the 2010 receives only as carriers. It will indeed be fascinating to use this monster DX chaser in the fall season, and take it to Grayland for the ultimate in Ultralight DXing excitement!

Construction Sources Despite the common complaint that long ferrite bars are unavailable, this author has discovered that at least in the USA, the internet auctioneer eBay is literally awash with vintage portables possessing very long and effective loopsticks… for extremely low prices. As an example, to provide loopsticks for the described experimentation, a total of seven "Channel Master Super Fringe" (Model 6515) portables were purchased via eBay in February, for the average price of $12.00. Not only do these models have an extremely effective 7-inch loopstick (visible in the photos with a gray vinyl covering), but they also have pre-wound coils (both fixed and movable) that almost exactly match the inductance of the stock SRF-39FP large coil, making the job of the transplant hobbyist much easier. 6.25" ferrite bars may be obtained from many Sony vintage portables, such as the 6R-33, TR-6400, etc. Panasonic and Sanyo also have similar vintage portables common on eBay, typically for very low prices. Most of these vintage portables are inoperable, which may help to reduce hobbyists' psychological reluctance to remove the long loopsticks.

Construction Techniques The hobbyist has a choice of winding new coils with Litz wire on homemade movable forms, or using recycled coils on forms provided on the vintage loopsticks. All of the described models were quickly constructed by using recycled coils on

movable forms, with inductances adjusted by removing turns as necessary. It was truly a great shortcut to success, with the vintage loopsticks even providing a generous amount of wax to secure the finished coils. The use of recycled materials, especially from the "Channel Master Super Fringe" vintage portables, made the creation of the 7" transplant units essentially a 2 hour job.

Specific construction techniques for each of the previously described models will soon be available on request, after detailed instruction files are written. Detailed instructions have purposely been avoided in this general article, but it is the author's sincere hope that many readers will personally discover the excitement and enjoyment of loopstick transplants, and accomplish a huge increase in the sensitivity of their SRF-39/59 units.

Loopstick Transplant Science—Not Limited to Ultralight Radios! For those of us long committed to MW DXing with truly portable radios, the next phase of Transplant Science seems obvious: my ICF-2010 will shortly receive a huge loopstick transplant ~~here~~, which should enable this classic receiver to be truly "supercharged" for portable TP-DXing. It should also restore its ability to act as a "spotting receiver" for the 14" and 20" SRF-39FP transplant models, which currently are running wild over it in sensitivity :>) The ICF-S5W has also been one of my favorite portables, and is deserving of a huge loopstick, as time allows.

The Exciting Future Ultra-sensitivity is exciting, but it is only one component of overall DX performance. The ultimate challenge is to create a hot-rodded portable with both great sensitivity AND selectivity. The huge loopsticks have solved the sensitivity challenge, and by themselves, they enable the SRF-39FP's to outperform any stock portable on QRM-free frequencies. But actual DXing is rarely so ideal, and meeting the selectivity challenge (especially for the CXA1129 units with their unusual IF) will require innovation. The DT-200VX digital units (with an IF of 450 kHz) and the Eton E100 units (455 kHz) can both be modified with commercially available narrow filters, which they certainly will need, when subjected to the overwhelming RF levels of a 14" or 20" loopstick.

One final word of caution: Any design defects existing in a portable before a huge antenna transplant will be greatly magnified by the transplant. The ICF-2010's tendency to have spurious signals 25 kHz above and below strong locals will be much more obnoxious (there is a cure for this). The ICF-S5W's image reception problem will assume nuclear proportions (there is no cure for this). The reason why the SRF-39FP and DT-200VX ultralights were chosen for transplants was because of their resistance to RF defects in stock form. Before choosing a portable to "supercharge," make sure that your portable has similar well-behaved stock performance.

My own experimental vision is to create an extremely effective portable DX chaser, completely self-contained, that can provide thrilling reception of TP's should I accidentally be near the ocean around sunrise. Perhaps the current group of hot-rodded Ultralights are "halfway there." But there are still about four months before the fall DX season begins, and Ultralight tinkerers are already making great discoveries. Collectively, we have the potential to make pocket radios extremely effective, both in sensitivity and selectivity. Hopefully, this article will inspire others to experiment, and really enjoy the exciting future that Ultralight radios have brought to the AM-DX hobby.

73 and Good DX to All,
Gary DeBock