Assembly and Assessment of a SAGA ST-10 Guitar Kit

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The aim of this project is simple to state: build or repair a guitar. The original thought was to assemble a guitar from disparate parts fabricated in the lab, obtained online, from dealers, or salvaged from broken instruments. As an alternative, I considered purchasing either a guitar that was broken, but not beyond repair, or a functional one used or of low quality, and then repairing and upgrading it with better components. It quickly became apparent that obtaining all the necessary components separately would be prohibitively expensive, due largely to shipping costs. An additional concern was the risk of obtaining incompatible parts, primarily the body and neck. It would be difficult to ensure a proper match without obtaining parts from exactly the same model, which voids the purpose and advantages of scavenging for the parts piecemeal. Building the parts in the lab was also an unreasonable approach; given my mediocre woodworking skills and the extreme precision necessary on tasks such as fret placement and neck aligning. In addition, there was never any intention of assembling electronic components, such as the pickups, from scratch.

The next approach was to seek broken or undesirable guitars, and upgrade one into a quality instrument. Unfortunately, broken guitars are not readily available, and even the cheapest hand-me-down guitars cost too much, considering that many of the parts were to be replaced regardless. After several weeks of struggling with the above possibilities for procuring a guitar to work on, attention turned to finding a kit to assemble from. At first this seemed like a bit of a cheat- the parts were already fabricated and were sure to be compatible. All that would be required would be assembly and some cosmetic adjustments. After a bit of introspection, I realized this is what I was looking for but had no hope of finding in the parts bucket, scrap heap, or a pawnshop. The project then shifted to finding an inexpensive kit, and upgrading components as deemed necessary. After searching and comparing available kits, one was purchased through an online supplier. This kit was an obvious mimic of Fender's famous Stratocaster line produced by an obscure company called SAGA.

Fig. 1. The SAGA ST-10 kit. Not mine. Note the unshaped headstock and the pre-assembled pick guard with electronics.

The kit (fig. 1) arrived and assembly began. Though most of the mechanical elements of the guitar needed assembly, the electronics were, by and large, already arranged and soldered to the back of the pick guard, which cut the assembly time significantly. The neck was also mostly prefabricated, the frets spaced and set and the truss rod adjusted by professional hands, which are tasks that I could not do with reasonable quality in a reasonable time frame. That aside, the guitar came together over the course of two weeks, despite vague instructions in which all screws looked the same, be they the 2-inch neck bolts, or the ½-inch screw to hold the string tree in place. This inevitably led to some mistakes, which were corrected by those more knowledgeable of guitar anatomy. Nearly every pre-drilled hole in the body and neck was slightly misaligned, but not so badly that components couldn't be coerced into place. This was somewhat disturbing in the case of the neck bolts that remain at about 10° off perpendicular, though the neck and body appear well joined. This initial assembly proceeded quickly, in order to assess the quality of the guitar and its components and determine what (if any) parts needed to be replaced or upgraded. The guitar was strung and the tension on the tremolo was adjusted to attain a middle action on the strings. The string tree was added after drilling the missing pilot hole. I also swapped the extra string tree in my kit for spare screws from another kit being assembled in the class (fortuitously for both of us). This went to replace a screw on one of the tuning pegs that had stripped during assembly and was useless. Despite these minor fabrication errors, mediocre instructions and screws, and less than perfect part allocation, the end result (fig. 2) unquestionably exceeded our expectations. After adjustment and tuning, the ST-10 had "a pleasant tone and a good feel" according to several experienced players in the lab, which seem to be the case to my trained ears if not under my untrained hands.

Fig. 2. The SAGA ST-10 fully assembled with the headstock carved, fresh coat of polish, just restrung.

At this point, about half the course remained, and it appeared that my augmentation scheme would not be necessary, or even helpful. Aside from some cosmetic issues and the addition of a protective coating, the guitar was complete. New paths of exploration became available- a variety of assessments of the acoustic and electronic character of the guitar. Since an extensive database of electronic data on various pickups had been compiled over time, it seemed reasonable to make similar measurements on a pickup from the SAGA and compare it to various other brands and models. This had the added advantage of allowing work to proceed on the body and neck while a pickup was being assessed. The guitar was unstrung and disassembled and the pick guard assembly was taken off.

The headstock came in a blocky form, allowing the assembler to choose the shape and style of this feature. I chose to mimic the curl of an old ('54) Fender Stratocaster that was in the lab for assessment, seeing this as the noblest lineage my pseudo-strat could aspire to. After tracing the classic guitar's headstock and transferring this outline to my uncarved block, I attempted several means of cutting the headstock. Fearing coarse electric saws would damage the wood, I used a coping saw, which progressed very slowly, overheated often, and bound easily in the hard maple of the headstock, but eventually succeeded in hacking out the rough shape desired. Sanding followed, from initial coarse work, down to final touch-up with ultra-fine 1500-grit.

The body and neck (but not the fretboard) had been pre-coated with a thin clear coat to avoid damaging the wood with finger oils and so forth, but the manual (and my compatriots in the class) suggested a more permanent finish be placed on the wood to protect it and give it more style. Also note that in carving the headstock I had just opened a large hole in the initial protective layer. I elected to preserve the natural color and grain of the wood and thus chose an acrylic clear coat to spray on the body and neck, with the fretboard masked off. To ensure a high quality coating, the wood was wiped clean with reagent grade isopropanol and the coat was left to dry for over a week undisturbed in a low dust environment. This produced an even coat that I buffed with a wax polish to get a final dull sheen on the body and neck. I unmasked the fretboard and worked special fretboard oil into it to protect from damage by my skin oils or other incidental exposures. Giving this a day to dry, the guitar body was finished and reassembly quickly followed, as the semester was winding down.

While this finish work was proceeding, assessments were made of all three pickups. This was done while they were still attached to the pick guard. The magnetic cores of the middle pickup (which I give as an example) had a South polarity, as normal for a stratocaster-style guitar, with the bridge and neck pickups being North. The resistance (5.1 kΩ) and the inductance (3.1 H at 120Hz, 3.42 H at 1 kHz) were measured. The field strength of each ceramic core in the pickup was mapped, with maxima in the 330-375 Gauss range. The other two pickups had similar values for all these data. The interesting thing about these values is that they resemble the '54 Fender strat's pickups more than any other pickup in the database, including modern "vintage style" Fender strats. By way of comparison, the '54 strat's bridge pickup has a resistance of 5.36 kΩ and field strengths of 290-485 Gauss. One pickup off of the 2002 Fender strat has a resistance of 5.91 kΩ and fields in the 1035-1280 Gauss range. A Seymor Duncan pickup fashioned from the classic Alnico-2 magnetic alloy had a resistance of 6.45 kΩ and fields of 560-715 Gauss, despite being an attempt to mimic the vintage components. It was certainly unexpected to find that pickups from an inexpensive kit guitar from a virtually unknown brand would match the profile of a vintage pickup so well, and is almost certainly happenstance, although these values were roughly the same for all three pickups on both of the SAGA guitar assembled during this course. It is thought that the pickup from the ’54 Fender has cores made from the Alnico-1 alloy giving it relatively low field strength, but this does not explain the SAGA pickups which are clearly have modern ceramic magnets as cores.

Because the values for the SAGA and ’54 Fender align so well, a similarity is present in a plot of their impedance measured as a function of frequency (fig. 3, 4 respectively). The “calculated” curve is used as a guide, and several parameters are adjusted to conform the “measured” curve to its shape and maximum point, but not necessarily its values. Graphs should be compared based on the “measured” curves, as these represent the data, while the “calculated” curves are a shaping tool. Compare also to the curves for the 2002 Fender and the Seymor Duncan pickup (fig. 5, 6 respectively). However, note that the frequency of the highest impedance varies most widely between the ST-10 and the ’54 Fender, whereas the 2002 Fender is nearly the same as the ’54 and the Seymor Duncan pickup is closer than the SAGA, at least. So, for all the coincidences between the ’54 Fender and the SAGA pickups, they are not identical.

In the end analysis, however, it is the sound of the pickup, not its physical characteristics that matter. These are certainly related, but it is rarely as simple as “a lower field sounds better” or “impedance peak at 7 kHz has a singing tone,” but is rather a combination of many small traits and personal preferences. These data are all interesting, and surprising, even, but you really just have to trust your ears. All in all, I’m content with what I hear from this newly built guitar. Now I just need to learn to play…

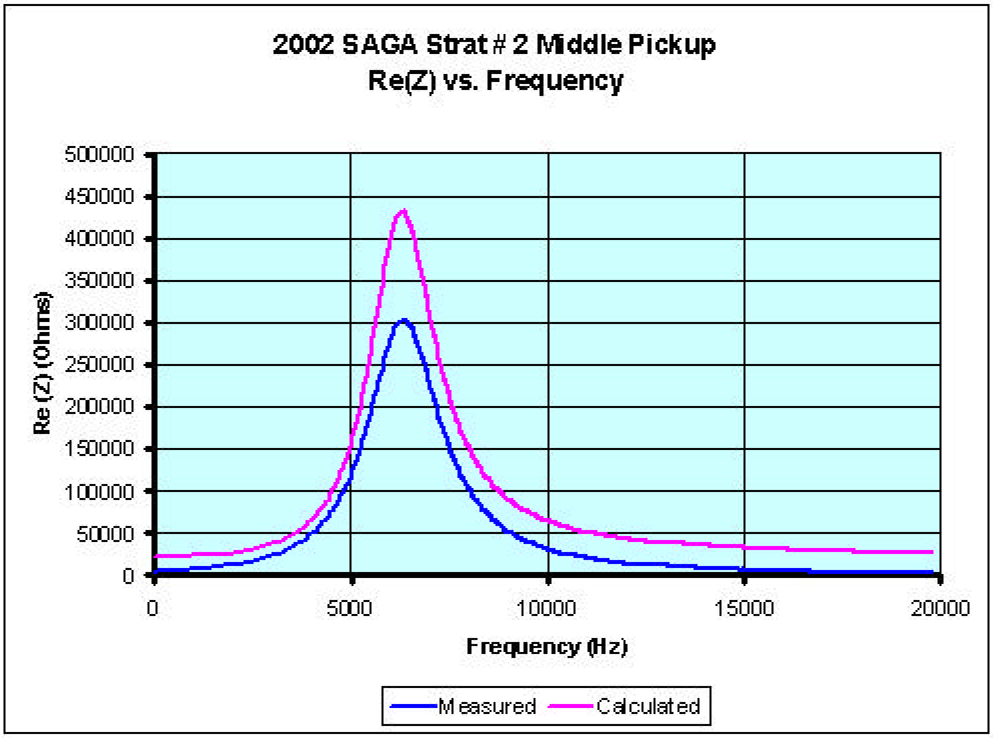

Fig. 3. Impedance response vs. frequency for SAGA ST-10. Notice the rounded peak and the value of the "measured" maximum.

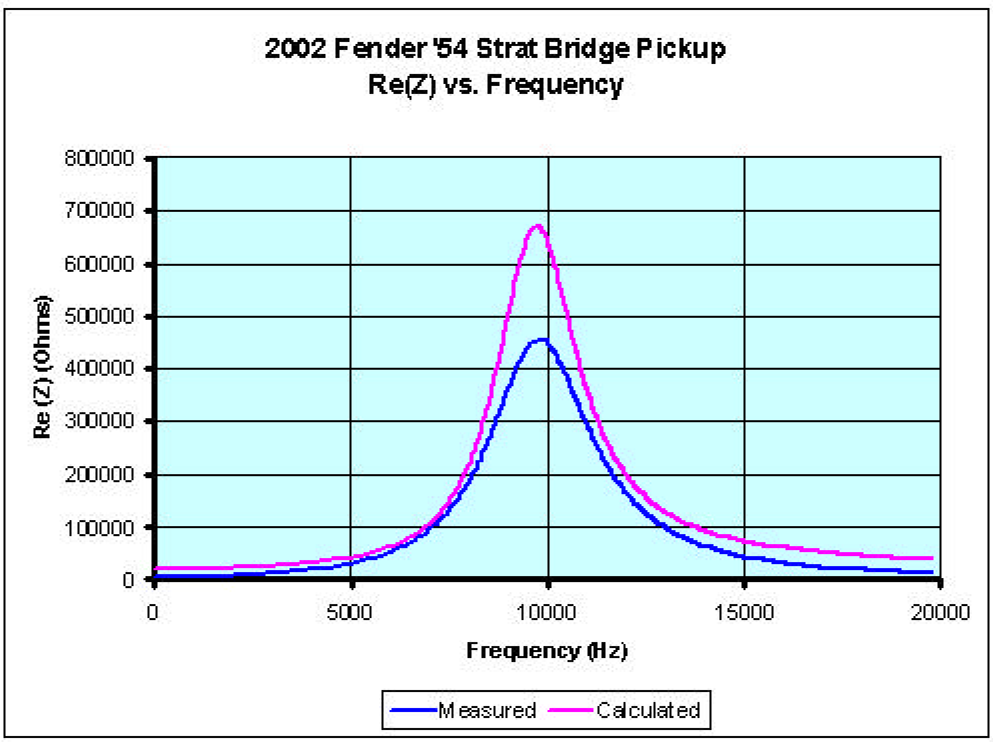

Fig. 4. Impedance response vs. frequency for '54 Fender Stratocaster. Notice similar peak shape to ST-10 and maximum value.

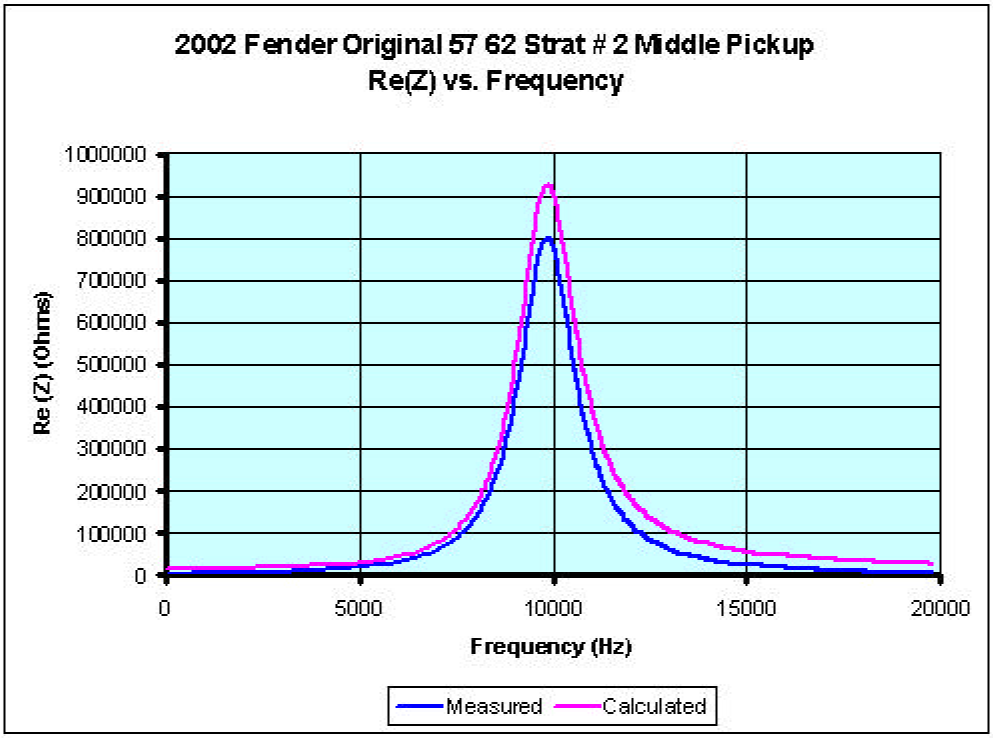

Fig. 5. Impedance response vs. frequency for 2002 Fender Stratocaster. Note relatively sharp peak shape and significantly higher maximum value, as compares to ST-10 and '54 strat.

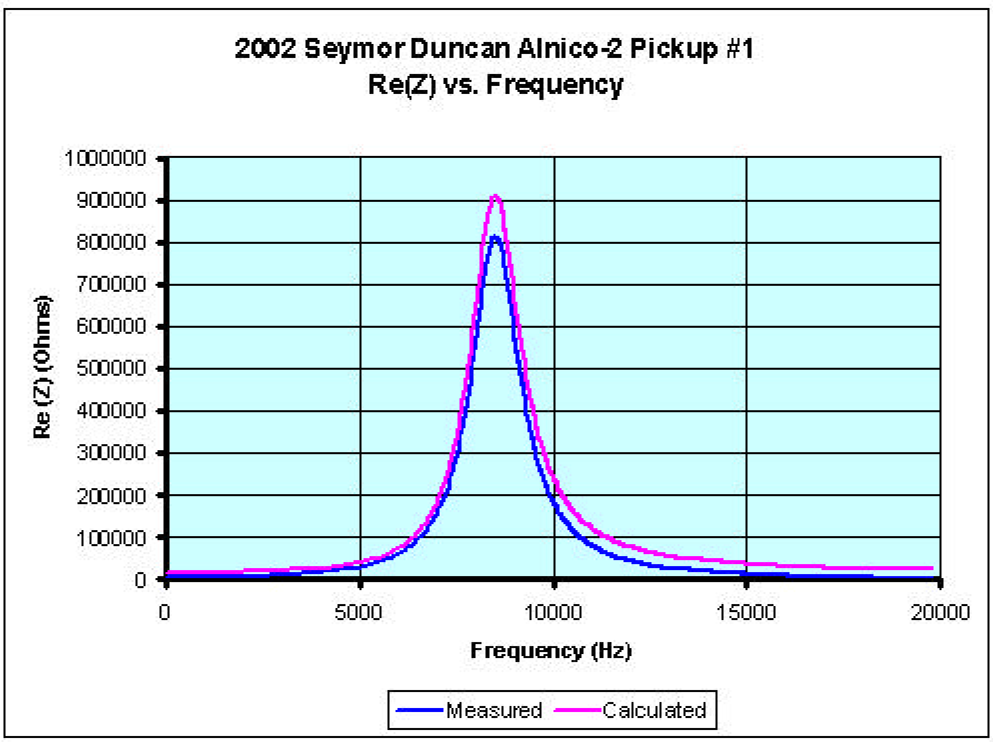

Fig. 6. Impedance response vs. frequency for 2002 Seymor Duncan Alnico-2 pickup. Note again the relatively sharp peak shape and significantly higher maximum value.