Ameritron AL-811H Tuning

from Bill Wortman, N6MW on January 12, 2008
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Ameritron Al-811H Tuning for Power/Dissipation/Linearity, and More Generally 811A Tube Amps in Grounded Grid

Part I - Tuning Info Available

Having recently gotten a used AL-811H and put 4 new tubes from Ameritron into it, I ventured out on to the eHam site, AMPS reflector and other web postings and documents to see if the operation instructions provided in the manual might be made a little clearer and to avoid possible smoke-producing events.

The first part here is taken from the preponderance of various available opinions, some in mutual contradiction, so any corrections on my filtering would be appreciated.

Background

There are a number of commercial 811A GG amps out there as well as a number of homebrew construction articles and reviews. (These amps and tubes are very well tested, if not of very modern design - the standard RCA 811A data sheets dated 1949 can be found on the web.) In addition there are several articles about tuning of amps in general, much of which appears to apply to 811A units.

The commercial and homebrew 811A amps out there have some variations that can provide some differences in detailed quoted performance parameters (drive power, plate current, grid current, power out (or power input from older times), tuning methods). These variations include tuned input circuit (allowing less drive), grid bias (if any), power supply loaded voltage and power supply stiffness/capacity. Commercial units include 4 tube Heath Warrior HA-10, Collins 30L-1, Gonset SB-201 (3340 models with 811As) and the Ameritron AL-811H (and 3 tube AL-811). The HB units include the DX-811A (CQ Magazine 1982, a very elegant piece of engineering), “A Compact High Power Linear”(QST June 1961), a 2 tube unit “A Table-Top Half KW” (QST Jan 1980 and a 1 tube unit “An 811-A 200-Watt G-G Linear Amp” apparently from an ARRL handbook.

Tuning Up - Conventional Wisdom

Here is a weaving of (my interpretation of) standard recommendations for tuning:

Set Load and Plate (called Tune for some amps) controls to designer nominal values, or better yet your experience-determined values, for the frequency

Apply low drive power (~ 20w) and quickly tune the Plate for a dip in plate current (some say tune for a peak in power out)

Then alternate between Load and Plate control adjustments to get max power out

Plate and, especially, grid current should be well below rated values. High grid currents (and resulting grid heating) can quickly destroy the grid.

Now increase drive power and repeat avoiding excessive key down time

Stop when you reach design rated power, OR design/rated plate current, OR design/rated grid current, OR when power increases become small (which one seems to depend on who you ask).

Then you are usually instructed to “make loading a little bit heavier” or words to that effect. This is done by moving the Load capacitor control toward a smaller capacitance (which is a higher indicated panel number for AL-811H by clockwise rotation - not necessarily true for all amps), this decreases both the power and the grid current a bit. Exactly how much to increase the loading is often not specified clearly, but apparently at least enough to make a detectable reduction in power on the meter.

You may now transmit CW or SSB

TUNING UP - Observations on Conventional Wisdom

The rotation points in the Plate control setting, which provide 1) a dip in plate current and 2) the max power out, are not quite the same. The difference in dial setting between them is small but the difference in more important ways can be large. (For example, I tuned up my amp for a particular condition and got 485 w out - then changed only the Plate control a small amount (to lower numerical setting) to get a plate current dip. This sent the power down to 350 w with only a 525ma to 500 ma reduction in plate current and the grid current from 90ma to 70ma. The performance is very sensitive to the Plate setting compared to the Load setting. The plate current dip may not be pronounced at operational settings.) You probably never want to used the dip point for operation but it does provide a starting point for the Load/Plate back and forth steps. This last point may be considered as obvious for the expert but instructions (e.g., “tune for maximum smoke”) are often not very explicit.

The step of increasing the loading at the end is said to get better linearity for SSB operation. This is not only not required but probably not desirable for CW or other modes that do not need linearity. More later on linearity/dissipation issues.

Some recommend that you do the final driver power tuning with a drive level such that the power/current rating is maxed out or even somewhat exceeded (but briefly), and then finally back off drive to recommended maximum or desired output level at the end for operation, leaving the Plate/Load settings unchanged. This is said to provide some “headroom” for SSB peaks that are higher than the constant amplitude used for tuning, for linearity. (It is not assured that this max amplitude difference is true for all drivers but is appears to be for a Kenwood TS-570, for which the peak SSB amplitude is about 10% higher than CW on my scope, implying about a 20% peak power difference.)

So it appears that both the power reduction at the end and the heavier loading at the end are directed at the same goal - linearity. Some recommend doing both things (e.g., http://www.w8ji.com/loading_amplifier.htm). Others go with just one of them and some for neither.

It is pretty much universally pointed out that you should never retune for maximum power as the last step after reducing the drive power at the end. The reason for this is often not made clear but it will defeat the plan to provide linearity for SSB operation. Again, this is likely not correct for modes without linearity concerns including CW, RTTY and FM.

Tuning Targets for the Al-811H and Other 811A Units

Here is a collection of different 811A AMP's typical operation parameters gathered from the web, manuals, …, and using appropriate multiplication factors to convert to 4 tube equivalent when required for 2 cases (except for the AL-811 at bottom, 3 tubes, where power supply limitations seem important). The last row provides rating from 811A tube spec sheets, values are X4 where appropriate.

Amp	Drive watts	I plate ma	I grid ma	Power Out watts (unless otherwise indicated)	RTTY Power/Current recommend
AL-811H manual	65	625 (here I find Vload~ 1450 v)	150-175	800SSB 600CW 400 watts continuous for hour	400ma plate/120ma grid max implies ~ 400 watts out
AL-811H eham article 15783 comment by WA4DOU 20m results	45	610 (implied by input power)	125	590 CW best case	<350 w with reduced drive on 20/40 only (dissipation issue)
30L-1	70	600-700	na	1000SSB PEP IN	DO NOT USE FOR RTTY

manual			(no meter)	1000CW IN	
Gonset 201 manual	100	600	na (no meter)	1500SSBPEP IN 1000CW IN	750w RTTY IN
Heath Warrior	50-75	660ma max	140 ma max	1000SSB IN 1000CW IN	650W RTTY IN
HB DX-811A	60-80	750	120	1000IN	No info
HB Compact HP Linear	~ 50	500+	100+	875IN?	No info
HB A Table-Top Half KW (X2)	<100	700	120	1000 IN	No info
HB An 811-A 200-Watt G-G Linear Amp (X4)	60	640	108	800 IN	No info
AL-811 ARRL Review ***(3 tube version only, values in table NOT X4/3 here)***	57	590	118	550CW(max) (This required 125 watts /tube dissipation in ARRL tests)	Reduced power generally recommend 400w/360ma gets acceptable dissipation (54w/tube) for to RTTY duty cycle level
811A Tube Rating (X4) at 1500V class AB2 (-4.5 V bias)	32	700ma max/ 628ma typical	200ma max/ 80ma typical	640w OUT typical 940 w IN max	65 w (RCA) or 60 w (newer) dissipation max per tube ICAS

Table 1. 811A and Amps Information.

Useful info from WA4DOU indicates that good operating conditions are a bit over 600 ma plate and 120 ma grid thus providing 86w/tube peak dissipation (20m). Since the tubes are rated at 65w/tube for ICAS (or maybe 60w for new tubes), this would allow a duty cycle of 75% (provided the on times, some say, does not exceed ~15 seconds based on the thermal capacity of the plate) which is good for CW and SSB. It is not so good for RTTY.

Worse yet, the resting plate current will be on during key-up times between characters on CW and between words on SSB. This means that you are dissipating ~ 200 watts, or 50w/tube, during these times so it is questionable, for running near max power, whether even low duty cycles will avoid problems, unless perhaps you are running QSK with full break-in in such a way as to kill the resting current between symbols.

All told, the Ameritron-specified parameters seem pretty close to typical but may push into the high concern region for frequent new tube purchase. It is unclear how you can tune for 600W CW and then have 800W PEP SSB output - but there does seem to be a bit of additional PEP available since the duty cycle of SSB is typically given as < 35%. However, it has also been suggested that going to the limit with this unit may push the power supply (said to be the same as that for the 3 tube version) to transformer overheating levels.

For the AL-811H, and AL-811, most (non-Ameritron marketing) folks recommend that you do not run at maximum power possible due to the fact that you may be pushing the tube/power supply ratings for these units.

Part II - Actual Data for an AL-811H and Implications for Tuning, Dissipation and RTTY Use

The following information comes from data taking by the tuning of one particular AL-811H under different conditions.

Maximum Power Output Tuning at Different Drive Levels with Increasing Drive

Following the steps laid out before, the 811H was tuned for max power out for a set of driver powers (rather than absolute max power out). The results (with no additional loading after tuning) are provided in the following plot showing power out, plate current and grid current for indicated driver levels from 10 to 70 watts. For reference here, resting zero drive plate current is about 140 ma for this amp (resting grid current is zero).

By way of apology, the measured power values are subject to prior century Radio Shack technology uncertainties and might be taken with at least a grain of salt, but the trends should be fine. Power reported for the driver is taken as gospel from the TS-570 power setting readout and the wattmeter values were then scaled to this readout - this is based on past experience made with better controls - but it is poorly calibrated. These measurements were all done for 15 meters into a less than ideal load but with a smallish VSWR. The uncalibrated raw meter-indicated values run on average ~15% below the indicated TS-570 digital readout for the particular load used. This R/S wattmeter has been found to provide raw results that vary significantly with load impedance (not surprising). It appears that the raw values are probably low for this particular case, perhaps ~15%. When looking at dissipation later, where absolute power is important, it looks like the driver level recalibrated meter powers do tend to fall pretty well in line with expectations - still, don't take the absolute powers quoted here too literally.

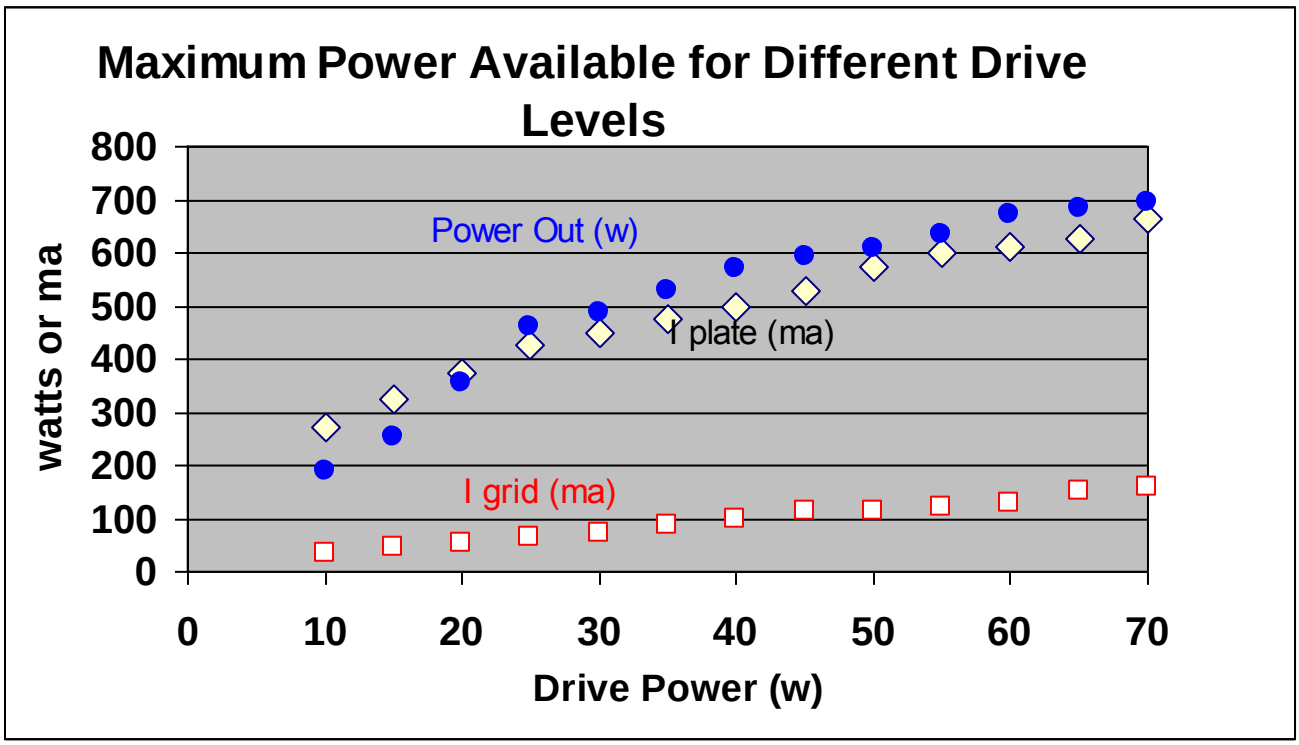

Figure 1. Maximum power out available for different drive powers (constant key down).

Some points might be noted here:

Power out, plate and grid currents all increase pretty much as expected with increasing drive power.

Grid current and plate current are roughly in proportion, at least for higher drive levels. (This is sometimes pointed out as some rough indication of linearity)

Amplification (power out/drive power) falls off with increasing drive level and is about X10 at the largest drive.

Maximum power out (without significantly exceeding current ratings) approaches 700 watts at 70 watts drive. For this condition Iplate is ~ 665ma and Igrid is ~ 160ma. Both these values are probably higher than you want to use for the 811H. At a more sustainable level, Iplate is ~ 575ma and Igrid is ~ 105ma the power out is ~ 600 watts for 50 watts of drive.

These results seem largely in line with typical values in the earlier table.

The Load and Plate dial settings for the AL-811H for max power out for the same set of driver powers is provided in the a separate plot below.

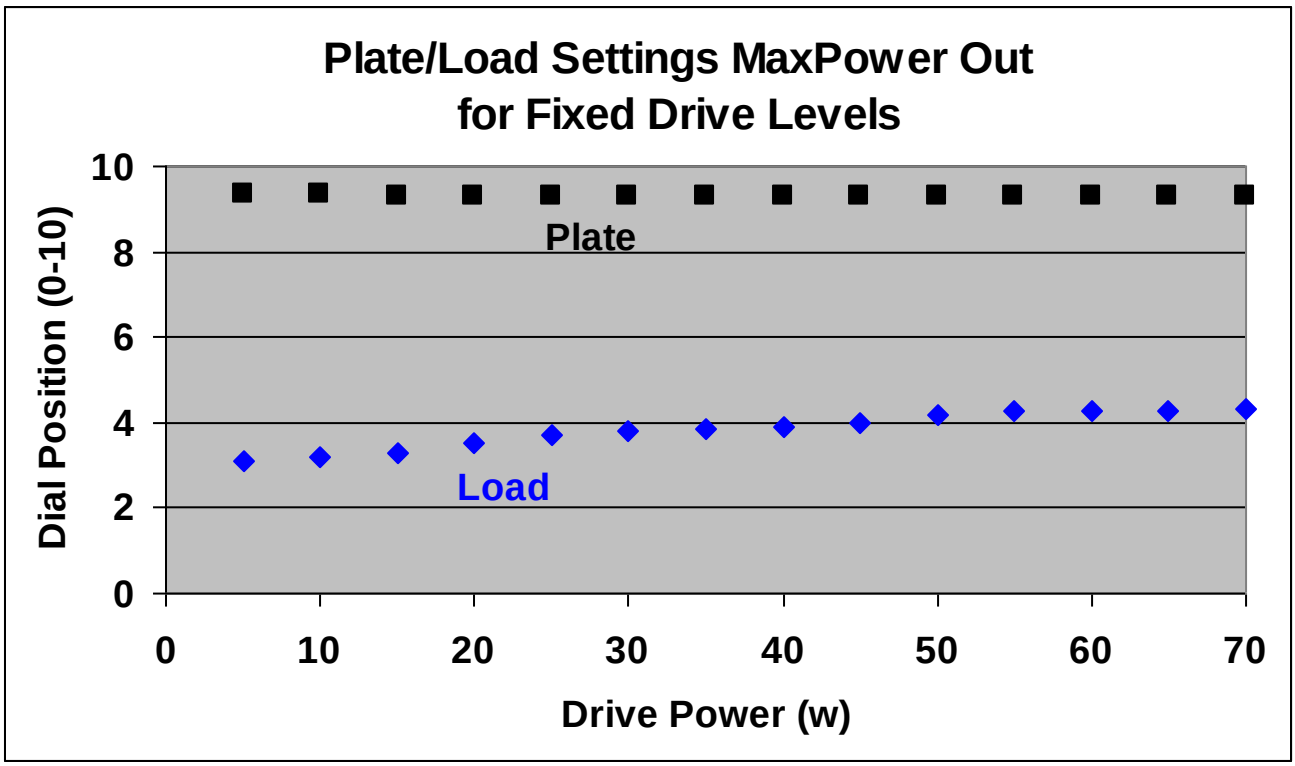

Figure 2. Plate and Load amp setting for max power out for the same conditions in the first figure.

The Plate dial setting is nearly (but not quite) independent of drive while the Load setting increases with drive.

Effect of Reducing Drive Power and Output Power while Holding Load/Plate Setting Fixed at Their Max Output Power Values

In a limited way, you can get a handle on expected linearity of an fully tuned amp by tuning to full output and then simply reducing the drive level (not retuning!) and comparing the amp output level with the driver level input to the amp. If the amp is linear, the relationship between the two powers will be linear. If only the plate voltage is stiff and independent of drive, this would be perfect. However, plate voltage is normally not very stiff and it also is somewhat dynamic in the sense that the power supply voltage depends on not just the instantaneous current but on the recent current history. For the 811H, steady state voltage is about 1620V loaded at 10 w drive falling to 1450V at 70 w drive. That would correspond to a 25% power reduction from the soft supply voltage if the plate current falls in proportion to the voltage. (We assume amp designers take this sort of thing into account.)

In spite of this power supply limitation, interesting, and maybe useful, information can be gotten by just turning down the drive power and noting the change in output. The results doing this are shown in the next figure for increments of 10 watts drive starting from 60 watts. The higher points on the curve are about the same as that from Figure 1 - but the lower points are different with lower output power values since we are no longer peaking up these powers by retuning at each driver level. A straight line is drawn in just to help the eye.

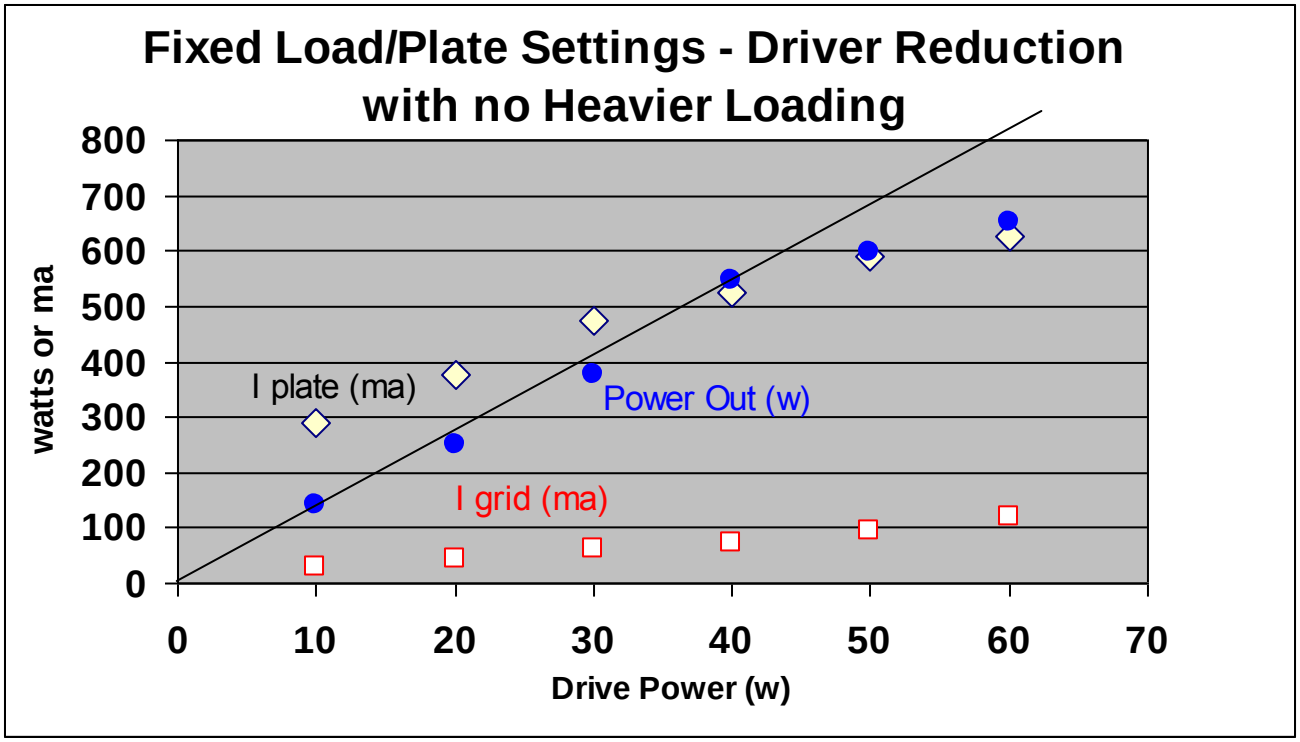

Figure 3. Effect of driver power reduction with fixed Plate/Load settings.

Obviously the relation between the drive power and the output power is not quite linear viewed in this format, but the lack of power supply stiffness is influencing the result at higher powers by reducing the voltage and output there. However, if the response of the supply voltage output to variable loading was very fast, the curve would be a proper measure of amp linearity. This is probably not the case. Viewed in a more appropriate way, the output from the lower power driver is now being helped due to the fact that the power supplied is not so loaded down. Taking into account the power supply softness, the unit is probably more nearly linear than the Figure 3 plot might suggest. Based on just these results, it is hard to know if this tuning will actually produce linear behavior for a complex voice waveform without looking at the gold standard, the intermodulation distortion (IMD) spectrum. Unfortunately, one is not available to your average amateur.

Heavier Loading

Now consider the conventional wisdom mentioned before of making the loading a bit heavier as the last step of tuning to provide better linearity. The visible meter effects of increasing loading are to reduce grid current and power out while increasing the plate current - all in modest amounts. For example, Table 2 shows these changes at the 60 watt drive level while Figure 4 shows the “linearity test” plot of output power vs driver power for the case just provided in Figure 3 (no extra loading) along with two other cases 1) extra loading and 2) more extra loading.

Dial - Loading	Power Out (w)	I plate (ma)	I grid (ma)
4.25 No Extra	650	625	120
4.3 Extra	625	635	110
4.5 More Extra	600	655	100

Table 2. Extra loading effects at 60 watts drive, fixed Plate control.

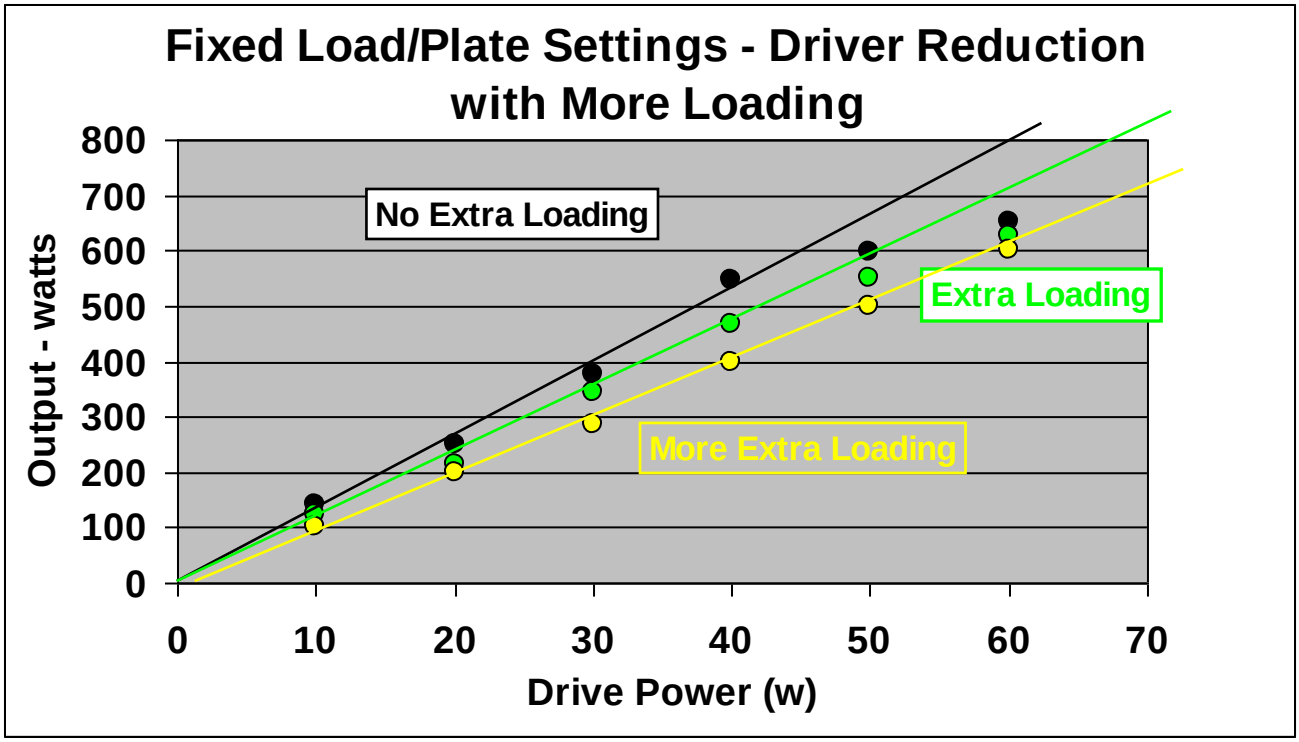

Figure 4. Effect of driver power reduction with fixed Plate/Load settings for 3 levels of loading.

Clearly the use of heavier loading will tend to push the amp in the direction of improved linearity (if needed), just as conventional tuning wisdom indicates. However, I note again that this specific example does not tell how to achieve linearity for any particular amp, including this one, since the conditions of steady state at reduced amplitude (as used in this test) are not the same as the conditions for complex waveform modulation with a rapidly varying distribution of amplitudes.

Trapezoid Scope Pattern as a Linearity Test during Different Loadings

Well known poor man's (no spectrum analyzer) linearity tests are by the two tone pattern and, probably better, the trapezoid pattern. Some point out the trapezoid pattern is hard to read accurately, at least without a pretty nice scope with hold, due to the transient nature of the modulation that can make it hard to determine the straightness of the edge of the trapezoid. It is generally agreed that if you are significantly overdriving your amp into non-linearity, this can be seen in the trapezoid by an evident curving in the “trapezoid” edge at the higher RF amplitudes (showing that the RF high amplitudes are less amplified than the low amplitudes). I have an older scope, with come linearity issues of its own, that is set up for the trapezoid test.

With this in mind, I looked at the trapezoid pattern for the 60 watt driver level and the different loadings. As far as I can tell, there is no difference in the pattern for No Extra, Extra, or More Extra - the pattern appears to have straight edges for all cases.

However, if I reduce the loading significantly, a visible curving in near the trapezoid base does occur consistent with the generally claimed relation between loading and linearity.

In a subjective on-the-air test, a remote helper found no difference in audible signal quality between driver alone and the amp driven at 60 watts with No Extra loading.

Unfortunately, exactly what the correlation is between the audible distortion/splatter, IMD spectrum changes and trapezoid edge curvature seems not to be very cleanly known, so we may sometimes need a gentle reminder from one of our fellow hobbyists if things go wrong.

Dissipation Considerations

For SSB, linearity is vital so you want to make sure that the loading is adequate. However, one consequence of maintain loading, especially for Extra, is that the plate current is raised and the power out is reduced - that is, plate dissipation (approximately the

difference between DC power consumed by the tube, Vdc * I plate, and the RF power out) is increased and efficiency (power out/DC power consumed) is reduced.

Efficiency is nice to have but dissipation can be vital. High dissipation means high heating rate of the plate. The ICAS dissipation rating of a 811A tube is 60 or 65 watts per tube (average) or 240-260 watts for the Al-811H amp (ignoring cooling fans, heat reflection off tube housings etc.). Detailed application of this rating seems to be a little ill defined but the general view is that if you run the amp at an average (over short term duty cycle) dissipation in excess of the rating, you will be needing new tubes before long. The understanding of "average" in terms of duty cycle considerations is important here. Duty cycles that have long key down full output periods, say RTTY and FM, are generally said to be limited by the key down time. One view is that roughly 15 seconds key down or greater should start to be considered as if the duty cycle is 100% since there is no chance to cool off before the plate becomes too hot from the high heating rate. For SSB (duty cycle < 35 %) or CW (~50%), the short term duty can be used in deciding the dissipation allowable, giving ~750 w for SSB and ~500 w for CW for 4 balanced tubes. For RTTY, conventional wisdom is to not derate based on duty cycle but to limit peak dissipation to ~250 watts.

Dissipation Variation with Driver Power

People are sometimes heard to say that their amp is just "loafing along" since they are running a power below the maximum possible - this might be taken to mean that you can handle your dissipation concerns by just reducing power, but beware.

Figure 5 shows the variation of dissipation and power out for a set of drive powers from 10 to 60 watts. The solid points come from tuning at the 60 watt level for maximum output (No Extra loading) and then reducing the power without retuning using Fixed Load/Plate values. The Maximum Power open points begin the same but correspond to the maximum power out for each reduced drive level by retuning for each level. (Points at 35 and 45 watts drive have been added here that are not in the other series.)

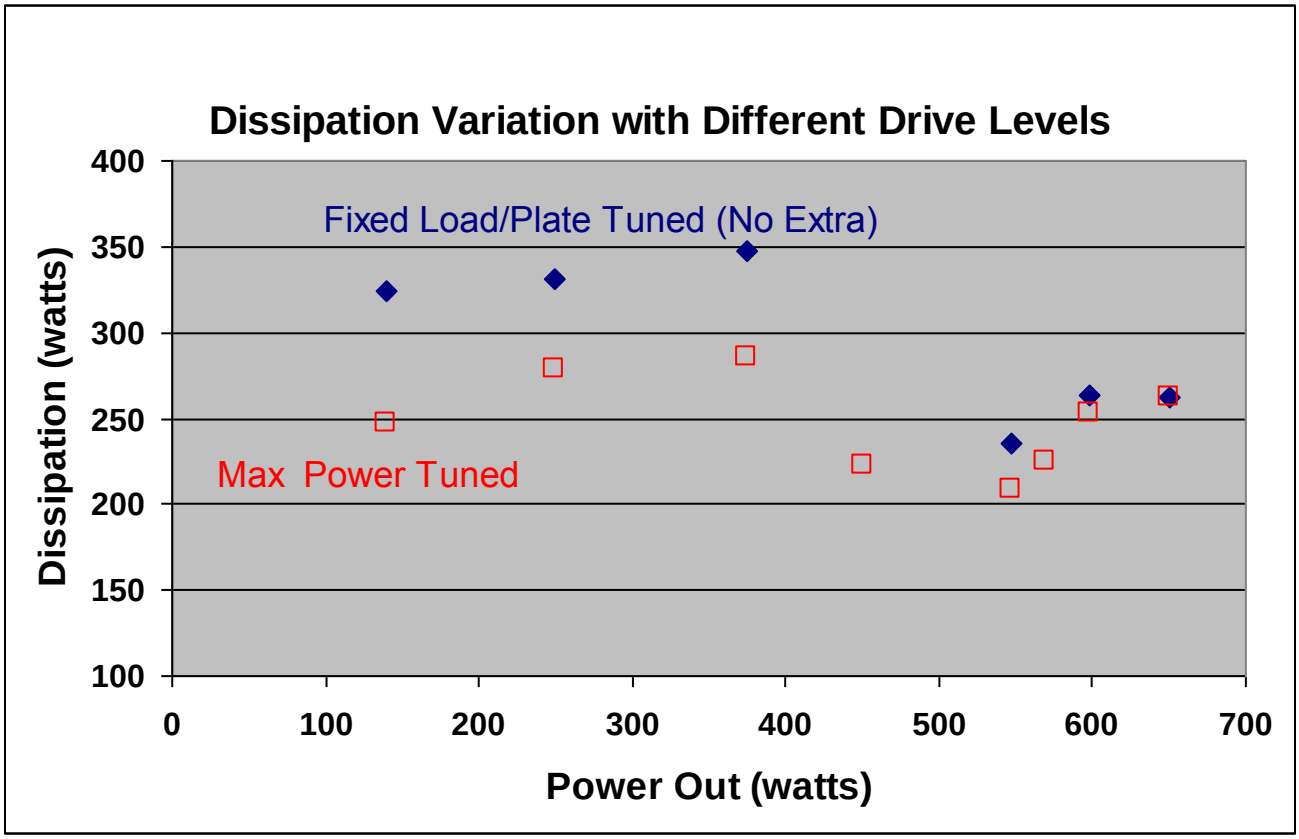

Figure 5. Variation of dissipation with drive power reduction.

So (but keeping in mind the lack of a good power calibration):

For Fixed Load/Plate conditions (meaning again, you tune for max power out with full drive, then only reduce drive) the dissipation is consistently higher than for tuning for max power at the final drive level.

There appears to be a regime of drive powers (35-45watts) where the dissipation is at a minimum.

Lower drive powers, 10-30 watts, have dissipation levels that exceed even those for full drive. (Danger in loafing along?)

The dissipation should be fine for CW and SSB for any drive level.

A requirement for <250 watt dissipation (4 tubes) for high duty cycle/RTTY use might be met with a driver power in the “sweet spot” range of 35-45 watts.

Heavier/Lighter Loading Effects for Reduced Power - Best Dissipation and Linearity

Finally, noting that the dissipation can be a problem but that it might be minimized, one last test was carried out using 40 watts indicated drive (35 watts on the R/S meter with amp bypassed and ATU run). The amp was tuned for maximum power output and then the LOAD control (but not the PLATE control) was varied around its max power position of 3.6. Results for Power Out, Plate Current, Grid Current and Dissipation are shown in Figure 6.

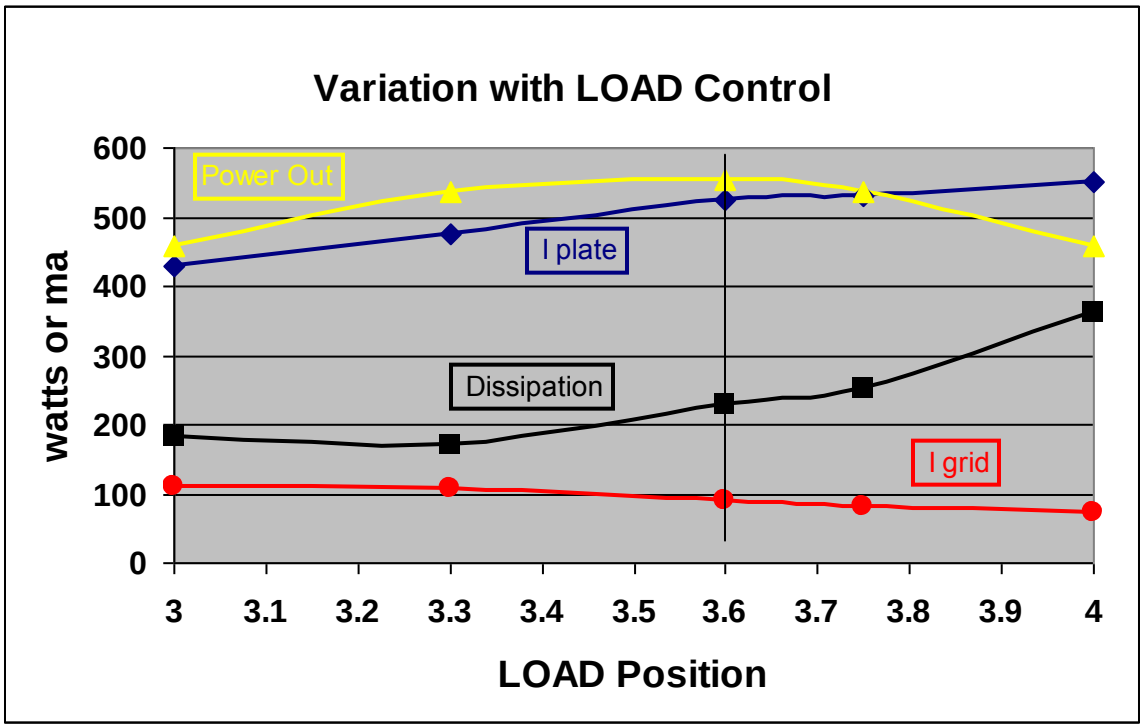

Figure 6. Effects of Load control variation (on 15 meters) about the max output with fixed 40 watts drive.

So:

Power output changes slowly with loading.

Increased loading (higher numerical value, less capacitance) increases plate current and dissipation while reducing grid current (just as we saw for full drive) - and the opposite for decreased loading.

A 10% reduction in loading from 3.6 to 3.3, and below, significantly reduces the dissipation to a minimum region that is below the 811A rated allowed dissipation.

Note the Ameritron manual recommendations for RTTY: Use reduced drive, retune to peak power for that drive and do not exceed 400ma plate current or 120ma grid current. They also say the Al-811H is rated for 400 watts output for a half hour continuous. While Ameritron does not specify lighter loading as a method, the Figure 6 curves seem quite consistent with the recommendations.

A point here is that using both reduced driver power and lighter loading can allow operation with significantly lower dissipation to make RTTY use less exciting, but in a good way.

A commonly stated scheme for avoiding the borderline RTTY dissipation problem is the direct replacement of 811As with 572Bs with no other changes. The two tubes are electrically and physically very similar but the rated dissipation for the 572B is more than two times greater. Replacement does raise some other issues that have been well discussed, if not well resolved.

What you can't see is linearity. However looking at the trapezoid pattern for these five positions of the Load control shows that the linearity appears okay for the three higher load levels (corresponding to No Extra, Extra and More Extra from before). When the Load control is lightened, the characteristic trapezoid distortion with high amplitude RF reduction curving does appear suggesting that linearity is being lost. However, no one is suggesting operation of SSB with lighter loads since dissipation is not an issue.

Caveats

Manufacturer's Instructions - We presume these folks know what they are doing (aside from possible performance puffery) and they want you to have success, so pay attention.

Collins 30L-1 manual says never use RTTY - suggesting that an 811A amp may be borderline for RTTY.

Input Network and Drive Power - The input network of the AL-811H has a tunable coil (with no instructions) so it would not be surprising if different users find different drive level are needed.

ALC Overshoot - This is a subtle point made by W8JI suggesting the when using reduced drive (possibly making the ALC effects on initial signal greater), there may be a tendency for a startup impulse into the amp that can distort the initial amp signals. This might be a downside to reduction of driver power due to character of the transceiver ALC. However, this effect does not seem to be well documented by transceiver.

Tube Balance - The tube with the highest dissipation will be the weak link.

Tube Variation - Tubes with differing characteristics due to age or manufacturing will affect results.

Load Dependence - When operating into a real world load, your results may vary.

Wattmeter Calibration - Your Bird may not be fully accurate, let alone your Radio Shack.

Bill, N6MW

Member Comments:

This article has expired. No more comments may be added.

Ameritron AL-811H Tuning
by NI0C on January 12, 2008 Mail this to a friend!
All this analysis and effort on behalf of the AL-811H would seem to indicate I made a wise choice by purchasing the AL-80B amplifier instead. The latter is a very forgiving amplifier. Just RTFM and go!

Ameritron AL-811H Tuning
by W2BLC on January 12, 2008 Mail this to a friend!
Interesting and very complete report. Makes me think that the AL-811 series of amplifiers are good if treated kindly. Good bang for the buck.

As for myself, I have found that quick tuning for "max smoke" is the best. I apply the typical 100 watts of drive (use the CW or FSK setting in the XMTR) and tune the amp for the max power out. I do record rough settings for future use - saves time and heat when changing bands.

My last 3-500 tube lasted for 19 years using this method - it was used every day.

RE: Ameritron AL-811H Tuning
by K0BG on January 12, 2008 Mail this to a friend!
ALC transient response notwithstanding, the most prevalent tube killer for the 811H (and especially for the 3 tube 811), is too much drive power.

Tom recommends full power out for tuning, and I don't have an argument with that. However, he also states (sic) that if the exciter's (transceiver if you will) output power is grossly more than the amplifier is designed to handle, some sort of attenuator should be installed between the exciter and the amplifier.

Since the 811H only requires 65 watts of drive for full power (52 watts for the 3 tube 811), I venture to say 100 watts out from a nominal solid state transceiver is gross overdrive.

This begs the question, how many owners of these amps, actually use such an attenuator? I venture to say, none! Further, considering how long it takes some folks to tune their amplifiers, it is conceivable that the finals could be destroyed within the first 60 seconds of ownership.

I don't take much stock in any scope reading. In order to see the transient spike Tom refers to, or any IMD on the signal which could cause splatter, takes a very good quality storage scope and the requisite ancillary equipment, and the knowledge of what to look for.

Probably the best solution is not to try making an AL1200 out of an 811H by driving it with a full 100 watts PEP, replete with high compression settings, and the mic gain set for stun!

Alan, KØBG
www.k0bg.com

RE: Ameritron AL-811H Tuning
by N3JBH on January 12, 2008 Mail this to a friend!
"Probably the best solution is not to try making an AL1200 out of an 811H by driving it with a full 100 watts PEP, replete with high compression settings, and the mic gain set for stun!"

I would have to agree with that Allen. I have had the Al-80-B Amp and the Al-811-H and i liked the 811-H just a littile better. Ok the AL-80-B did have the edge for power. But the 811 is quiter i like that and still has the Power to be usefull.

But it is what it is. And that a small Amp. Treat it like a small amp and it should reward you for you kindness. If your in need of that all mighty power and want to run a full 100 watts in to your Amp and well blaa blaa blaa look at the AL-82 Amp.

But the 811-H has been a great amp for me and it has made a differance when i need that tiny kick in the butt to get out. Best thing i like about it is the fact that it does seam to be forgiving of them silly goofs i make when half asleep.

If your looking for an easy to use and decent amp this is it in my book Jeff.

RE: Ameritron AL-811H Tuning
by W4VR on January 12, 2008 Mail this to a friend!
This article goes to show you that they don't make amplifiers like used to. I used a Heathkit Warrior (HA-10) amplifier for 12 years back in the 60/70's with the original four 811 tubes and never had a problem with it. I even used it as an amplifier on AM for a couple of years. I never tuned it up by slowly increasing the drive power as the author suggests...I would go through the tuning process for max power out with full 120 watts drive. If you know approximately where your tune and plate loading controls should be when you change bands, and do a quick tune for max power out with full drive you should not have a problem with a good boat anchor...but apparently not with the AL-811H.

RE: Ameritron AL-811H Tuning
by W7MJM on January 12, 2008 Mail this to a friend!
I quickly, and the key word is quickly, tune my 3-tube AL-811 for maximum peak power out using 100 watts of CW drive, pulsed with the electronic keyer at maximum speed (60 wpm).

I then increase the loading a hair (just enough to see an almost imperceptible drop in output power) and finally decrease the drive so peak output is about 500 watts (SSB or CW).

I do use moderate (<10db) RF speech compression on SSB, but I figure keeping the peak power output 100 watts below maximum gives me the necessary headroom for the resulting increase in duty cycle.

Recently, I replaced the Taylor 811A tubes with Taylor 572B's to provide even more plate dissipation headroom (and more margin for operator error), though the 811A's were still doing fine after 3 years of regular use.

I've followed W8JI's recommendations on tuning and the 572B replacement; I figure the designer of this amp probably knows it best! Kudos to Tom Rauch for designing this reliable, affordable amp.

RE: Ameritron AL-811H Tuning
by KC2FTN on January 12, 2008 Mail this to a friend!
Nice article. To make tuning even easier, I use one of these: http://tinyurl.com/2am2jc

Mike KC2FTN
www.hamwave.com

RE: Ameritron AL-811H Tuning
by W4KVW on January 12, 2008 Mail this to a friend!
The 811H is VERY simple to tune as are MOST of todays new amps.Replace the 811's with 572B's for a MUCH cooler shack & BETTER tube life for just a FEW more dollars!GREAT little amp that will get you UP the list in a pileup! }:>)

Clayton
W4KVW
(CURRENT 811H OWNER & USER)

RE: Ameritron AL-811H Tuning
by N3JBH on January 12, 2008 Mail this to a friend!
Tom is this True? You recomend we change the 811's out for 572's ? I agree You should know best about the Amp. And i also thank you for a neat design. But i was not aware of your Recomendation of the tube change.

Would you mind giving us the plus and minuses of this thanks Jeff

Ameritron AL-811H Tuning
by WX1F on January 12, 2008 Mail this to a friend!
For years, I have used an old telephone answering machine tone box to tune my tube amps. (It fits in my shirt pocket. 3" x 2" x 1/2") It puts out 1000 Hz audio tone. To tune my amp to a new freq, I select the band/freq on the rig and tube amp, then switch to a dummy load. Key the little tone box into my mic. Then switch on the amp and quickly tune the amp for max out with 50 watts in. After I'm done, I record the settings. I seldom have to do this anymore, because I have quite a list of freqs and settings built-up. Just make sure that the tone box you choose, is actually putting out 1000 Hz tone...and watch your swr every day, in case Mr Squirrel has made a meal of your coax while your back was turned!!
73, Gordon

RE: Ameritron AL-811H Tuning
by NO9E on January 12, 2008 Mail this to a friend!
Nice and very complete article. The measurements are on CW so probably one can load the amp a bit lightly on SSB as the voltage will drop a bit less. Thus 811H may be 600W linear key down and 700W+ PEP, as the specs say.

Once one knows the amplification factor, one can tune at very low power levels with a good autoranging wattmeter like LP100. Set tune at 10W and tune so that the peak power at resonance is 100W. Then increase the drive power to a level when increases in grid and plate currents are proportional. When the grid current increases while the plate curent is almost constant, the amp is overdriven.

Ignacy, NO9E

RE: Ameritron AL-811H Tuning
by K0BG on January 12, 2008 Mail this to a friend!
It appears that a lot of folks upgrade their 811As to 572Bs without really knowing the full story.

First, it is the power supply dynamics which typically limit the amount of power out any given amplifier will deliver assuming the tubes are sized accordingly. This is certainly the case with the 811H.

The inter-electrode capacitance of 572Bs, are higher than those of the 811As. This effects the amplifier's tank parameters, but you don't hear users mention any change(s), probably because they can't physically see or measure the change.

If one is to believe the published specs of the 811As versus 572Bs, the grid dissipation is slightly higher in favor of the 811As.

I can't, and won't speak for Tom Rauch, W8JI, but I personally do not believe there is any clear advantage to replacing 811As with 572Bs, except in the mind of the user.

Alan, KØBG
www.k0bg.com

RE: Ameritron AL-811H Tuning
by K7PEH on January 12, 2008 Mail this to a friend!
Interesting article. I would like to have read this back when I first bought my Ameritron AL-572.

In the spirit of passing along information though I thought I would give equivalent information for using my current amplifier: The Icom PW-1. The steps for tuning and adjustment are below.

Step 1: Turn it on.
Step 2: There is no step 2, it is ready to run.

RE: Ameritron AL-811H Tuning
by WB2WIK on January 12, 2008 Mail this to a friend!
Nice article, but I've tuned AL-811H's lots of times in about three seconds.

1. Peak TUNE and LOAD for max output power, using slightly less than full drive power.
2. Increase drive to "full."
3. Re-peak and increase loading to reduce grid current to <150mA.
4. Done.

Seems to me if you go through a multi-step procedure you're spending an awful lot of time tuning up.

As for those using attenuators to reduce drive, actually, I do. Had to back in the days when I used 8877 amps which are easily driven to well beyond legal limit with 100W.

WB2WIK/6

RE: Ameritron AL-811H Tuning
by KE3WD on January 12, 2008 Mail this to a friend!
>>"Seems to me if you go through a multi-step procedure you're spending an awful lot of time tuning up."<<

Indubitably.

!

RE: Ameritron AL-811H Tuning
by WB2WIK on January 12, 2008 Mail this to a friend!
I kind of suspect those who need to follow a prescribed format for amplifier tuning are those who never built a vacuum tube transmitter, and maybe never even owned a Ranger or Valiant or Apache, or Globe Scout -- or anything with a tube PA.

Because those who did, and grew up tuning up vacuum tube transmitters, understand that tuning up a kilowatt amplifier is exactly the same, and should not be an "effort," or something to "think about."

It's quick knob twirling. With my amplifiers, I often tune up as I'm calling somebody. By the time I get their call out, and mine, the amp's tuned.

WB2WIK/6

RE: Ameritron AL-811H Tuning
by AD5TD on January 12, 2008 Mail this to a friend!
"3898 Pecker", best investment you can make in tuning an amp. Limits the amp to 30% duty cycle. Drives others nuts. What more could you ask for?

Ameritron AL-811H Tuning
by WD9IDV on January 12, 2008 Mail this to a friend!
Bill, your article is well thought out and researched.
There are some good points to heed with tube amps.

However, my preference has always been with quality solid state amps like the Yaesu Quadra VL-1000. In this day and age with modern tranceivers, automatic tuning, auto band switching, and digital electronics, tube amplifiers do not appeal to me or my operating preferences.

In this fast paced world, I want an amplifier that can instantly tune what ever band I jump to or frequency I quickly tune to.

In closing, there is a place for both tube and solid state amplifiers. I just prefer the more modern kind.

Robert WD9IDV

Ameritron AL-811H Tuning
by WM2P on January 12, 2008 Mail this to a friend!
Wow! Makes me glad I bought a Pecker right after I bought the amp. Takes me a few seconds to safely and accurately tune my 811 for SSB. This article does explain why all those LIDS take so long to tune up on frequencies in use though. I thought it was just because they were stupid people and could not figure out how to tune their amps but it turns out that they are just following proper tuning procedure. :) Next time I hear one of these knowledgeable Hams tuning up during one of my QSOs I will not think ill of him but rather admire his skill at tuning up in a manner that will preserve the life of his inexpensive 811a tubes. The way I figure it is if a ham cannot afford a dummy load (odd that dummies do not use these) he certainly can not afford to buy new 811a tubes every few years. Now please explain the various noises I hear Hams make while tuning their amps during my QSOs. I understand the whistling but I have heard some strange sounds being used while tuning. I assume that if the Ham can not afford a dummy load that they cannot afford a store bought device to aid them so they use their vocal chords to do the job. Just my theory. :)

Ameritron AL-811H Tuning
by KG6TT on January 13, 2008 Mail this to a friend!
[Now one of my amps is yet another 'commercial' variant... the Ten-Tec Centaur that also uses three 811s with a slightly beefier power supply and built in QSK. Other than that I am sure it tunes up very much like the three tube AL-811.]

While I've not had problems with my 811-based amp I have repaired four AL-811s and AL-811Hs for other hams over the past two years. Three had cascading failures in the power supply due to voltage imbalances across the capacitor bank. These failures were basically component issues (which I won't go into) so I don't count them as fault of the user. The forth failure.... more recent... was a first for me. More about that shortly... and you should find it interesting.

Some may wonder about the robustness of the AL-811 series (I do) and surely we must agree that something must be sacrificed in the design and parts selection in or to keep the cost down of this highly popular amplifier. One of those sacrifices many probably fail to consider is in the area of internal cooling capacity. Cooling efficiency, or a potential lack of it, is an issue that effects not only normal operation but also comes into play during overly lengthy tune up sessions (not all that uncommon).

Now back to that unusual AL-811 failure I mentioned... A local ham friend of mine recently purchased his first HF amplifier... a used but not abused AL-811. Another local ham and I assisted our friend in learning to quickly and efficiently tune his amp... including printed tables of starting positions for LOAD and TUNE, etc. We had him begin with a lower transceiver power... say 40 watts... then tune from the presets to maximum output while insuring the GRID current remained at safe levels. Then up the power once or twice till he reached the recommended drive... each time going for maximum output (to a 50 ohm dummy load) and a safe GRID current. Then he would switch over to his tuned antenna. He got the hang of this particular technique quickly and was soon reaching out to more DX than ever before.... A very happy camper. Till that fateful day....

Our friend is also a budding CW and phone contester and about 14 hours into this years CW CQP he noticed that his AL-811's meters were reacting erratically. At one point he notified me that his GRID current meter was madly bouncing about but never going higer than mid scale and the multi-meter seemed stuck at about 70% scale no matter what he did. I cautioned him to consider turning the amp off immediately till we could investigate but the contest had him going. He reduced power (without the aid of functional meters) and continued watching for further signs of impending failure.... although he was merely guessing at this point regarding TUNE and LOAD settings (a formula for disaster). He contested to the end thinking that he was running about 200 watts out.

The next day he brought the amp to me to look at. I began with a physical inspection and then I found a failure first. Both of his meters had actually MELTED inside the amplifier case (reminded me of the wicked witch). The plastic meter cases were literally twisted about and of course highly distorted in their physical shape therefore causing the strange meter readings. I have no way to

know the melt point for these meters but it is evidently below whatever temperature the amp rose to internally during that contest. I had him order new meters and I installed them. Not knowing the actual breakdown point of the plastic nor how much my friend's tuning of the amp may have contributed I installed a temperature sensor onto the inside front panel in between the new meters. I estimated that the safe 'high' internal temperature would be slightly above 196 degrees (a figure confirmed my Ameritron service). I then cautioned my friend to make some typical temperature meter readings and then to avoid exceeding those by more than 20 percent or so when contesting. So far so good. There was no other apparent damage... and the 811's still output their max power.

So did he simply exceed this amplifier's ability to cool itself even though it was properly tuned up.... or was the failure to properly cool exasperated by the amplifier possibly NOT being properly tuned up? I wasn't there so I am not sure.

RE: Ameritron AL-811H Tuning
by N3JBH on January 13, 2008 Mail this to a friend!
My question is then. Is the AL-811 Series amp's Really meant to be used for contesting? I am not a contester but if i was i do not think that amp would be on my short list of picks.

Also W8JI has written many times about the cooling issue of that and other Glass tube amp's. I am not sure from what he has wrote that pushy a larger volume of air would have done much better.

RE: Ameritron AL-811H Tuning
by KT4WO on January 13, 2008 Mail this to a friend!
"One of those sacrifices many probably fail to consider is in the area of internal cooling capacity. Cooling efficiency, or a potential lack of it, is an issue that effects not only normal operation but also comes into play during overly lengthy tune up sessions (not all that uncommon). "

Very True!..I added a 12VDC "Muffin" fan on the right side of my amp(cut BIG hole in the side) so the extra air blows on the xformer/cap bank...this dropped the output temp. 20deg F during 100% duty cycle digi modes.
Before the extra fan..the top of the amp got VERY warm..not its cool to the touch. I did replace the 811's with 572B's...Not for extra power..but from what I had read ..they are better for 100% modes..Why?..got me..hihi..What ARE the reasons? Anyone got a clue??

Trip - KT4WO

Ameritron AL-811H Tuning
by NG1I on January 13, 2008 Mail this to a friend!
GREAT article for me.....firt time I have owned a 811H and all the info is quite useful. Tells me I have to change a little how I tune it. Thank you & 73

Frank
NG1I

RE: Ameritron AL-811H Tuning
by AD5TD on January 13, 2008 Mail this to a friend!
I bought mine from an old CBer for $300.00. (AL-811) It had been "run hard and put away wet" for many years. It was rusted and ugly. I replaced the 811's with a Chinese set I got off of ebay for $38.00 and replaced the ceramic caps on the tubes that were burnt to a crisp.

It has performed flawlessly for the last two years. I run 100 watts into it with a FT-1000mp and get 750-800 watts out. The scope is clean and so are my reports. If I burn up the tubes, I know where to get more for cheap.

RE: Ameritron AL-811H Tuning
by K4FX on January 13, 2008 Mail this to a friend!
WB2WIK/6 hit the nail on the head, no need in all that tweakin, you are gonna shorten your tube life no matter how fast you do it with all those cycles, I do it just like WIK mentions, about 1/2 to 2/3 power, tweak, full power tweak, and done, only I use my keyer set to 50-60wpm to act as a pulser sending dits, and it works fine, and it's a lot less load on the amp during tune ups.

I have compared the dits to a steady tone and it's identical, only a heck of a lot less strain on the amp.

K4FX

RE: Ameritron AL-811H Tuning
by N6AJR on January 13, 2008 Mail this to a friend!
I preset to a point (write down your setting in a matrix) then start with low power (10 - 20 w)and tune for max output. then check

the dip and the peak, and then take it up to full power and tweek, then drop the input power a tad.

so if it peaks at 52 watts input, you tune it for max output there, check the peak and the dip, then back off the power say to 48 or 50 watts.

you will never notice the diferenc in the transmitted signal, but the tubes will last for ever.

with a matrix, and a little skill you shoud be able to tune up in one or two 3 or 4 second bursts.

Ameritron AL-811H Tuning
by W9GDH on January 13, 2008 Mail this to a friend!
Replace the 811As with 572Bs and tune for max hum from the plate Xformer. The 572b can dissapate around 160 watts each or 640 tatal. The 811a is 60 watts or 240 watts total. Go with the Glow.

RE: Ameritron AL-811H Tuning
by N6AJR on January 13, 2008 Mail this to a friend!
the general consenous is that 572 tubes are little to no benifit on a 811 amp.

the amp was designed for 811's and also 811's are 20 bucks apiece, where 572 are 60 bucks each, so you could retube 3 times fro the price of 1 set of 572's.

and it puts out no more poser as the power supply is the limiting factor. it was designed for 811's, so why change sor some imagined benefit.

RE: Ameritron AL-811H Tuning
by K7PEH on January 13, 2008 Mail this to a friend!
By the way, there is an Ameritron 811H listed on Ebay right now. It was just posted and has 6 days plus remaining on the auction but you can buy this for $0.99 (ninety-nine cents) if you bid and no one else bids on it over the next six days. I think your chances of picking it up for 99 cents are a lot better then winning the lottery.

RE: Ameritron AL-811H Tuning
by A9KW on January 14, 2008 Mail this to a friend!
The Pecker works great.

TOM
N9ZV

RE: Ameritron AL-811H Tuning
by W7MJM on January 14, 2008 Mail this to a friend!
This was the posting on the eHam.net Elmers forum that convinced me to swap out my 811a's for 572b's in my AL-811 amplifier:

www.eham.net/forums/Elmers/76917
RE: 811A Vs 572B
by W8JI on October 30, 2004
I designed the AL811 series (and about 30 other amps for Ham Radio, hi hi)

The design target I was given for the 811 was to build the cheapest amp possible. The weakest link is the tubes.

572B's are a good thing. You will not get much more power, but it will be more tube life by far.
A good 572 will last for many years more than the 811 tubes.

You just decide if you want to spend more money for longer life. It is life vs cost If you tune and operate carefully, the 811 is OK. If you beat the amplifier up for 30 seconds, you can ruin the 811's but not a 572.

RE: Ameritron AL-811H Tuning
by W7MJM on January 14, 2008 Mail this to a friend!
One other point about tuning up which I didn't make in my initial comment; though I tune up using 100 watts drive at first, that's because I preset the tune and load controls to approximately where they should be, based on previous tuneups.

The first time tuning up on a new or altered antenna, I do use about 20 watts of drive and tune for peak output to get the initial settings, then up the drive to 100 watts, tune for peak output, advance the loading control a hair (per W8JI's recommendations),

then back off on the drive to bring the output power down so that I'm within the amplifier's limits (checking the grid current too, just to be sure that's within limits).

Once you get used to the procedure, you can do it within a few seconds. Pulsing the drive (using your keyer or a pulser) also helps limit component strain during tuneup; presetting the controls and limiting tuneup time further reduces your chances of damaging your tubes or other components in the the amp. That and not pushing the amp right to the edge of its specified limits will result in a longer life for the tubes and other components.

OK, I guess I've put in about 6 cents by now, but you have to adjust for inflation. :-) See you on the air. 73, Martin

RE: Ameritron AL-811H Tuning
by KE3HO on January 14, 2008 Mail this to a friend!
<< "One other point about tuning up which I didn't make in my initial comment; though I tune up using 100 watts drive at first, that's because I preset the tune and load controls to approximately where they should be, based on previous tuneups." >>

Why would you tune the amp at 100W drive when it only needs 65W drive for full output? Or perhaps more fundamentally, why would you ever put 100W into an amp that only requires 65W drive for full output?

Just curious.

73 - Jim

Ameritron AL-811H Tuning
by VE6XL on January 14, 2008 Mail this to a friend!
Excellent article Bill !

Thank-you for sharing. I have an 811H and your information is quite useful.

RE: Ameritron AL-811H Tuning
by WB2WIK on January 14, 2008 Mail this to a friend!
Like many things in life, the AL-811H operating manual instructions regarding tune-up are confusing and conflicting.

One paragraph says you absolutely should use the ALC connection if using an exciter capable of more than 70W output power. Another paragraph discusses 80W as the maximum. In one place it says you really don't need ALC. The tune up instructions address CW, then about what meter readings might be for SSB, and how to reduce drive substantially for continuous duty modes including RTTY and FM, but never mentions AM anyplace.

I think the amp is probably better than the instructions.

I also think they should have included a directional coupler in the design so users would have at minimum a relative output power meter reading and some idea of reflected power, without having to use an external meter for this. Evidently the amp really was designed to be "rock bottom low-end, entry level" without frills. Even the old SB-200 had a relative power meter circuit.

They need to hire better writers. A better manual including photographs or photo-like CAD renderings in lieu of line drawings wouldn't add $5 to the cost of the manual; I'd go for it.

WB2WIK/6

RE: Ameritron AL-811H Tuning
by N3JBH on January 14, 2008 Mail this to a friend!
Well Steve it is quite possible if these words are true as reported to have been said by Tom “The design target I was given for the 811 was to build the cheapest amp possible”
Then that would explain the reason for the lack of the directional coupler. Of course you did already state this. But some how they did seem to still make what seems to be a pretty good product well at least in the AL-811-H model. It did seem that there was a tad more effort involved in the H model then the 3 tube version. And it does look to be true they both share the same power supplies. The general construction of the H model is in my opinion more robust.

Yes I have had both of them and there is a difference besides just the extra tube. I would like to seen a switch added to select a different tap to restrict the power for RTTY although I understand that is not really needed as you should simply drive it easier. I just think it been I nice feature especially being this amp is often the so called beginners amp.

Another nice touch would have been the mounting of the ALC control to the front panel. Again I understand that is a feature that is not adjusted all that often but sure would be much more convenient to have it on the front instead of the rear.

I heard Folks say the transformer is a cheap unit. I guess the fact it is not a Peter Dahl unit makes it cheap? I am not certain I personally follow that theory. The manual indeed really needs some work on it. I personally I don't know if I could have made it any more confusing. It would seem they could write it better and simpler.

But with all my complaining on this subject I say it is indeed a very good amp for the money. I have made a few of them 2 am sleep deprived mistakes to this linear and it seems to just set back and shrug it off. So my hats off to W8JI for designing an amp that is as they say Cheap yet rugged enough to take the abuse. Oh and yes I am still on the original set of 811-A tubes it came with and it don't seem to be having any problems. Jeff N3JBH

RE: Ameritron AL-811H Tuning
by WI7B on January 14, 2008 Mail this to a friend!

Bill N6MW,

Really nice research article. I find your data sets an absolutely practical reference.

However, I am surprised no one has commented on your concept of amplifier linearity.

In fact, the actual relationship that should be plotted in your figure "Fixed Load/Plate Setting Driver Reduction with no Heavier Loading" is Pout(dB) vs. Pin(dB), no Pout(W) vs. Pin(W). This is a log-log plot. For amplifier linearity, the data of this log-log plot should be linear, not the one of Pout(W) vs. Pin(W).

I have taken your data and plotted it correctly. Guess what? It's LINEAR...

slope = 0.86668 ± 0.052 (effective unity)

So, over the range of 10-60W input, you AL-811H IS operating in a linear regime. I will email you directly with a JPG of the plot.

73,

---* Ken

RE: Ameritron AL-811H Tuning
by W7MJM on January 14, 2008 Mail this to a friend!
From what I recall of W8JI's information on his website www.w8ji.com , this procedure results in better linearity.

<< "One other point about tuning up which I didn't make in my initial comment; though I tune up using 100 watts drive at first, that's because I preset the tune and load controls to approximately where they should be, based on previous tuneups." >>

Why would you tune the amp at 100W drive when it only needs 65W drive for full output? Or perhaps more fundamentally, why would you ever put 100W into an amp that only requires 65W drive for full output?

Just curious.

73 - Jim

RE: Ameritron AL-811H Tuning
by W7MJM on January 14, 2008 Mail this to a friend!
Here's the link to W8JI's website section about proper tuning and loading: http://www.w8ji.com/loading_amplifier.htm

Ameritron AL-811H Tuning
by KI6LO on January 14, 2008 Mail this to a friend!
I have the AL-811 3 tube amp. Replaced the 811A's with 572B's as others have. They actually came new with the amp when I bought it used. Not that they will do any more power than the 811's as the power supply and other circuitry determines that but mainly for the dissipation factor provided by the 572B's. I use the AL-811 on SSB, CW and RTTY with great results. On RTTY I just back the drive down a little to achieve about 400-450 output. Sure the amp gets warm but that's what the fan is there for.

For tuning, I tuned the amp into a Cantenna to initially get in the ballpark. Then after tweaking on the antenna(s), I cut a series of triangle from different colored sticky labels. The appropriate TUNE, LOAD and BANDSWITCH tuning points were marked with

similar color triangles per band by sticking to the tuning scale on each. Tuning now is as simple as switching to the desired band and rotating the TUNE and LOAD control dial indicator marks to the corresponding color triangles. An inline cross needle SWR/Wattmeter monitors the SWR and power out for any problems. Essential transmit free tuning for my amp.

Really enjoy my AL-811. Makes a world of difference having an amp over barefoot.

Gene KI6LO

RE: Ameritron AL-811H Tuning
by W8JI on January 15, 2008 Mail this to a friend!
Let me weigh in on this since I understand the history of tube failures quite well.

The single dominant failure in the 811 tube is excessive dissipation as a function of time and dissipated power. It is NOT drive, it is virtually never a grid (I've never seen a bad grid in dozens and dozens of bad tubes I've looked at).

The typical failure by far is the anode get heated so hot it actually starts to melt a hole in the anode. At that point materials are liberated from the anode and the tube is poisoned.

Anode damage is always a function of time and anode power dissipation level. Dissipation is somewhat less than Pin/Pout, since not all of the wasted energy is in the anode. That's close enough however.

It's ALWAYS a fuction of time vs heating energy when dissipation is the failure mode. Something has to get hot enough to reach a critical temperature. It isn't drive power, it isn't output power. It's time vs heat.

Long actual transmitting times (when RF is coming out) at high dissipation kills the tubes. It's always time and heating power.

The reasons the manual advises extra heavy loading are linearity and voltage on tank components. Linearity is a non-issue on RTTY and the ALC, after an initial overshoot, has time to catch up. On CW or SSB the ALC can overshoot hundreds of times in a single QSO, and it can cause bandwidth issues as well as stress on tank components if the loading is too light for the overshoot power.

Rigs like the IC706 and FT100 have horrible overshoot. The IC775DSP is another terrible rig, as are some Kenwoods. On the other hand the FT1000D has virtually no overshoot and can be run down to a few watts with no overshoot. An IC775DSP I owned was well over 200W on peaks when I had it set at 50-60 watts carrier. I looked at a rig for Varian that was eating 3CX800A7's up (Ten Tec amp) and found the 3CX800's were being hit with 250 watts at the leading edge of every envelope rise from zero.

This is why the exciter should roughly be sized to match the amplifier, and why lowering drive power often doesn't make things cleaner. It is actually better to run nearly at full output on the radio and use an attenuator pad to reduce drive power in the PA.

Metal oxide cathode tubes are an entirely different animal. The dominant problem in them is grid dissipation and peak cathode emission.

73 Tom

RE: Ameritron AL-811H Tuning
by N3JBH on January 15, 2008 Mail this to a friend!
So Tom Is it true then you do recomend switching over to the 572-B tubes? Please a simple yes or no please.

I would just like to see the answer from you is all. many here including myself have a very high respect for your word. That being said many of us would like to here it right from the enginner's keyboard hii hii. Jeff

RE: Ameritron AL-811H Tuning
by W8JI on January 15, 2008 Mail this to a friend!
Tube dissipation is always the biggest field problem.

If you remove the four 811's and replace then with three 572B's, there will be virtually no change in SWR or neutralization.

The available dissipation will be more than 2-1/2 times higher, and the thermal lag of a 572B is significantly longer. This results in a significant life increase if you are a bit slow on tuning or run high duty cycle modes at high power.

IMO if you have life problems with tubes that you can't cure with a change in operating methods then the simple solution is to use 3 572's to replace the four 811's, leaving the socket nearest the fan (right rear socket) empty and removing that plate cap.

73 Tom

RE: Ameritron AL-811H Tuning
by W8JI on January 15, 2008 Mail this to a friend!
Let me comment again on cooling. Some people think more air equals longer tube life. That is totally misguided thinking unless the tubes are failing from seal failure issues.

The heating of the tube anode, which is about the only thing that fails, is almost the same if the tube is convection cooled or placed in a tornado. Nearly all of the heat exits the anode via infrared radiation, very little cooling is through conduction to the envelope.

If you run 100-120 watts dissipation in a single tube for 20-30 seconds the anode will be close to melting. That's true if the fan is blowing 200 CFM or zero CFM.

The only tube style that has significant anode temperature changes with changes in airflow for a given dissipation are the external anode style of tubes, where the cooling is by direct conduction through the metal anode to the outside of the tube.

The amount of airflow is critical only to components around the tubes and the top caps of the 811 tubes, and the glass envelope. Even the base seals are totally insulated from airflow. If you are not melting the glass or causing the top seal to leak air, additional air won't help the tubes a bit.

The cooling was designed so the seals and envelopes fail comfortably after the anode would melt, so it is at the point where it is already not the limiting factor.

This assumes the glass is the same as the original spec, and not soft glass. Some Chinese tubes had very low melting point glass.

73 Tom

RE: Ameritron AL-811H Tuning
by W7MJM on January 15, 2008 Mail this to a friend!
"the simple solution is to use 3 572's to replace the four 811's, leaving the socket nearest the fan (right rear socket) empty and removing that plate cap."

That's very interesting, Tom. I always thought in terms of replacing all the 811A's in either the AL-811 or the AL-811H with 572B's. In my 3-hole AL-811, I replaced the 3 811A's with 3 572B's. Is that a mistake? Should I pull one of the 572B's and only run the amp with 2 572B's plugged in and one tube socket left empty?

RE: Ameritron AL-811H Tuning
by N3JBH on January 15, 2008 Mail this to a friend!
Thanks Tom i agree with the other fellow now about why not use all 4 tubes? hmmm i am sorry if this is getting old fast but we are learning stuff here. And i can say i am enjoying it very much. i never had a problem with the 811 tubes but i did ask Ameritron about this subject they stated if i was running hi duty cycle modes replace all tubes with 572-B Tubes

In all Fairness to you i rather follow your advice on the topic rather then theres of well quite obvious reasons. So why only 3 and not all 4 please.

Jeff

RE: Ameritron AL-811H Tuning
by W8JI on January 15, 2008 Mail this to a friend!
I never tested an AL811 with 572's, just the AL811H.

The 811H is better with three tubes because the stray capacitances are lower and the input match is slightly better. It's also a closer match to the neutralizing circuit.

More than double the dissipation is enough. You really don't need any more dissipation, so why spend the money if nothing gets better and a few things get a little worse?

73 Tom

RE: Ameritron AL-811H Tuning
by N3JBH on January 16, 2008 Mail this to a friend!
Cool thanks Tom. That explainded it. 73 Jeff

RE: Ameritron AL-811H Tuning
by W7MJM on January 16, 2008 Mail this to a friend!
Thanks for the reply Tom. Well, so far the 3 572B's are working fine in my 3-hole AL-811, so I guess I'll leave 'em all plugged in.

As I recall, the AL-811 isn't neutralized and that neutralization was only needed, and therefore implemented, in the AL-811H. So neutralization shouldn't be an issue when replacing all 3 of the 811A's with 572B's in the AL-811.

I understand that you personally have not tested the AL-811 with 572B's, but based on your knowledge of the design, might any issues crop up on the 3-hole AL-811 as a result of switching to 3 572B's? If so, does the benefit of increased anode heat dissipation outweigh those issues?

RE: Ameritron AL-811H Tuning
by AB9PZ on January 17, 2008 Mail this to a friend!
>>>>by W9GDH on January 13, 2008
Replace the 811As with 572Bs and tune for max hum from the plate Xformer.<<<<

More to this explanation, I hope. I get this terrible picture of a tank circuit way off resonance resulting in the plate current dimming the lights in the neighborhood, leading to "max hum."

RE: Ameritron AL-811H Tuning
by W7MJM on January 18, 2008 Mail this to a friend!
W8JI: If you're still reading this thread, I just wanted to confirm that the 3-hole AL-811 is indeed NOT neutralized and that the switch from 811A to 572B tubes will therefore NOT raise neutralization issues on that unit. So, I assume that replacing all three 811A tubes with 572B tubes on the 3-hole AL-811 is fine. And while we're on that topic; since the power supply of the AL-811 is the same as that of the AL-811H (isn't it?), and a trio of 572B's can easily handle the plate dissipation that goes along with pumping out 800 watts PEP, shouldn't it be possible to safely crank the 3-hole AL-811 up to 800 watts PEP output, the same limit as its 4-hole AL-811H cousin, once the swap to 572B's is made, as long as grid current is kept within rated limits?

Thanks for sharing your technical expertise with us, Tom. It's greatly appreciated.

RE: Ameritron AL-811H Tuning
by W7MJM on January 18, 2008 Mail this to a friend!
Here's a relevant posting I found on the Amps email list, which would seem to support the idea of using 3 572B's in the 3-hole AL-811:

"To: amps@contesting.com
Subject: [Amps] Ameritron AL-811H-- Again
From: OTAKEBI@aol.com
Date: Sat, 1 Oct 2005 23:41:24 EDT
List-post: <mailto:amps@contesting.com>

I do not think the power supply of the AL-811H can handle four 572's.
This is why when you change from 811's you don't see that big of a power output jump in the AL-811H.
The power supply is at the edge of its design.
It can hardly four 811's.
Now, the Al-811 can do better with the 572's because with only three tubes you have a little extra to drive those tubes from that power supply.
In fact the AL-811 does not suffer from those sudden pops and unrest as does the AL-811H.
Before going to the AL-811H I would recommend dropping three 572's in an AL-811.
You will get the same output as with the AL-811H.
I would still suggest not to push it. Keep it at about 1.7KV .
If you want more output than 600 watts CW you need another amp.
With any equipment, when you go over the design tolerance you are asking for trouble and funny things start to happen.
All it takes is a reactive load and bam, kaboom, and golly gee Batman.
MFJ went to the edge with the AL-811H and some operators are driving it over the cliff.
Don't blame MFJ.
Dan/N4VET"

RE: Ameritron AL-811H Tuning
by N6MW on January 18, 2008 Mail this to a friend!
The cautious authors of manuals and web postings who were the sources of suggesting starting at lower drive and working your way up are directing the recommendations to inexperienced (and thus not so quick) users or those who are not familiar with the amp at hand – the primary targets of the article. Once you are comfortable with your amp, presumably you can set the drive to a target value and the Load and Plate setting to those for this band/antenna and very quickly touch up the Plate/Load and be done in a few seconds tops. However, one benefit of a cautious approach is that should you accidentally have the wrong power, band, antenna or whatever selected, you stand a chance of getting error feedback without bending the meter needles or internal arcing. Then again, I never make mistakes like that, usually.

For those who like to tune up with the driver running much more power than will be used during operation, the key word seems to be “quickly.” Note that the Figure 2 plot in the article suggests that the resulting Load setting (from high drive) will be a little heavier than you would get tuning at lower power so that could be good for linearity and other reasons mentioned by W8JI.

One comment was that if you plot Pout vs Pin in dB (that is, a log-log plot) you do get a straight line from the Figure 3 data. While this is true, the slope of the line must be 1 to have linear amplification, which is not the case here.

Bill, N6MW

RE: Ameritron AL-811H Tuning
by W9GDH on January 19, 2008 Mail this to a friend!
>>>>by W9GDH on January 13, 2008
Replace the 811As with 572Bs and tune for max hum from the plate Xformer.<<<< This was JOKE.
You can overload the Plate Xformer before damaging the tubes so be carefull.

RE: Ameritron AL-811H Tuning
by W9GDH on January 19, 2008 Mail this to a friend!
N6MW How about doing the Ameritron AL-80B next.
I'm thinking about getting a AL-80B and your very detaild info would be helpful.

Ameritron AL-811H Tuning
by WA7RAI on January 19, 2008 Mail this to a friend!
Great article-- great thread.

2 years ago my Drake L4's filament xfmr failed and Peter Dahl was back-orded on replacements, so I purchased an 811-H as a temporary amp. It's a nice amp for the money... so nice, I decided to keep it as a backup.

That aside, one point regarding input power for tuning has been overlooked here: The 50w AM carrier mode available on most modern xcvrs.

I found that using the 50w carrier available in the AM mode sufficient for tune-up: I simply tune and load for maximum output at minimum grid current. Following that, I simply adjust the power level of my IC756 to 50% and transmit. PEP output (and tune-up power out) shows between 550w and 690w PEP, depending upon the band.

It seems fruitless to me, to try and squeese another 100 watts, or so, out of it, since no one on the other end will hear the difference... more importantly, running at a conservative power level allows plenty of headroom for agressive speech processing, which *will* make a difference on the other end. At 600w PEP out, the case of my 811-H remains cool.

Chuck, WA7RAI

RE: Ameritron AL-811H Tuning
by WB9CUX on January 27, 2008 Mail this to a friend!
W8JI: Tom, I was wondering if you could respond to W7MJM's first question, posted on Jan 18, about using 572Bs in place of the 811As in the AL-811. Basically the questions are: 1. Are there any neutralization issues? 2. Can the power level be raised with these tubes? Thanks so much for the information you are providing. It is difficult to find reliable information about these issues. Lon.

Ameritron AL-811H Tuning
by N6TZ on January 27, 2008 Mail this to a friend!
Hey Hams, is it possible to improve our English?

"Having recently gotten a used AL-811H and put 4 new tubes from Ameritron into it"

I think you mean:
Having recently "obtained", "purchased", or maybe "received" a used AL-811H

Look up "gotten" in the dictionary - please!

Also, how about this:
and "installed" four new tubes from Ameritron

Good English takes a little more thought and is well worth the effort. My English is not perfect but I try to proof read carefully for any possible improvements in my text.

Hal, N6TZ

RE: Ameritron AL-811H Tuning
by K7DZW on January 28, 2008 Mail this to a friend!
If your driving your 811h with 100 w your a moron.Or rich and don't care.I get 500-600w out with just 45w in from my 746 pro on all bands.Granted my Diawa CN 801 is not a Bird but then I am not splitting hairs or trying to impress with my number crunching from splitting hairs. I am happy about that performance and I know the amp will live a long time.You guys who tune 100w into an 811h are the same fools I see fire up outboard motors on a near freezing day and jam the throttle all the way forward 30 seconds later. If you can't hold a QSO at 600w do you really believe that 700w will make a difference ? The reccomendation from the Ameritron techs ? Don't feed your 811h with more than 60w. If your not getting somewhere near stated power near 60w then improve your antenna system.I can't believe anyone besides me will read all these responses. If your driving a low end amp with max wattage your a MORON.Have a great day and remember you have a choice when you get up every morning.You can be happy or sad. It's your choice.GB

RE: Ameritron AL-811H Tuning
by W7MJM on January 28, 2008 Mail this to a friend!
Lon,

In researching the AMPS list, I came across the following posting by Tom Rauch. Clearly, the 3-hole AL-811 is not neutralized. Would substituting 572b's for 811a's in that amp tip it over the edge to where neutralization would be required, or are 3 572b's "just on the edge of not needing neutralization" like their 811a cousins? That's the key question I'd like Tom to answer, if he has a moment. So far, I've had no problem with my 3 572b's in my 811a, and two of the 3 811a's that I pulled after 3 years of use were beginning to show signs of plate damage, so I'd have to agree with Tom's statement in his posting below that "572B's are a good mod to the 811 amp, they make it almost bullet
proof."

As for my other question, can the 3 572b's be safely driven to 800 watts PEP output; the answer depends on whether the AL-811 power supply is the same as that of its AL-811H cousin, and whether that power supply is stressed when the PEP output of the amp is pushed to 800 watts.

To be safe, I'm continuing to abide by the 600 watt limit specified for th AL-811 (especially since I run a bit of RF speech compression on the driver), but it would be nice to hear Tom's take on this.

To: <amps@contesting.com>
Subject: [AMPS] New to the Amps list
From: W8JI@contesting.com (Tom Rauch)
Date: Tue, 22 Jan 2002 14:16:51 -0500

> 1) Is the AL-811H the same copy of AL-811, but
> has an extra matched tube.??

No. The AL811H is neutralized and has a few other changes. I'd go for the AL811H.

> 2) Can i buy an AL-811 and then later, when i
> retube it, drop in a matched quad of 572B's to
> make it a AL-811H. I assume the 811 will have an
> unused tube socket.

You can drop in 572B's, but it would be a bear to add a fourth tube to the AL811. Three 811's are just on the edge of not needing neutralized, add a fourth tube and you would need to neutralize otherwise you'd have the Clipperton Syndrome.

Even the Collins 811 amps with four 811's are not totally stable because they lack neutralization.

572B's are a good mod to the 811 amp, they make it almost bullet proof. It is a cheap way to pick up the most power gain per buck. If your signal is marginal, the first few hundred watts more makes the biggest difference.