

# A 1 KW Solid State Power Amplifier for 1.8-54 MHz

By W6PQL

It's been a while since I built an amp for HF; I'd have to go back to the 60's and a pair of the venerable 3-500z tubes that I put together back then. Time to upgrade, so I built this one. A [legal-limit version](#) was also built...a few photos of it are near the end of this article.

It can accommodate almost any driving radio, and only requires 2 to 3w drive for 1kw out, a potent companion for my Elecraft KX3 and the other QRP rig I own, the FT817. But because it has a configurable input attenuator, it's also a good match for one of the 100w radios used here, and lately that's the FT991.

The cabinet is a bit deeper than the VHF amplifiers to make room for the large low pass filter board (the cabinet measures 12w by 6h by 16d), but still fits into the operating position with ease.

Details on the construction and performance of the [RF deck are at the end of this article](#).

The rear panel has all the usual connections; input/output, power supply, attenuator configuration jumpers, ALC and PTT.

In addition to these is a band select interface connector, which allows the driving radio to control the band switch function in the amplifier. When used, the front panel band switch is disconnected, and the amplifier band select slaves to the radio.

At the time this photo was taken, I hadn't finished the interface electronics yet, hence the jumper plugged in to enable the front panel band switch.

I was going to "invent" my own interface, but was happy to find one available from [Unified Microsystems](#) that did the job and was very reasonable (their model BCD-14). That board is powered by 12v from the amplifier's interface connector, and is housed in a small mini-box between the amplifier and the radio. I could have put it inside the amplifier cabinet, but decided against it in the event I wanted to use a different radio (which may or may not require a different interface board).

The inside of the cabinet is packed full of the essentials; the [RF deck](#), [low pass filter assembly](#), control circuits, antenna relays and so forth.

It got a bit crowded at the back panel area due to all of the ferrite cores used as RF chokes for external connections, but it all fit OK.

The 3 cable connectors on the left side are for disconnecting the front panel, which is the next photo.

The 3 disconnects allow one to remove the front panel if the amplifier should ever require service, allowing easy access to the rest of the components, (next photo).

The [low pass filter board](#) is also removable...the cable disconnect is tucked under the board, which covers up a few other components mounted underneath it.

It's mounted on 2-inch spacers to make room for those parts, and is positioned in the air stream of the cooling fans, located at the back of the heat sink. Air flows out the front of the heat sink fins, across the filter board, and vents through side cut-outs in the cabinet cover.

Shown before most wiring was in place are some of the power resistors and other parts; the two boards on the right are [dual directional detectors](#).

The one at top right is used to sense whether the band switch is in the correct position (the wrong position can cause damage); if it isn't, it locks out the RF deck (via the control board). The one below it measures forward and reflected power for the bar graph power meters, and also provides the high SWR lockout signal to the control board.

If you will be switching the band select manually, this might be a good idea to talk about the best way to set that first dual detector board up to sense whether the band switch is in a potentially damaging position. [Click here for details](#)

The [input and output relays](#) are mounted to the right side of the heat sink, clear of other components.

The left side houses the control board; mounted on the top left side of the heat sink are the [high current FET switch](#) and the input attenuator.

The photo below shows how it fits in with the other kw amplifiers in the station (vhf/uhf). Good thing there are no more bands to design for, I'm out of room for amplifiers. But naturally, the story can't possibly end there...if one RF deck will do a KW, why not use two of them and build a full legal-limit version that will loaf along at 1500w?

I built the one shown here for a fellow who wanted just such an amplifier, but also wanted it to match the color scheme of the other radio equipment in the station...so the panels are black anodized with white lettering.

Looking inside from the side, the heavy lifting is done on top of the heat sink, where the two rf decks, output combiner, fet switches and input attenuator are located.

The low pass filter is mounted vertically in front of the heat sink in the air stream of the fans located at the back.

The small board at lower left is the band select interface; this one was to be used with an Elecraft K3; the amplifier follows the K3 band selection automatically using this interface.

And here's a look at the rear panel connections; Anderson power poles for the power connections, and a db15 connector for the K3 band data control. Plugging in the control cable from the K3 automatically disables the front panel band switch on the amplifier.

A couple more photos of the interior:



**A description of one of the 1kw RF decks follows:**

There is also a newer RF deck applying all revisions since this original one was developed ([use this link for the details](#))

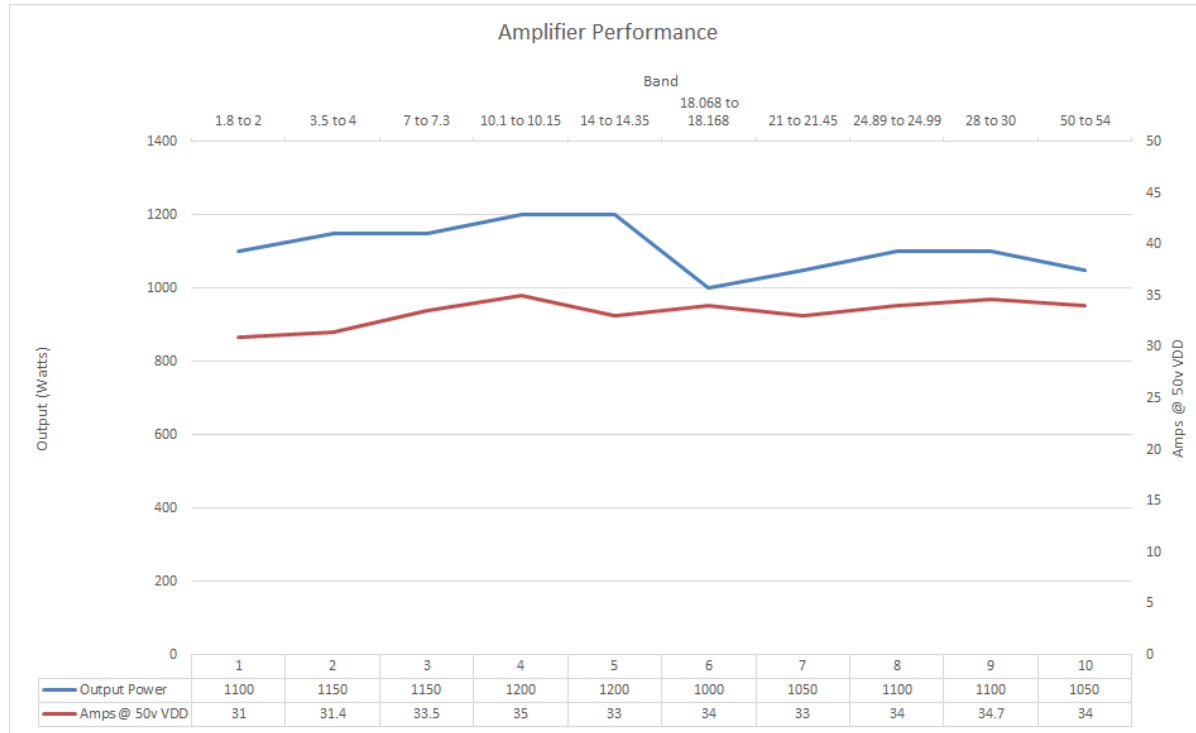
This RF deck is nice and compact, only 4" by 6.5".

Note: Beginning in August 2016, a modification to the input circuit was added to eliminate an instability discovered when operating above 20 MHz into certain narrow-band antennas. This change, and a revised schematic [are documented here](#).

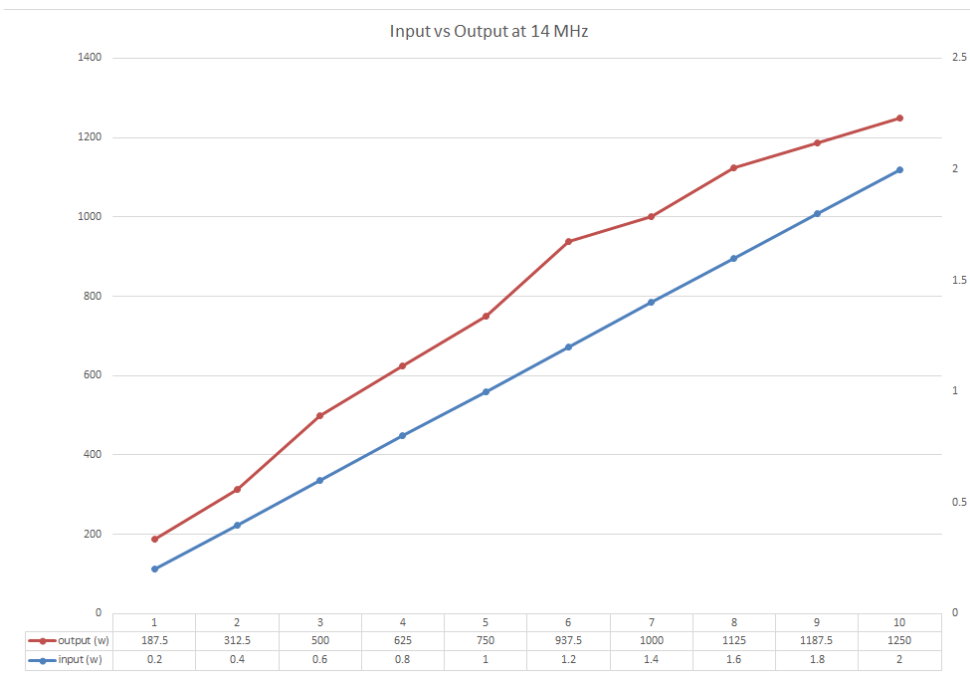
The VHF amplifiers using the newer Freescale and NXP devices also generated interest in their use for the HF bands. I've read some discussion in various user groups about why these devices, originally intended for plasma excitors, can work at VHF but not at HF. The explanations for this seemed to lack any credible science, so I decided to experiment away. What I found was these parts worked very well indeed...you just need to provide some degenerative feedback to keep them stable (the gain is very high at HF). So far, I've tested this with the NXP BLF188xr and the Freescale MRFE6VP1K25H, and one plays as well as the other, no circuit changes are required.

I looked over several designs before settling on the NXP engineering example provided to me; it originally covered 3 to 30 MHz, but after considerable fussing with matching transformers and minor modifications, I managed to include 160m and 6m with a kilowatt over the entire range. Some bands are even better (1200+), but on the whole, 1kw is what you can expect when you attempt to cover such a wide range of frequencies.

Here's a graph showing typical performance after passing through the [low pass filter](#) also featured on the site (I've built several of these rf decks now, and they all played the same).

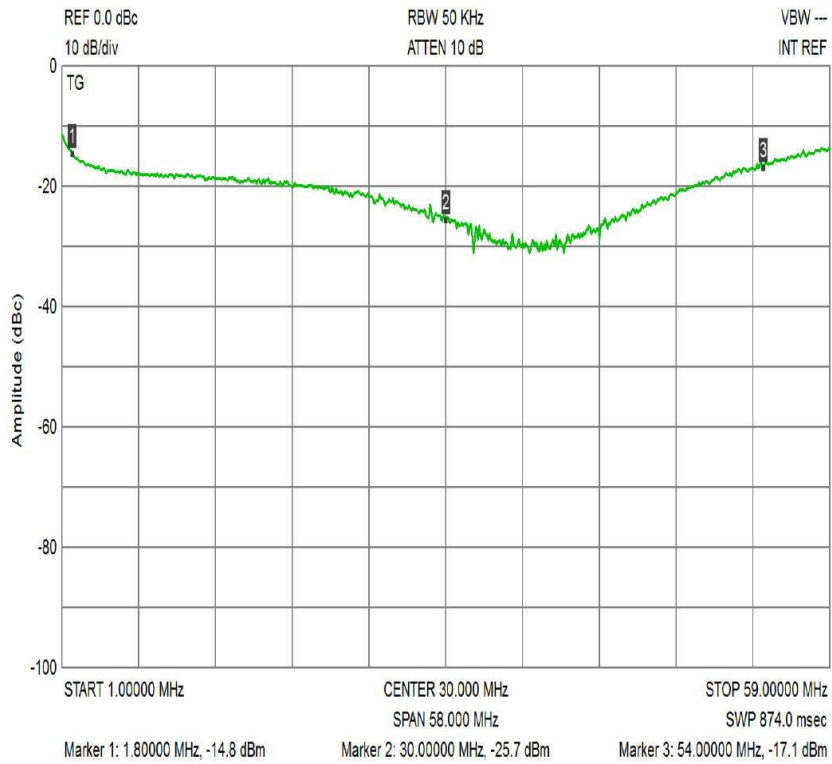


As far as being linear, here's the input vs output ratios measured at 14 MHz:



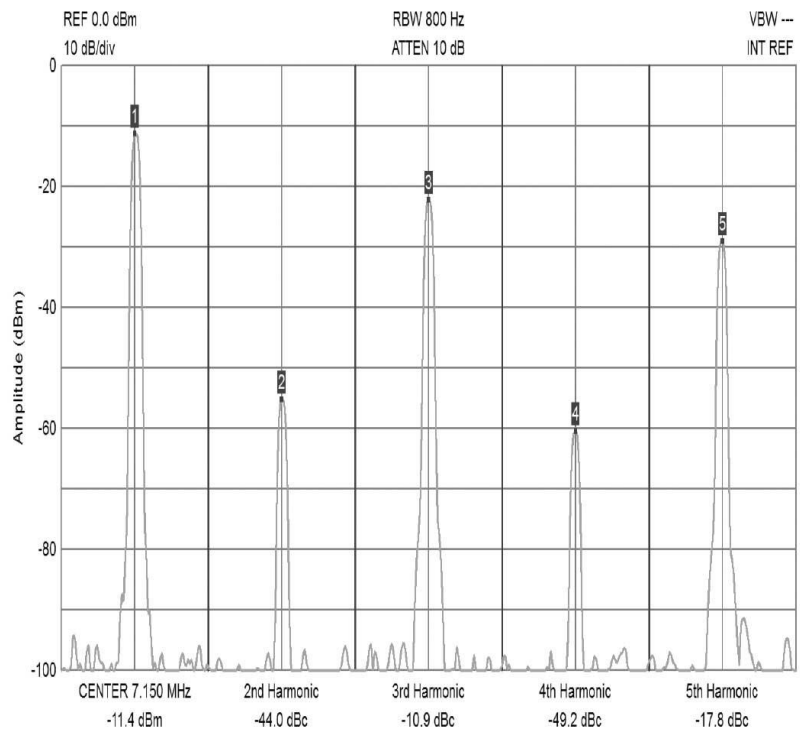
Don't hold me to the very low drive power readings at .2 and .4w, I was using my Elecraft KX3's power settings to measure that, and the accuracy is good, but not perfect. Still, it looks like 1db compression happens at about 85% of full output. In this case, and on this band, that's at about 1062w out (85% of 1250w). By now you've probably noticed that you can drive this to full output with an average of just 2 or 3 watts.

The input return loss (SWR) is shown below (less than 1.5 to 1 across the entire range).

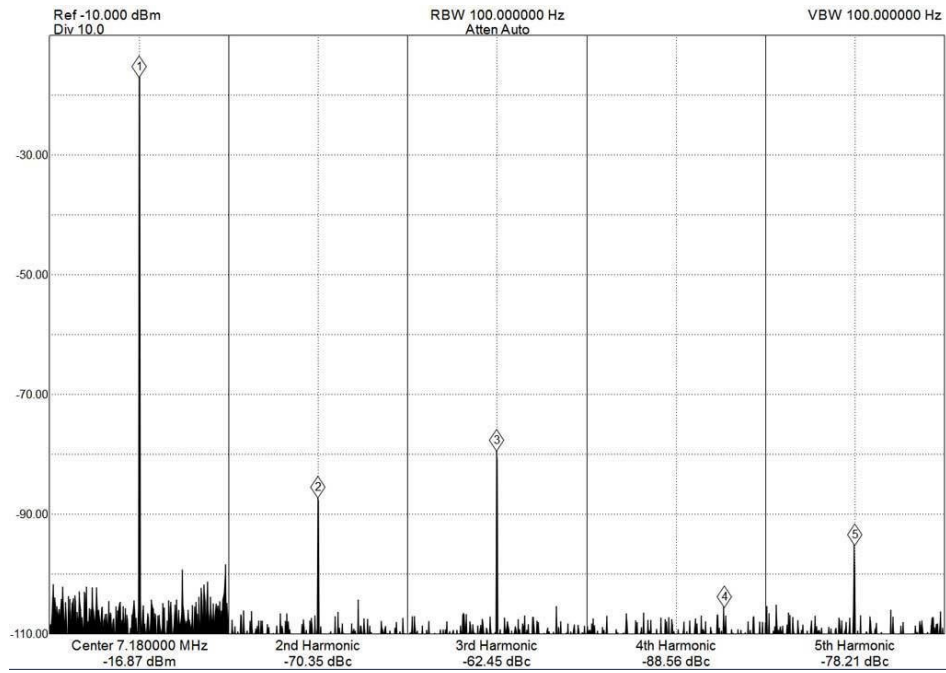


Two of these rf decks, properly combined, will loaf along at full legal limit (1.5 kw). The article for the [combiner set is located here](#).

The amplifier is a push-pull design, using a dual-LDMOS device; by nature, this type of amplifier does a good job of suppressing even harmonics, but the odd harmonics are monsters, so be sure to use a good low pass filter. Just look at this spectrum analyzer display of the unfiltered output on 40 meters:



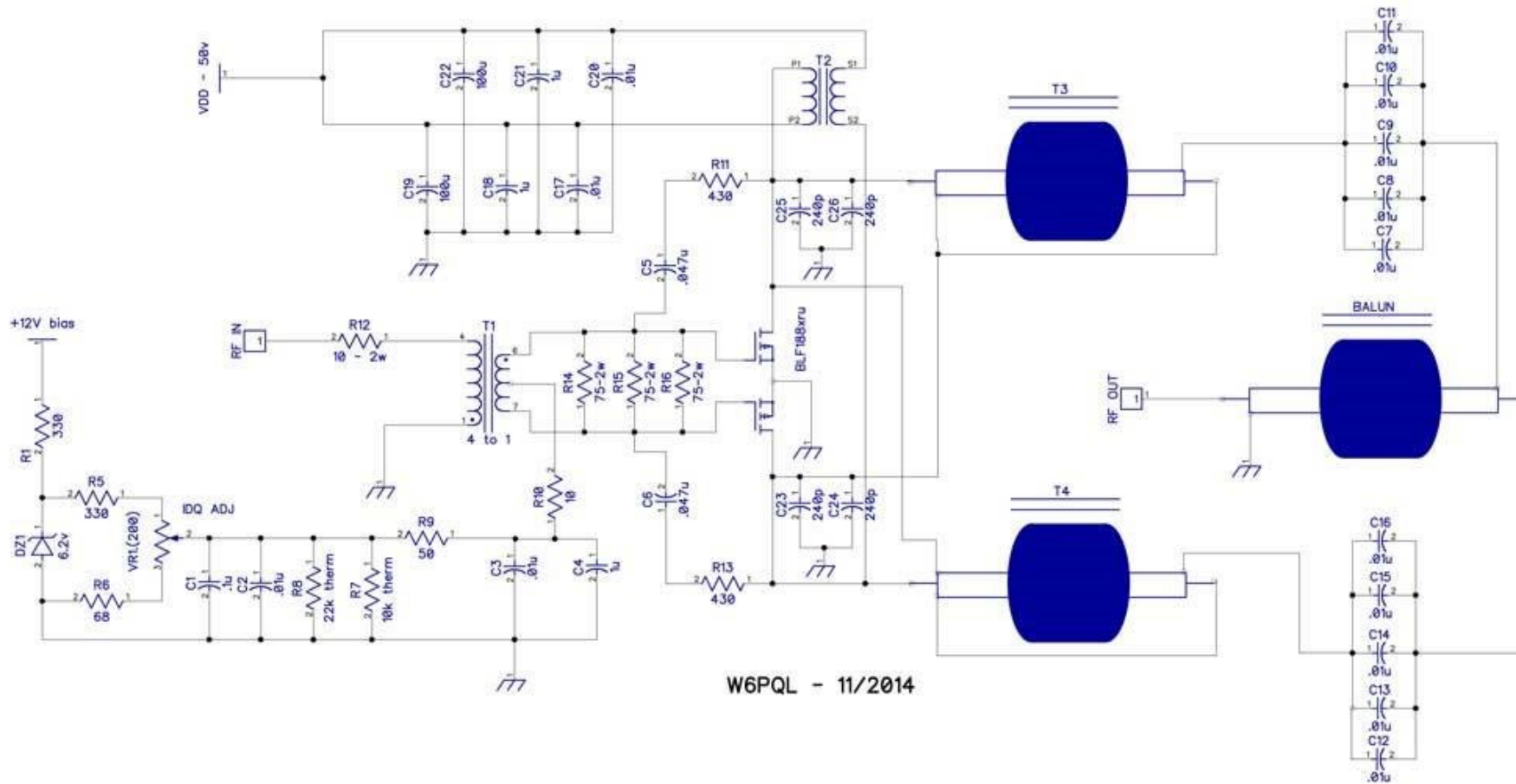
After passing through the [LPE](#), the spectrum is much more reasonable, and in compliance with FCC regs.



The PC board material used in the design is not FR4; it's Arlon TC-350, a material that has excellent thermal conductivity (very helpful in drawing heat away from components).

Here's the schematic for the amp:

## 1.8 - 54 MHz Kilowatt Amplifier



And a Bill of Materials (BOM)

RefDes	Value	Name
BALUN	4T, 50z rg402 FEP	made with a Laird 28B1020-100 core
C1	.1u 100v	capacitor_1206
C2	.01u 100v	capacitor_1206
C3	.01u 100v	capacitor_1206



C4	1u 100v	capacitor_1206
C5	.047u 450v	capacitor
C6	.047u 450v	capacitor
C23	240p	capacitor-MC18 mica
C24	240p	capacitor-MC18 mica
C25	240p	capacitor-MC18 mica
C26	240p	capacitor-MC18 mica
C7	.01u 250v	capacitor_1210
C8	.01u 250v	capacitor_1210
C9	.01u 250v	capacitor_1210
C10	.01u 250v	capacitor_1210
C11	.01u 250v	capacitor_1210
C12	.01u 250v	capacitor_1210
C13	.01u 250v	capacitor_1210
C14	.01u 250v	capacitor_1210
C15	.01u 250v	capacitor_1210
C16	.01u 250v	capacitor_1210
C17	.01u 100v	capacitor_1206
C18	1u 100v	capacitor_1206
C19	100u 63v	capacitor - electrolytic
C20	.01u 100v	capacitor_1206
C21	1u 100v	capacitor_1206
C22	100u 63v	capacitor - electrolytic
DZ1	6.2v	Zener Diode
Q1	BLF188xru	DUALDMOS
R5	330	resistor_1206
R6	68	resistor_1206
R7	10k thermistor	resistor_1206
R8	22k thermistor	resistor_1206
R9	50	resistor_1206
R10	10	resistor_1206
R11	430 2w	resistor, metal film
R12	10 - 2w	resistor_2512

R13	430 2w	resistor, metal film
R14	75 - 2w	resistor_2512
R15	75 - 2w	resistor_2512
R16	75 - 2w	resistor_2512
R1	330	resistor_1206
T1	4 to 1, 2T/1T 25z Teflon coax	input transformer, made with 2 Laird 28B0375-300 cores
T2	5T x2 #14 200C magnet wire	BIFILAR drain choke, made with a Laird 28B1020-100 core
T3	4T, TC-18 coax	coax transformer, made with a Laird 28B1020-100 core
T4	4T, TC-18 coax	coax transformer, made with a Laird 28B1020-100 core
VR1	200	IDQ ADJ trimmer
PCB	Circuit board, TC-350 material	available through <a href="http://www.w6pql.com">www.w6pql.com</a>
TC18	18 ohm Teflon coax	29 inches
TC24	24 ohm Teflon coax	6.25 inches
RG402FEP	insulated RG402 conformable coax	18 inches
magwire	#14 magnet wire, 200C	36 inches

The LDMOS is flow-soldered to a 3x5x1/2 inch copper heat spreader; the spreader is then secured to the heat sink with machine screws, thermal paste used at the joint. I used 1/2" spacers around the edges of the spreader so the board would not overhang the copper; that way I was able to use my standard KW copper spreaders I stock here for the VHF amps, which are smaller than the HF board by 1/2 inch all the way around.

If you are building this project from a kit I supplied, [the assembly guide is here](#)

[template for drilling/tapping your heat sink](#)

Flow-solder attachment is the recommended way to fasten the LDMOS to the copper; here's a [video on how to do it](#). If you are hesitant to do this yourself, that service is available...but it's pretty straightforward, and not at all difficult to do.

For those who enjoy building their own, blank boards only, or kits and assembled/tested RF decks are available on the [parts page](#) (kits already contain the PC boards). The kits will save you some \$, so you'll have to weigh the value of your time against the cost of the assembled versions, though there is also some comfort in knowing the major parts are working correctly and are ready to go. Here is a list of the major assemblies offered there that will be required to duplicate the amplifier shown at the top of the page:

- 1.8-54 MHz Kilowatt RF Deck, kit or assembled/tested (if building from the basic kit, the items in the indented sub-list will also be needed)
  - Machined copper spreader, if ordering the basic kit
  - board spacer set, if ordering the basic kit
  - LDMOS transistor, if ordering the basic kit
  - flow-solder service for LDMOS, if needed
- machined heat sink, drilled/tapped for RF deck above
- 6-segment Low pass filter, kit or assembled/tuned/tested

- two dual directional detectors, kits or assembled/tuned/tested
- two tri-color bar graph displays, kits or assembled/tested
- 48v high current FET switch, kit or assembled/tested
- control board, kit or assembled/tested
- SPDT High power output relay board
- DPDT Mid power input relay board
- ALC board, assembled/tested
- input attenuator - 10 db recommended for 50w driver, 13db for 100w driver

The cabinet consists of the front and rear panels and a floor plate I have made by Front Panel Express (FPE, [www.frontpanelexpress.com](http://www.frontpanelexpress.com)); they have design software you can download for free, which allows you to design custom panels and order them through their system. Their CNC machining process does all the hole cutting and engraving of those parts, and the panels can be ordered in a powder-coat or anodized finish.

The wrap-around cover and internal support brackets and tie-ins I make here; the standard color I use is light gray with a medium gray cover, but if you want to match existing equipment, many other color schemes are available (black anodized finish with white lettering for example). You can expect to pay about \$275 for the panels if ordered directly from Front Panel Express, and the rest of the parts to make the cabinet will cost around \$175 if I make them here, plus shipping for the completed cabinet. If you have your own sheet metal tools (shear and bending brake), you can save some \$ there. The Panels for the 2-deck unit are larger and more expensive (about \$335 from FPE), and the supporting cabinet work is also \$175 plus shipping. Domestic shipping for the finished cabinet has been running about \$50 using FedEx ground service.

One other decision to make on the 2-deck cabinet is the cover fitting flush and behind the front and rear panels, or with a 1/8 inch over-hang (shadow cabinet cover). I prefer the latter, but some do prefer the former; it can be done either way.

If you do want to go the Front Panel Express way, a block diagram of the amplifiers, and my design files for the panels mentioned above [can be found in this folder](#).

The following two lists are the full bill of materials (BOM) for the single deck amplifier, and following that, for the 2-deck amplifier; the auto-band-select interface is omitted in these lists, as this is clearly an optional component, and will vary with the type of radio you use with your amplifier. For Yeasu and others with BCD encoded outputs, the board offered by Unified Microsystems is a good choice. For Flex SDR radios, a program called DDUTIL and a different interface card is necessary; for Apache (ANAN) SDR's, no interface is required, these radios already have control outputs that can operate the amplifier's band select relays directly.

**This first BOM is for the single-deck amplifier (1kw):**

description	p/n	quantity	supplier
#10 THHN stranded wire, black		15ft	Ace hardware
#10 THHN stranded wire, red		15ft	Ace hardware
#14 THHN stranded wire, blue		5ft	Ace hardware
#14 THHN stranded wire, red		5ft	Ace hardware
#18 THHN stranded wire, red		5ft	Ace hardware
White rubber feet, 4 per pack		1 pack	Ace hardware
multi-conductor hook-up wire, 10ft	10cs22	10ft	Allelectronics
meter, panel, 100V DC	85C1 100v	1	Ebay

meter, panel, 50A DC with shunt	85C1 50a	1	Ebay
sma jack for rg174/rg316	Ebay	4	Ebay
sma plug for rg174/rg316	Ebay	4	Ebay
rg142 coax, 5ft	Ebay	1	Ebay
rg316 coax, 6ft	Ebay	1	Ebay
rg402 coax, blue outer covering, 2ft	Ebay	1	Ebay
flat washer, #4	90126a505	box of 100	McMaster-Carr
flat washer, #6	90126a509	box of 100	McMaster-Carr
flat washer, #8	90126a512	box of 100	McMaster-Carr
flat washer, 1/4" (thin)	90945a760	1	McMaster-Carr
k/l nut, 4-40	90675a005	box of 100	McMaster-Carr
k/l nut, 6-32	90413a101	box of 100	McMaster-Carr
k/l nut, 8-32	90675a009	box of 100	McMaster-Carr
lock washer, internal, 1/4"	91113a029	1	McMaster-Carr
machine screw, 2-56 x 3/16	90272a076	box of 100	McMaster-Carr
machine screw, 4-40 x 1/2	90272a110	box of 100	McMaster-Carr
machine screw, 4-40 x 1/4	90272a106	box of 100	McMaster-Carr
machine screw, 4-40 x 3/16	90272a105	box of 100	McMaster-Carr
machine screw, 4-40 x 3/4	90272a113	box of 100	McMaster-Carr
machine screw, 4-40 x 3/8	90272a108	box of 100	McMaster-Carr
machine screw, 6-32 x 3/8	90272a146	box of 100	McMaster-Carr
machine screw, 6-32 x 3/4		pack of 6 to 10	Local hardware store
machine screw, 8-32 x 3/4	90272a197	box of 100	McMaster-Carr
phillips screw, sheet metal, #6 x 3/8	91775a640	box of 100	McMaster-Carr
#6 solder lug	7326	10	Mouser
12 ohm 50w metal-cased resistor	rh50-12	1	Mouser
15-pin d-sub connector	K86X-EA-15S	1	Mouser
24v spdt relay	T9AP5D52-24	1	Mouser
25 ohm 25w metal-cased resistor	rh25-25	1	Mouser
250 ohm 25w metal-cased resistor	rh25-250	1	Mouser
3.5mm mono jack	161-3142m-e	1	Mouser
3.5mm mono plug	171-PA3191-1-E	1	Mouser

30a bridge rectifier	mp251	1	Mouser
3mm led mount	C-103-SR	6	Mouser
3mm led, green	WP132XGD	6	Mouser
4700 pf 50v 1206 capacitor	VJ1206Y472MXAPW1BC	4	Mouser
5.1k 1206 resistor	CRCW12065K10JNEA	1	Mouser
50 ohm 15w power resistor	MP915-50.0-1%	1	Mouser
510 ohm 1/4w axial resistor	CCF07510RGKE36	2	Mouser
51mm spacer, tapped both ends 4-40	3484	3	Mouser
560 ohm 3w resistor	RSS3560RJTB	1	Mouser
80mm fan, 38cfm, 12v	OD8025-12HSS	3	Mouser
80mm fan guard	08172	3	Mouser
anderson power pole cable clip pkg	115g7	1	Mouser
anderson power pole cable housing, 2x2	1460g1	1	Mouser
anderson power pole chassis shell, 2x2	1470g1	1	Mouser
anderson power pole contact, 30A	1331	4	Mouser
anderson power pole contact, 45A	261g2	4	Mouser
anderson power pole housing, black	1327g6	2	Mouser
anderson power pole housing, blue	1327g8	4	Mouser
anderson power pole housing, red	1327	2	Mouser
anderson power pole retaining pin	110g9	1	Mouser
d-sub hardware	160-000-010R031	2	Mouser
ferrite core	2643006302	50	Mouser
ferrite core	2643625002	30	Mouser
knob, pointer type	43021-2B1/4	1	Mouser
molex .062 contact, female	02-06-1103	27	Mouser
molex .062 contact, male	02-06-2103	27	Mouser
molex .093 contact, female	02-09-1104	6	Mouser
molex .093 contact, male	02-09-2103	6	Mouser
molex plug, 12 circuit, .062	03-06-2122	1	Mouser
molex plug, 6 circuit, .062	03-06-2062	1	Mouser
molex plug, 6 circuit, .093	03-09-2061	1	Mouser
molex plug, 9 circuit, .062	03-06-2091	1	Mouser

molex receptacle, 12 circuit, .062	03-06-1121	1	Mouser
molex receptacle, 6 circuit, .062	03-06-1061	1	Mouser
molex receptacle, 6 circuit, .093	03-09-1061	1	Mouser
molex receptacle, 9 circuit, .062	03-06-1092	1	Mouser
phono jack	16pj052	1	Mouser
resistor, 1k 1/4w	CCF071K00GKE36	1	Mouser
rocker switch w2/green led	r1966ablklkesgrn	1	Mouser
rocker switch w2/yellow led	r1966ablklkesyel	1	Mouser
rotary switch, 1/4 shaft, 6 position	SR2511F-0206-19R0B-E9-N-W	1	Mouser
spacer, 1/4" for #4 screw	398	12	Mouser
spacer, 3/8" for #6 screw	407	8	Mouser
terminal, .187 tab, 18-22 awg	159-2187	2	Mouser
terminal, .250 tab, 16-14 AWG	8-696302-1	7	Mouser
terminal, for #8-10 screw, 12-10 AWG	35109	3	Mouser
uhf connector	so239	2	Mouser
Bar graph display support bracket	BARBRACKET	2	W6PQL
copper spreader, 3 x 5 x 1/2	CS-machined	1	W6PQL
flat washer, #5	supplied with FET switch kit	2	W6PQL
heat sink, 10 x 6 x 3.5, 6 pounds weight	HS-machined	1	W6PQL
input attenuator, 6, 10, 13 or 16db	INATTEN	1	W6PQL
Kit, bar graph display, red, green, or tri-color	BARGRAPH	2	W6PQL
kit, basic hf amplifier	HFAMPKIT	1	W6PQL
kit, control board	CTRL-v6.2	1	W6PQL
kit, dual directional detector	DDD	2	W6PQL
kit, high current fet switch	HCFS	1	W6PQL
kit, low pass filter	LPF	1	W6PQL
kit, ALC board	ALC	1	W6PQL
LED pcb, 4 position	LEDPCB	1	W6PQL
LPF support bracket set	lpfbrackets	1	W6PQL
relay, rf input	relayin	1	W6PQL
relay, rf output	relayout	1	W6PQL
spacer set for hf amplifier	AMPSPACERS	1	W6PQL

u-spacer, 51mm	uspacer	1	W6PQL
ldmos, blf188xr	blf188xr	1	W6PQL

**The following BOM is for the 2-deck amplifier (1500w +):**

description	p/n	quantity	Supplier
#10 THHN stranded wire, black		15ft	Ace hardware
#10 THHN stranded wire, red		15ft	Ace hardware
#14 THHN stranded wire, blue		5ft	Ace hardware
#14 THHN stranded wire, red		5ft	Ace hardware
#18 THHN stranded wire, red		5ft	Ace hardware
ammeter shunt, 100a	snt-100	1	Allelectronics
meter, panel, 100A DC	pmd-100a	1	Allelectronics
meter, panel, 100V DC	pmd-100v	1	Allelectronics
multi-conductor hook-up wire, 10ft	10cs22	10ft	Allelectronics
rg142 coax, 5ft	Ebay	1	Ebay
rg316 coax, 6ft	Ebay	1	Ebay
rg402 coax, blue outer covering, 2ft	Ebay	1	Ebay
sma jack for rg174/rg316	Ebay	4	Ebay
sma plug for rg174/rg316	Ebay	4	Ebay
flat washer, #4	90126a505	box of 100	McMaster-Carr
flat washer, #6	90126a509	box of 100	McMaster-Carr
flat washer, #8	90126a512	box of 100	McMaster-Carr
flat washer, 1/4" (thin)	90945a760	1	McMaster-Carr
k/l nut, 4-40	90675a005	box of 100	McMaster-Carr
k/l nut, 6-32	90413a101	box of 100	McMaster-Carr
k/l nut, 8-32	90675a009	box of 100	McMaster-Carr
lock washer, internal, 1/4"	91113a029	1	McMaster-Carr
machine screw, 2-56 x 3/16	90272a076	box of 100	McMaster-Carr
machine screw, 4-40 x 1/2	90272a110	box of 100	McMaster-Carr
machine screw, 4-40 x 1/4	90272a106	box of 100	McMaster-Carr
machine screw, 4-40 x 3/16	90272a105	box of 100	McMaster-Carr
machine screw, 4-40 x 3/4	90272a113	box of 100	McMaster-Carr

machine screw, 4-40 x 3/8	90272a108	box of 100	McMaster-Carr
machine screw, 6-32 x 3/8	90272a146	box of 100	McMaster-Carr
machine screw, 6-32 x 3/4		pack of 6 to 10	Local hardware store
machine screw, 8-32 x 3/4	90272a197	box of 100	McMaster-Carr
phillips screw, sheet metal, #6 x 3/8	91775a640	box of 100	McMaster-Carr
#6 solder lug	7326	10	Mouser
12 ohm 50w metal-cased resistor	rh50-12	1	Mouser
15-pin d-sub connector	K86X-EA-15S	1	Mouser
24v spdt relay	T9AP5D52-24	1	Mouser
25 ohm 25w metal-cased resistor	rh25-25	1	Mouser
250 ohm 25w metal-cased resistor	rh25-250	1	Mouser
3.5mm mono jack	161-3142m-e	1	Mouser
3.5mm mono plug	171-PA3191-1-E	1	Mouser
30a bridge rectifier	mp251	1	Mouser
3mm led mount	C-103-SR	6	Mouser
3mm led, green	WP132XGD	6	Mouser
4700 pf 50v 1206 capacitor	VJ1206Y472MXAPW1BC	4	Mouser
5.1k 1206 resistor	CRCW12065K10JNEA	1	Mouser
50 ohm 15w power resistor	MP915-50.0-1%	1	Mouser
510 ohm 1/4w axial resistor	CCF07510RGKE36	2	Mouser
560 ohm 3w resistor	RSS3560RJTB	1	Mouser
80mm fan, 40cfm, 12v	OD8025-12HSS	3	Mouser
80mm fan guard	08172	3	Mouser
anderson power pole cable clip pkg	115g2	1	Mouser
anderson power pole cable housing, 2x3	1460g2	1	Mouser
anderson power pole chassis shell, 2x3	1470g2	1	Mouser
anderson power pole contact, 30A	1331	4	Mouser
anderson power pole contact, 45A	261g2	8	Mouser
anderson power pole housing, black	1327g6	4	Mouser
anderson power pole housing, blue	1327g8	4	Mouser
anderson power pole housing, red	1327	4	Mouser
anderson power pole retaining pin	110g9	1	Mouser



Black plastic foot	F-7800-A	4	Mouser
d-sub hardware	160-000-010R031	2	Mouser
ferrite core	2643006302	50	Mouser
ferrite core	2643625002	30	Mouser
knob, pointer type	43021-2B1/4	1	Mouser
molex .062 contact, female	02-06-1103	27	Mouser
molex .062 contact, male	02-06-2103	27	Mouser
molex .093 contact, female	02-09-1104	6	Mouser
molex .093 contact, male	02-09-2103	6	Mouser
molex plug, 12 circuit, .062	03-06-2122	1	Mouser
molex plug, 6 circuit, .062	03-06-2062	1	Mouser
molex plug, 6 circuit, .093	03-09-2061	1	Mouser
molex plug, 9 circuit, .062	03-06-2091	1	Mouser
molex receptacle, 12 circuit, .062	03-06-1121	1	Mouser
molex receptacle, 6 circuit, .062	03-06-1061	1	Mouser
molex receptacle, 6 circuit, .093	03-09-1061	1	Mouser
molex receptacle, 9 circuit, .062	03-06-1092	1	Mouser
phono jack	16pj052	1	Mouser
resistor, 1k 1/4w	CCF071K00GKE36	1	Mouser
rocker switch w2/green led	r1966ablklkesgrn	1	Mouser
rocker switch w2/yellow led	r1966ablklkesyel	1	Mouser
rotary switch, 1/4 shaft, 6 position	SR2511F-0206-19R0B-E9-N-W	1	Mouser
spacer, 1/4" for #4 screw	398	12	Mouser
spacer, 3/8" for #6 screw	407	8	Mouser
terminal, .187 tab, 18-22 awg	159-2187	2	Mouser
terminal, .250 tab, 16-14 AWG	8-696302-1	7	Mouser
terminal, for #8-10 screw, 12-10 AWG	35109	3	Mouser
uhf connector	so239	2	Mouser
2-pallet combiner set	HFCOMBINERKIT	1	W6PQL
Bar graph display support bracket	BARBRACKET	2	W6PQL
copper spreader, 3 x 5 x 1/2	CS-machined	2	W6PQL
flat washer, #5	supplied with FET switch kit	2	W6PQL

heat sink, 10 x 10 x 3.5, 10 pounds weight	HS-machined	1	W6PQL
input attenuator, 6, 10, 13 or 16db	INATTEN	1	W6PQL
kit, ALC board	ALC	1	W6PQL
Kit, bar graph display, red, green, or tri-color	BARGRAPH	2	W6PQL
kit, basic hf amplifier	HFAMPKIT	2	W6PQL
kit, control board	CTRL-v6.2	1	W6PQL
kit, dual directional detector	DDD	2	W6PQL
kit, high current fet switch	HCFS	2	W6PQL
kit, low pass filter	LPF	1	W6PQL
ldmos, blf188xr	blf188xr	2	W6PQL
LED pcb, 4 position	LEDPCB	1	W6PQL
LPF support bracket set	lpfbrackets	1	W6PQL
relay, rf input	relayin	1	W6PQL
relay, rf output	relayout	1	W6PQL
spacer set for hf amplifier	AMPSPACERS	2	W6PQL