Product Review and Short Takes from *QST* Magazine

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PRODUCT REVIEW

Ten-Tec Titan III HF Linear Amplifier

Reviewed by Jim Parise, W1UK
ARRL Technical Advisor

Early in 2003, Ten-Tec introduced their third generation Titan amplifier, the Model 417 Titan III. The new Titan, like its two predecessors, is a legal limit amplifier designed for the HF bands. This new Titan marks a return to a two tube design while retaining similar features to its predecessor.

The Titan III makes use of a pair of Russian made 4CX800A ceramic tetrodes in a grid driven configuration to produce 1500 W on most bands. Like the Titan II,[1] the power supply and RF deck are combined in one beefy enclosure. While the two models share a similar front panel layout, the Titan III is in a larger cabinet. This is no diminutive amplifier. You will need quite a bit of real estate on your shack desk to accommodate its 19×20 inch footprint. It better be a strong desk, too, because the Titan weighs in at over 80 pounds! The cabinet is finished in a flat black color and looks terrific sitting next to the new Orion transceiver.

Figure 1—Front view of the Ten-Tec Titan III while it is pumping out 1500 W.

Getting started with the new Titan

The Titan arrives in two boxes. One contains the amplifier unit and the other the MCI Limited 3 kV transformer. The transformer needs to be unbolted from a piece of plywood, which holds it securely in the carton during shipping. Ten-Tec thankfully only initially installs 10 of the 34 screws used to attach the cabinet cover. Once the cover is removed, a side chassis rail must be removed to allow access for the power transformer. The transformer weighs nearly 50 pounds, so extra care must be exercised when installing it on the four studs protruding from the floor of the chassis. There is less than 1/4 inch of clearance to connectors on the metering circuit board, so you can't afford to lose control of the heavy iron while maneuvering it into position.

Once it is bolted down with nuts from the hardware pack, two connector attachments complete the installation. The tubes are preinstalled at the factory. Provide Ten-Tec with a copy of your license and they will include an input matching circuit board that will allow operation on 10 and 12 meters. Installation is a simple swapping out of the standard input filter. Attach your preferred 240 V, 20 A plug and the amp is ready to be put into service.

The amplifier chassis is quite roomy, well laid out and divided roughly in half between the power supply and the RF deck. On the left side an aluminum squirrel cage blower sits directly behind the plate transformer and pressurizes a raised sub-chassis. Cool air is drawn in through vents on the right front side of the chassis cover. Another transformer provides screen and filament voltages. The two Svetlana tubes are cooled by forced air from below through a composite material two-part chimney. The chimney extends right to the cabinet cover cutouts for venting and to prevent hot air from circulating within the cabinet. Band changing is accomplished by a heavy-duty three stage rotary ceramic band switch. The eight position switch has two 160 meter and two 40 meter positions, and one position each for 80, 20 15 and 10 meters.

The tubing used for the tank circuit coils is silver plated and is of a large diameter. Large wide spaced air variable capacitors sit one above the other for the TUNE and LOAD controls. The plate choke juts out horizontally from the aluminum partition that runs through the center of the chassis.

As with most any legal limit amplifier, the Titan requires a 240 V ac power connection rated at 20 A. The manual recommends a dedicated circuit. Connecting the amplifier to your transceiver and antenna is straightforward. The instructions in the *Operators Manual* are simple to follow and offer wiring diagrams for connection to Ten-Tec transceivers as well as those of other manufacturers.

Connection arrangements are offered for both QSK and PTT operation. For QSK operation with a Ten-Tec, or some late model Yaesu transceivers that are equipped with a full break-in keying loop, connection is made to the KEY IN and KEY OUT phono jacks on the rear panel. Keying is accomplished by the transceiver. To use with a transceiver that does not offer full break-in loop functionality requires that the station keyer to be connected directly to the amplifier KEY IN jack and the KEY OUT connected to the radio key jack. In this configuration the amplifier controls the keying sequencing. If you do not desire QSK operation, all that is needed is a connection from your radio's PTT OUT to the PTT/VOX jack on the back of the amp. The Titan has an ALC output available for older tube type rigs or transceivers with a negative going ALC system. Most solid state rigs do not require an external ALC connection.

Bottom Line

The Titan III rounds out the Ten-Tec line with a high quality legal limit amplifier that supports their QSK operation and should provide years of service.

[1]D. Patton, NT1N, "Product Review: Ten-Tec Model 416 Titan II HF Amplifier," *QST*, Sep 2001, pp 76-78.

Joel R. Hallas, W1ZR ♦ Assistant Technical Editor ♦ w1zr@arrl.org

Table 1
Ten-Tec Titan III, serial number 08C10023

Manufacturer's Claimed Specifications	Measured in ARRL Lab
Frequency range (US units): 1.8-2, 3.5-4, 7-7.3, 10.1-10.15, 14-14.35, 18.068-18.168, 21-21.45, 24.89-24.99,[1] 28-29.7[1] MHz.	As specified.
Power output: 1500 W continuous in SSB, CW, AMTOR/PACTOR (50% duty cycle or less); 1000 W RTTY/SSTV up to 10 min, 160-40, 20, 15 and 10 meters; 750 W on 30,[2] 17 and 12 meters.	As specified for SSB and CW.
Drive power required: 60 W typical.	Typically 75 W (band dependent).
Input SWR: <2:1.	1.5:1 maximum (typically 1:1).
Spurious signal and harmonic suppression: meets or exceeds FCC requirements.	43 dB. Meets FCC requirements.
Intermodulation distortion (IMD): Not specified.	See Figure 3.
Primary power requirements: 216-252 V ac, 20 A.	
Size (HWD): 8.5×19×20 inches; weight, 84 pounds.	

Notes
[1]As shipped from the factory, operation on 12 and 10 meters is disabled. The Titan III can be modified for operation above 15 meters. Information on this kit is available by written request, which should include a copy of the owner's valid Amateur Radio license.
[2]Note that in the US the limit on 30 meters (10.1-10.15 MHz) is 200 W PEP output.

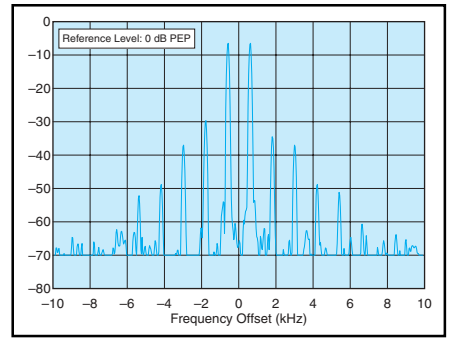

Figure 3—Worst-case spectral display of the Ten-Tec Titan III during two-tone intermodulation distortion (IMD) testing. The worst-case third order product is approximately 30 dB below PEP output, and the worst-case fifth order product is down approximately 37 dB. The transmitter was being operated at 1500 W PEP output at 14.020 MHz.

Figure 2—View of the Ten-Tec Titan III with top cover removed. The quality components are evident.

The front panel includes two large, easy to read illuminated meters. The left meter displays plate current and the right meter offers four choices: screen current, plate voltage, and forward and reflected power. A red warning zone is marked to show screen grid current in excess of 75 mA, the safe limit for the 4CX800A tubes. There are also two LED indicators that warn you if the amp is being overdriven with either excessive screen current or grid current. If you see either of these light up, the manual warns to reduce your transceiver drive power immediately and retune the amplifier to avoid tube damage.

A green LED bar graph displays peak RF output power. At the 1500 W level the LEDs are red, making for a quick visual check that the amplifier is fully tuned to the maximum legal limit.

There are three large rocker switches at the bottom left side of the front panel. The first is for power ON/OFF, the center switches between OPERATE and STANDBY and the third chooses QSK or PTT/VOX. The right third of the front panel contains the eight position band switch and the TUNE and LOAD capacitor controls. Both the TUNE and LOAD controls have smooth vernier tuning and large easy to grip rubber edged knobs. Position indicators are imprinted on the knobs themselves and read against a white reference mark on the panel.

Ten-Tec wisely includes protection and safety circuits to prevent the accidental dumb move that could destroy your tubes or otherwise seriously damage the amp. The Titan has a detection circuit that will "trip" the amplifier into standby mode if you overdrive it with excessive plate current. Step start current inrush protection is provided and a three minute wait is required at initial power up before it can be tuned or used.

Tune-up

Tuning the amp is pretty straightforward. After the three minute warm up and the WAIT light goes out, a quick check for correct plate voltage is followed by application of a small amount of drive power. The manual suggests between 10 and 20 W of initial drive for tuning. I found at least 15 W was necessary to get the plate current to increase enough to begin tuning. The process as outlined in the manual is to adjust the TUNE control for maximum screen grid current and RF output, while making sure not to exceed 75 mA. Then the LOAD control is adjusted for minimum screen grid current. A little more drive power followed by

another round of adjustments produced near the legal limit on all bands. I never got close to the 75 mA limit, but did manage to trip the plate current protection circuit a few times while trying to coax the legal limit out on the higher bands with a little too much drive power.

Changing bands and retuning reminded me somewhat of my late '80s Titan sitting nearby on the operating table. Both Titans are very simple to tune and operate. One difference that became apparent was the optimum settings for the TUNE and LOAD controls on several bands were very close to zero on the knob dials resulting in some squinting to find the right spot. Since the vernier knobs turn numbered skirts, there are no moving pointers to use for adding your own index marks directly on the face of the front panel. This is a favorite method for quick band changes during the heat of battle in a contest. The manual provides starting points for the tuning controls and Ten-Tec also provides a test result sheet for your particular amplifier, although these settings are accurate for a perfect 50 Ω load. For quick band changes and reduced wear and tear on your equipment, a "cheat sheet" with your optimized settings is always a good idea.

Operation

I used the Titan III in a variety of operating conditions including CW DXing, casual QSOs and in the CQWW CW contest. A couple of issues cropped up early on with the amplifier. During the CQWW contest, a bad smell and a sizzling sound caused me to immediately shut it off. After removing the cover, I noticed the plate choke was badly burned around its center. Ten-Tec quickly shipped out a replacement, which differed in the design of its winding. The new choke did the trick. (New Titans will have chokes of the new design. Ten-Tec does not expect many early amplifiers to have this problem, but if they do a new choke will be provided.) After tune up on some bands I noticed that even though high power output was achieved, the screen current metering showed little or no screen grid current. A check of the operating manual revealed that this is not abnormal behavior and is dependent on how you have the amplifier loaded. I did experience negative screen current on some bands, which the manual indicates requires retuning for more optimized settings of the TUNE and LOAD controls. Once I resolved those questions, I found that the Titan performed well. I also experienced slightly less than specified output power on 17 and 12 meters (1400 W). Following discussion with Ten-Tec, a new screen control board was provided and full output was achieved on all bands. The blower is fairly quiet as is the keying relay, and the amplifier runs quite cool. Using QSK was smooth and quite enjoyable thanks to the quiet 7 ms TR relay.

Considering Ten-Tec's reputation for backing up their products, this new Titan is worth a look if you are in the market for a high-end full power amplifier offering QSK, rugged construction and high quality components. It offers good performance and should give years of service as a workhorse amplifier backed up by Ten-Tec's excellent customer support.

Manufacturer: Ten-Tec Inc, 1185 Dolly Parton Pkwy, Sevierville, TN 37862; tel 800-833-7373; **sales@tentec.com**; **www.tentec.com**. Price: $3565.

Kenwood TM-271A 2 Meter FM Transceiver

Reviewed by Dave Hassler, K7CCC
News Editor, QST

Adopting the axiom "Less is More," Kenwood has introduced a no-nonsense 2 meter FM transceiver that packs a big 60 W punch—the TM-271A. This radio has all the functions that the vast majority of hams are likely to need, and delivers it all in a rugged package.

First Impressions

I was delighted the second I opened the box, because right on top, with the instruction manuals (yes, plural—more on this below), was a CD ROM. Popping this disk into my iMac resulted in learning that the English version of the manual is available as an Adobe PDF file. Nothing else was on the disk, which is a shame, because it would have been so easy for Kenwood to include the free programming software there and not require that users download the program off the Kenwood Web site (at **www.kenwood.net**). Still, the ability to print out a page or two of the manual to stick in the glove box or leave out at the operating position is a welcome plus.

My Kenwood TH-F6A tri-band FM handheld came with a manual that weighs in at 116 full-size 8 × 11 inch pages, half in English and half in Spanish. What a pleasure to see the manual cut into two separate pieces (English and Spanish) in the TM-271A box, each in a handy 5½ × 8 inch size, at 78 pages. This easily fits in my glove box without folding, spindling or mutilating. The manual is well written, with a table of contents, index and many embedded page references, so you don't have to keep flipping to the index.

Bottom Line

The Kenwood TM-271A provides basic 2 meter FM mobile capability in a rugged package with just the features most amateurs need.

The radio is small—about 6 inches square and less than 2 inches high. It weighs 2.6 pounds. About half of the package is the cast aluminium heat sink/chassis. I never cease to be amazed at how manufacturers today can cram so much into such small packages. Anyway, the

Table 1
Kenwood TM-271A, serial number 50700629

Manufacturer's Claimed Specifications	Measured in the ARRL Lab
Frequency coverage: Receive, 137-174 MHz; transmit, 144-148 MHz.	Receive and transmit, as specified.
Power requirement: Receive, 1.0 A; transmit, 13 A (high power).	Receive, 0.56 A; transmit, 8.5 A. Tested at 13.8 V.
Modes of operation: FM.	As specified.
Receiver	***Receiver Dynamic Testing***
FM sensitivity, 12 dB SINAD: <0.18 μV.	For 12 dB SINAD, 0.16 μV.
FM adjacent channel rejection: Not specified.	20 kHz channel spacing: 77 dB.
FM two-tone, third-order IMD dynamic range: Not specified.	20 kHz channel spacing: 73 dB; 10 MHz channel spacing: 98 dB.
FM two-tone, second-order IMD dynamic range: Not specified.	80 dB.
S-meter sensitivity: Not specified.	S9 indication: 1.2 μV.
Squelch sensitivity: 0.1 μV.	At threshold: 0.1 μV.
Receiver audio output: 2.0 W at 5% THD into 8 Ω.	2.4 W at 5% THD into 8 Ω.
IF and image rejection: 70 dB.	First IF rejection, 135 dB; image rejection, >146 dB.
Transmitter	***Transmitter Dynamic Testing***
Power output (H/L): 60/25 W.	59/24 W.
Spurious-signal and harmonic suppression: ≥60 dB purity.	73 dB. Meets FCC requirements for spectral purity.
Transmit-receive turnaround time (PTT release to 50% audio output): Not specified.	S9 signal, 88 ms.[1]
Receive-transmit turnaround time (tx delay): Not specified.	72 ms.
Size (height, width, depth): 1.7×6.3×5.4 inches; weight, 2.6 pounds.	

Notes
Unless otherwise noted, all dynamic range measurements are taken at the ARRL Lab standard spacing of 20 kHz.
[1]Squelch on; squelch off is 32 ms.

TM-271A looks as rugged as its MIL-STD rating implies, and it has the look and feel of a commercial radio, rather than typical amateur gear. The front panel has five buttons, a front-firing speaker, two rotating controls and a mic jack. That's it. The supplied microphone is a no-nonsense job, too, with a beefy feel, big illuminated buttons and a hefty PTT switch that reminded me a little of the radios I used in the '80s driving buses back in Portland. The microphone connector is a modular RJ-45 type, which seems to be today's prevailing design choice. A mounting bracket and hardware rounded out the contents of the box. I thought, "Hmmm...all I need now is an antenna and 13.8 V..." With that, I gathered up the lot and headed up to my attic shack.

Applying Power

I would have been remiss if I'd not tried to operate the rig without looking at the manual first. I had a modicum of success. After the 60 seconds it took to hook the radio up to a 12 A power supply, it took a number of more minutes and guesses to get into the menu system.

Once there, I was a little unclear on the abbreviations and didn't want to transmit from murky waters. But I felt OK with jumping over to 146.520 MHz, the national simplex calling frequency, by simply twirling the VFO knob and making a contact with a fellow a few towns over. Beyond that, I knew I needed to hit the manual, at least briefly.

Before going into the specific functions of the radio, let me say that I was presented with a very quick learning curve when examining the menu system. It's really not a "system" at all; rather, you activate the menus and the 43 options are presented sequentially, with most of the options you'll want to tweak available in the first six selections.

All the basics are there for typical repeater operation. Transmit power is selectable in two settings: 25 W low and 60 W high; there is no 5 W setting. Squelch doesn't have a separate control, but is accessible from the front panel buttons. VFO step is adjustable in 11 settings from 2.5 to 100 kHz. The subaudible tone and CTCSS (Continuous Tone Coded Squelch System) options include 42 frequency choices, while 104 DCS (Digitally Coded Squelch) codes are available. While a regular subaudible tone is necessary to access many repeaters, CTCSS and DCS only allow reception of signals that carry the tone or code you set. Basically, it filters those who don't know what tone you're using. The radio can also scan for sent tones and codes, handy when you're in unfamiliar territory and caught without your *ARRL Repeater Directory*!

The radio also features automatic repeater offset so you don't have to worry about remembering if the machine you're working through listens on plus or minus from the repeater's output frequency. There is also a provision to change the offset, anything from 0 to 70 MHz—although you'll most likely want to leave it at the default of 600 kHz. There are two ways to see if the station you're working through a repeater could be worked via simplex. There's a "reverse" button that swaps your reception from the output to the input frequency of the repeater you're using. If the station is strong on both, you could move off the repeater to a simplex channel and work directly. Alternatively, you could activate the automatic simplex checking

system to do the work for you.

What's in a Name?

The TM-271A sports 200 channel memories. If you want to use the alpha-numeric naming function, the memory capacity drops to 100. Frequency, tone, offset, reverse function, narrow or wide FM and beat shift—a way to silence any CPU harmonic images—can all be saved in a memory. Programming into memory is a snap. Set up the frequency, shift, etc, push a button and select an open memory channel, and push the "memory write" button. Switching between the VFO and the memory can be done from the panel or from the microphone, the latter better while operating mobile. Clearing a memory channel is not so intuitive. First you recall the memory channel, then turn off the rig, and then turn it on while holding down another button, and then confirm the erasure. Whew! Copying a programmed memory channel to an open memory channel is simple, though, and works just like regular programming, but in memory mode instead of VFO mode.

Scanning options are numerous on the TM-271A. You can scan the whole band, one of three user definable frequency ranges or within a 1 MHz range. Memories can be scanned as groups or *in toto*, and there are options to scan the call channel and user-set priority channels along with a set VFO or memory frequency. For those wanting to take advantage of a repeater's autopatch facility, the TM-271A has 10 dedicated DTMF memories, allowing the user to store up to 16 DTMF tones per channel, essentially giving the operator 10 "speed dial" numbers. Tone transmission speed and pause duration is adjustable, as well as locking out the DTMF functions of the microphone, for those who have no occasion to use an autopatch.

The "bells and whistles" have been mercifully kept to a minimum, but what has been included is useful. There is an automatic power off setting ranging from "never" to three hours. The Beat Shift function (mentioned above) thoughtfully takes into account the CPU in the radio, understanding that birdies can result from the CPU clock oscillator's harmonics. This function can help cancel that potential problem (although, in over a week of use, I noticed no birdies on either the 2 meter amateur band or while monitoring the public service band above 150 MHz).

The squelch can be approached two ways: either as an absolute value set from the front panel, or as an S-meter level, set in the menu system. I found the former, set at 1 was quite adequate, but those who operate in highly active conditions (read: "live in Intermod Alley") may find the latter option desirable.

For those fans of Star Wars, the responsive sounds of the TM-271A may remind one of the loveable sidekick robot R2-D2—the rig beeps and boops with every button press. If it's not your cup of tea, you can turn the auditory response off, as well as set the level of illumination on the display. There are also four user-definable buttons on the microphone keypad, and for those using the radio in a packet or data node application, data speed can be set at either 1200 or 9600 bits per second.

One of the coolest "bells" is the "Busy Channel Lockout." This prevents the operator from transmitting on a frequency that is currently in use. When turned on, it's impossible to double over anyone. Sure, no one means to transmit on top of anyone else, but this little safeguard (Menu Item Number 22!) should be turned on by even the most vigilant operator...just in case.

Finally, in addition to an extended receive range of 136 to 174 MHz, there's a NOAA Weather Alert facility that transparently monitors a selected NOAA station for a 1050 Hz alert tone. Should the radio detect an alert, it will switch over to the NOAA station. While it monitors only one (selectable) of the seven NOAA frequencies, the others could be programmed into a memory group and scanned, as well as any other frequency in the receiver's range.

Operating

In three different places in the manual, Kenwood advises against prolonged transmit at 60 W. That's a lot of power packed into such a compact package as the TM-271A. Remember, there is no fan on this radio, which also means it's as quiet as a church mouse, but the heatsink does all of the work of heat dissipation. In the hilly country of Connecticut, I found that I needed 60 W at times to hit "distant" machines 30 and 40 miles out. If you live in a flat area (such as my former QTH of Central Oregon), feel free to at least double those figures.

When I got into distant machines at high power, I found that the radio would get warm after about five minutes of operation, and hot after about 15 minutes; the heatsink was too hot to touch at that latter point. On low power, I found that the unit would get warm with prolonged QSOs, but not overly hot. Clearly, the heatsink does its job—just don't overdo it. Kenwood has confirmed that even though the radio gets hot, it is protected by an overtemperature shutdown mechanism. It never shut down in our testing.

As noted above, I had no trouble making a simplex contact and repeater operation was also trouble free, with the TM-271A feeding a 5/8 wavelength mobile antenna with a baseboard heater in the attic as my ground plane. I was able to hit all of my favorite machines from home, and quite a number that my old Azden PCS2000 just can't. I even once managed to get into a repeater in Queens, New York from my Southington, Connecticut home, a distance of 85 miles, albeit with an S3 reading on the TM-271A. I was also able to easily get into a machine in Great Barrington, Massachusetts on high power (48 miles northwest of me over very hilly terrain), and had a fun 10-minute contact with a ham up that way.

Going Mobile with the TM-271A

Installation was pretty easy, once I figured out where on my dashless Ford Ranger pickup the mounting bracket could go. Kenwood thoughtfully provides all the hardware you'll need to get the radio mounted securely in your vehicle. Four sheet metal screws with lock washers for the bracket, along with appropriately sized machine screws with lock washers for the sides of the radio, are packed into the TM-271A's box. The bracket is drilled in such a way as to allow numerous ways to install the radio. In my case, having numerous spacing options was critical in letting me get the bracket fixed securely to the limited metal and plastic I was afforded in the truck.

Additionally, there are several attitudinal positions you can choose to position the radio for best viewing of the display, in relation to where you're forced to put the bracket in your modern composite and plastic wonder wagon. The power cable supplied was long enough to get from the battery through the firewall and to the radio. However, the cable is actually two separate wires and I did choose to use electrical tape to make a single cable out of the pair of wires. It sure helped in threading the cable through the firewall and snaking it down the side of the engine compartment.

Whether local or "DX," I always got solid audio reports from those I spoke with. Many remarked on the clarity and fullness of the audio, a pleasing commentary, especially since I did not reveal what radio I was using. For the price, the Kenwood TM-271A provides a lot of value, especially considering the output power of the rig.

Manufacturer: Kenwood USA Corp, 3975 Johns Creek Ct, Suwanee, GA 30024-1265; tel 310-639-4200; **www.kenwood.net**. Price: $189.99. QST

The A&A Engineering 5 A Smart Battery Charger

By Joel R. Hallas, W1ZR
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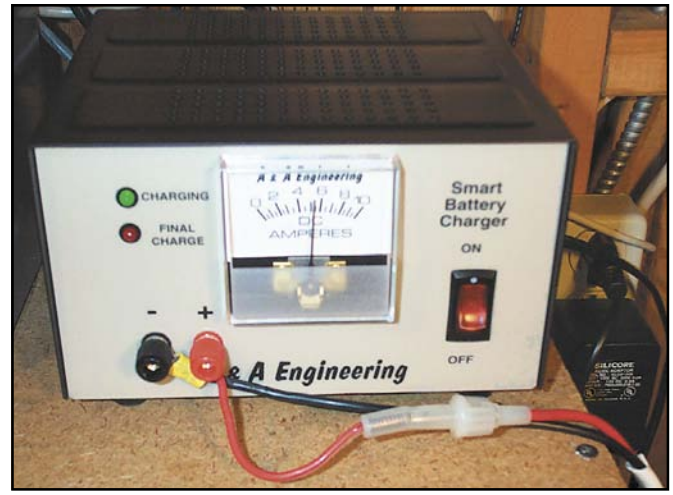
I received quite a few comments from readers about my article in December 2003 *QST*, "Emergency Power at W1ZR."[1] A number of comments were related to my note that I had significant RFI from the charger to filter. Further investigation determined that the culprit in the "smart switching" charger was from the switching function rather than the "smart" function.[2] Reader David Ferris, K5NT, suggested that I look into the chargers from A&A Engineering. Their chargers are smart linear (non-switching) units and the 5 A model seemed just right for my station.

I called A&A and spoke to Stas Andrzejewski, W6UCM, who noted that their chargers are particularly well suited to this application, since by their nature they don't generate RFI. The design of the charger is based on a *QST* article[3] describing the "smart" chip around which this unit is based. Their 5 A model uses an additional current amplifier stage to drive the series regulating transistors. We bought a unit for lab evaluation and found that while it's not quite in the "no RFI" category (see Figure 1), in comparison to representative marine switching smart chargers (see Figures 2 and 3), it is remarkably quiet.

Unlike many items, I suggest that you read the instruction sheet before trying this out. I blissfully plugged it in and turned it on. When I put a voltmeter on the output terminals (two color coded banana plug or ring terminal connectors), I was surprised to read 0.0 V. After checking fuses (both ac and dc sides are fused) and scratching my head, I noted that the instruction sheet clearly indicates that if the "battery" voltage is less than 6 V, the smart charger figures it is dealing with a dead or defective battery and puts out no power. The corollary is that this unit can't be used as a power supply unless a battery is connected (some equipment is just *too* smart!).

[1]J. Hallas, W1ZR, "Emergency Power at W1ZR," *QST*, Dec 2003, pp 41-44.
[2]J. Hallas, W1ZR, "Re: Emergency Power at W1ZR," Technical Correspondence, *QST*, Feb 2004, p 82.
[3]W. Dion, N1BBH, "A New Chip For Charging Gelled-Electrolyte Batteries," *QST*, Jun 1987, pp 26-29.



I tried it at W1ZR in place of the filtered marine charger I had been using and found that I could hear the difference—although in fairness, I don't think the residual RFI from my filtering would cause much of a problem. The physical characteristics are different, which may make a difference in some installations. The marine chargers are designed for bulkhead (translate to "wall" for non-boaters) mounting and thus take no shelf space. The A&A unit sits on a shelf, but also provides a useful meter along with LEDs indicating charge state. The A&A unit is also heavier and delivers a maximum of 5 A (our unit actually limited at 4.8 A, within specified ±5% tolerance) charging current rather than the 10 A of the marine units. In the analysis of my station's requirements, I concluded that I would need 5 to 6 A to keep the station running during fairly intense HF and VHF operation. I think if I were starting over, I'd go for the 5 A charger for about the same money and avoid the RFI problems altogether.

A&A Engineering, 2521 W LaPalma, Unit K, Anaheim, CA 92801; tel 714-952-2114; fax 714-952-3280; **www.a-aengineering.com**. *Price: $139.95 plus shipping.*

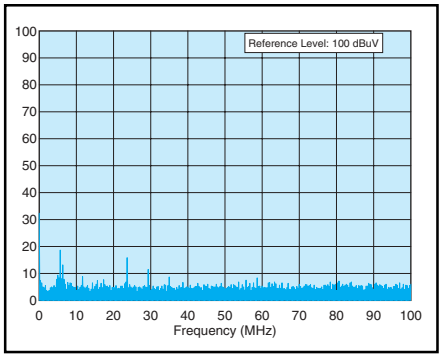


Figure 1—Spectral plot of the dc output of the A&A 5 A battery charger under load.

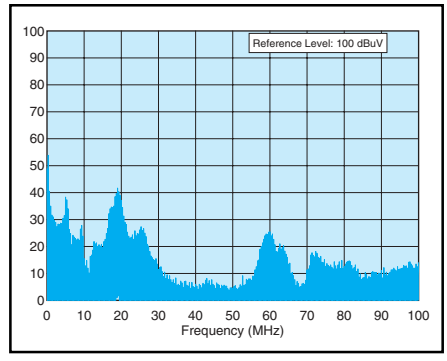


Figure 2—Spectral plot of the dc output of the Xantrex True Charge battery charger under load.

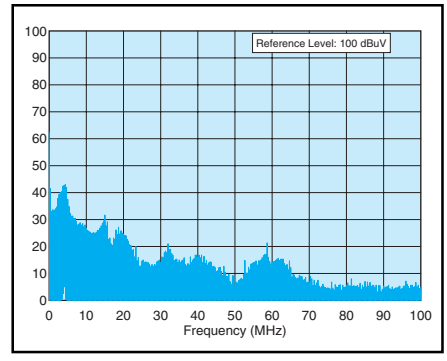


Figure 3—Spectral plot of the dc output of the Guest 2610 battery charger under load.

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Par Electronics SM-50 6-Meter Stressed Moxon Antenna

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What looks like a broken archery bow, weighs about three pounds, has a turning radius of about four feet and works better on 6 meters than it looks like it should? Give up? (Hint: Look at the big photograph on this page.)

The Par Electronics SM-50 is a clever version of G6XN's antenna for 6 meters. In case you aren't familiar with the Moxon rectangle, it's essentially a two element Yagi that has its element ends bent back toward the opposite element to form a rectangular creature. Aside from shrinking the antenna dimensions, this shape shifting actually improves the electrical performance of the antenna (for more detail, go to **www.cebik.com/radio.html**). In a nutshell, what the Moxon antenna gives is gain within a tenth or two dB of a traditional two element Yagi, while at the same time providing similar front-to-back and front-to-side performance to that of a three element Yagi. A three element Yagi will give about 2 dB more gain than a Moxon design, but will also weigh twice as much, have twice as much wind area and about one and a half times the turning radius. Not a bad trade-off.

The driven element of the SM-50 is made of a 7 foot section of $^{3}/_{4}$ inch square aluminum tubing, with a solid fiberglass center insulator. The stainless steel mast mounting hardware passes through the fiberglass insulator, and the box housing the matching components and the SO-239 UHF receptacle for the coaxial feed line attach to the driven element near the center as well.

The tricky part of the design is how the "bent" element ends and the reflector are constructed. The bent element ends are made from $^{5}/_{16}$ inch diameter round aluminum tubing, with center insulators of short sections of fiberglass rod. This keeps the element end spacing, a critical electrical dimension, stable regardless of any element flexing from the wind. When assembling the antenna, one end of each of the bent element ends is inserted into a hole in the square driven element aluminum tubing. The portion of the reflector that is parallel to the driven element is made from insulated Flex-Weave copper wire, with ring lugs soldered onto each end. Aluminum screws through these ring lugs into threaded holes in the bent element ends fasten the Flex-Weave wire to the rest of the reflector. The dimensions of the assembly are such that the Flex-Weave wire is taut; the bent element ends are placed under stress by the wire pulling them inward, holding them in place. Get it? It's a *stressed* Moxon antenna.

How Well Does it Work?

The SM-50 was brought to Mohawk Mountain in western Connecticut on Sunday afternoon of the 2003 ARRL September VHF Contest. Sunday afternoon isn't the most active of times, especially when the conditions are average as they were on that day. The wind was blowing and the rain was falling, both pretty hard at times. The wind gusts were over 30 miles per hour, and the rain was pouring to varying degrees.

My operating partner, W1XX, was quite skeptical of the whole thing, especially the small size of the SM-50, but he did like how easily the antenna went together; it took less than five minutes to assemble. The antenna was installed at the top of a 21 foot WonderPole. Using the 100 W output from an FT-847, close to 100 contacts were made in the approximately two and a half total hours of operation. Even on a dead band (somewhat of a major understatement), contacts were made out to about 400 miles to as far as the Pittsburgh, Pennsylvania area. Stations as far away as Montreal answered our CQs. Pretty good, eh?

The antenna did have a substantial null to the rear, as evidenced by how weak K1DG was off the back of the antenna, and how much stronger he was when the beam was turned toward him. The SWR was pretty low across the bottom of the band (50.0-50.5 MHz; as far as was checked), at least based on the in-van wattmeter. The rain didn't seem to affect the performance, and the wind didn't appear to make the antenna even flinch.

All the cleverness in the electrical and mechanical design of the SM-50 yields an antenna with performance almost as good as a three element Yagi in a package that is lightweight and durable, as well as easily and quickly assembled and disassembled.

Manufacturer: Par Electronics, Inc, PO Box 645, Glenville, NC 28736; tel 828-743-1338; fax 828-743-1219; **www.parelectronics.com/**, **w4op@parelectronics.com**. *Available from Amateur Electronic Supply and Universal Radio. Suggested list price: $79.*