The BEACON

West Mountain RADIO
Quarterly Newsletter

Quarter 3 - 2019

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Note: Discount only applies to the 4005, 4005H and 4008 models. No other discounts may be applied. Expires November 30, 2019.

Digital Modes News
by: Sholto Fisher K7TMG

WSJT-X

Big news for FT8 & FT4. K1JT has released WSJT-X v2.1.0 which brings FT4 to a finished state and offers improvement for FT8 along with a number of bug fixes. A 64 bit Windows version is also available.

All hams are encouraged to download this new version and follow the instuctions to “reset FT4 frequencies” as detailed on Joe’s website https://physics.princeton.edu/pulsar/k1jt/wsjtx.html

FT4 has been designed for HF contesting and I’m sure we’re going to be seeing a lot of action in this mode in the near future.

VARA

EA5HVK (Jose) has released a new version of his high-speed HF modem “VARA”. The new version is v3.0.2 and from July 27th all Winlink RMS stations will be using this new version.

Jose notes that the new version improves the S/N sensitivity which results in better performance in both good and bad HF conditions.

He goes on to say that retries have been increased to 10 (instead of 5) and the connection protocol is faster.

Also released is a new chat mode applicatoin which uses VARA as a peer-to-peer connection for transfering text and file transfers.

Upgrades to HF v3.0.2 are free for existing users and can be downloaded along with the new chat application from https://rosmodem.wordpress.com/

Free-DV

700D mode has now been ported to the SM-1000 so those of you owning these devices can now communicate in this remarkably robust digital voice mode.

The Free-DV PC/Linux/Mac software has included 700D for some time.
See https://freedv.org/ for more information.

Most digital voice activity is on 14.236 usb.

Bill Henry K9GWT, Cofounder of HAL Communications, SK

Sadly Bill has passed at the age of 78.

I have been a long time user and fan of HAL equipment and would like to extend my wishes to Bill’s family and HAL for his work and development of amateur digital mode technology (Clover). We wouldn’t be where we are today without Bill’s significant contribution.

Read more at http://www.arrl.org/news/hal-communications-cofounder-president-bill-henry-k9gwt-sk

73,

Sholto, K7TMG

Summits on the Air (SOTA) Sponsorship Search!

CQ SOTA ops ...

Are you an *active* North American SOTA operator? Do you know someone who is? Could your expeditions benefit from on-the-go solar power?

West Mountain Radio is looking to sponsor a SOTA activation in 2020 and would supply an Epic PWRgate to our chosen operator! To apply for sponsorship consideration, please send a brief bio of yourself, why you wish to be considered and photos of recent activations.

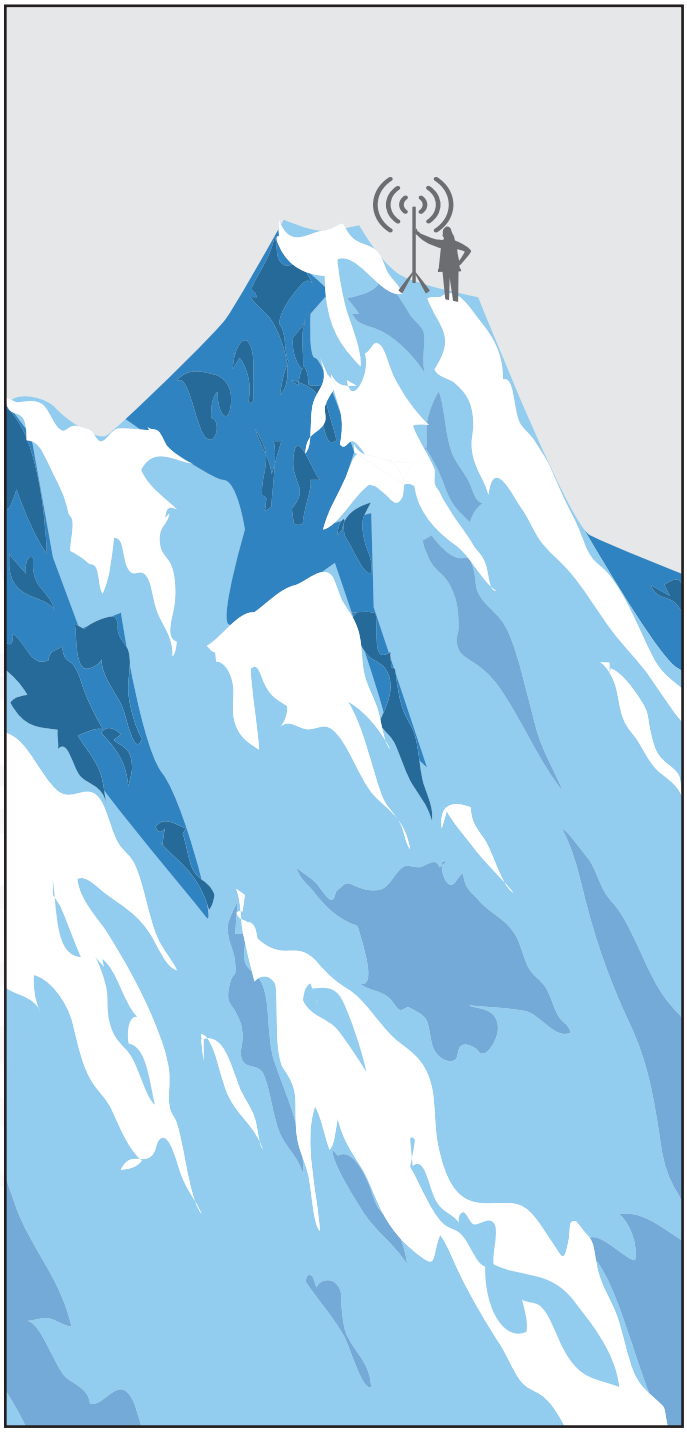
Photos and Bios can be emailed to:

marketing@westmountainradio.com

or postmarked and mailed to

West Mountain Radio SOTA Search
1020 Spring City Dr
Waukesha WI 53186

For information about the Epic PWRgate, check it out here! http://www.westmountainradio.com/product_info.php?products_id=epic-pwrgate



Please Note:
The submission Deadline is February 29th of 2020. The winner will be chosen shortly thereafter. Must be located in North America to be considered. Sponsored persons may be asked to give testimonies or reviews, along with photos of their mountain expeditions.

WE WANT TO HEAR FROM **YOU**!

If you would like to submit an article for consideration in future newsletters please contact marketing@westmountainradio.com

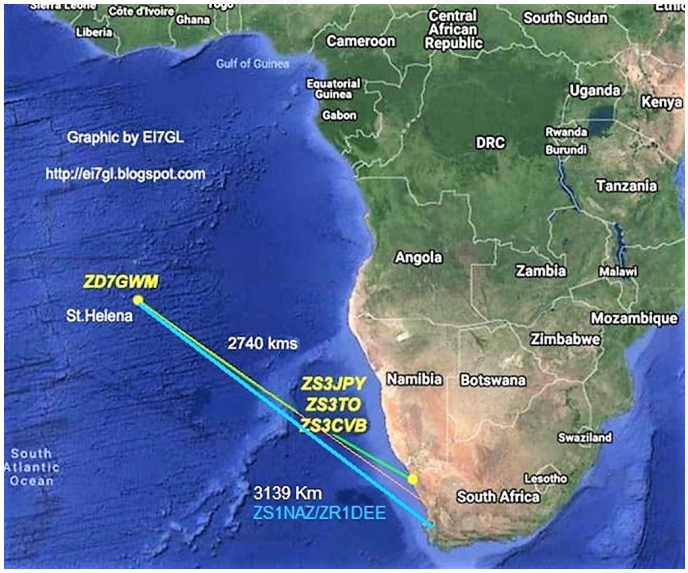
Vertical vs Horizontal Antenna Polarisation Benefits Questioned

by Hans van de Groenendaal

ee publishers

Published Online at:
https://tinyurl.com/yyy7kenn

Recent spectacular two-way communication between South Africa's West Coast Radio amateurs and St Helena during good tropospheric propagation condition has raised the question whether horizontal polarisation (H-Pol) of the antenna would yield better results than a vertically polarised (V-Pol) antenna.



144 MHz contact between South Africa and St Helena

Operating on the simplex frequency of 145,500 MHz making a two-way contact over a distance of over 3000 km does not happen every day. The amateurs on both sides were using vertically polarised antennas which started the debate. The convention says that H-pole antennas during tropospheric ducting conditions are preferred and should provide a gain advantage over V-pol antennas. It is, of course, important that both sides should use the same polarisation, which was the case with the St Helena contacts. This started a North-South debate that over the past years has become quite intense.

At a joint SARL/AMSATSA VHF workshop recently held in Gauteng, this subject was the main item on the agenda with a paper presented by Dick Coates (ZS6BUN) entitled "Are you serious about the last dB?" Coates did an intensive literature review and, coupled with experiential data from various radio amateurs, discussed the merits of both polarisations which proved that there was a marginal advantage using H-Pol over V-Pol. But does it really matter in practice? Well, yes and no!

Research into H-Pol and V-Pol started in the 1930s when the question was raised when one of the early TV stations in New York was planning to install their antenna on the Empire State building. The outcome was inconclusive so they decided on a compromise solution mounting the antenna at a 45-degree angle. It stopped the argument for some time but it did not prove anything.

By convention, the polarisation of an antenna is defined as the orientation of the electric field component of the wave it emits. For a yagi or a dipole this matches the orientation of the elements of the antenna. For many years, the "conventional orientation" for VHF and HF beams has been horizontal. Cross-polarisation losses, in other words, a V-pole antenna at one end and a H-pole antenna at the other end, can be large, up to 30 dB is often quoted.

Vertical vs Horizontal Antenna Polarisation Benefits Questioned

by Hans van de Groenendaal

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One of the misconceptions is that the polarisation of antennas is determined by the mode of transmission. For many years people believed that V-pol was best suited for FM modes. This idea came about because radio amateurs started using the FM mode when repeaters were established on the 145 and 435 MHz bands for mobile communication. It was simpler to fit a vertical antenna on a motor vehicle as it basically radiates omnidirectional while an H-pole antenna radiates directionally.
"Just recording audio or video of contacts with different antenna polarisations does not provide any reliable proof. One would need to set up two identical stations on either side with the ability to physically switch the antennas from V-pol to H-pol several times and take accurate signal strength readings with the AVC witched off. Simple readings on the s-meter built into the receiver will not work as S-meters are notoriously inaccurate", Coates said. "I have not come across any experiments as I have described."

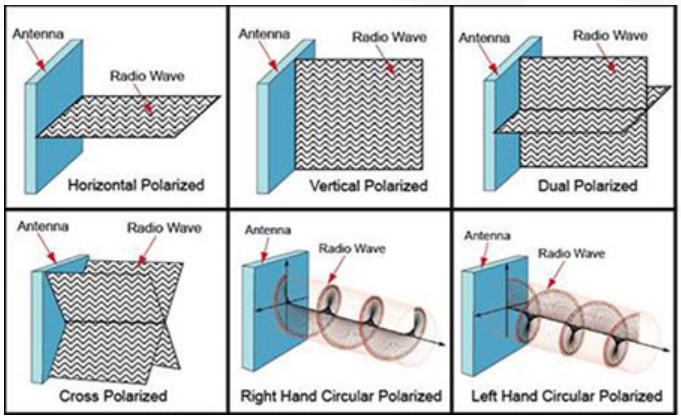

Image sourced from dataweek.co.za

From science we learn that an H-pole antenna is more efficient, even if it is relatively marginal, as ascribed to the electromagnetic characteristics (magnetic susceptibility μR, conductivity σ and relative permittivity εR) of the soil. However, under absolute perfect conditions there should be no difference between the two polarisations.

The question to consider is whether the signal at the other end is received in or out of phase. Transmitted radio waves can follow slightly different paths before reaching a receiver. The waves can arrive at slightly different times and will be slightly out of phase due to the different path lengths. Depending on the magnitude of the phase shift, the waves can interfere constructively and destructively. The path between the transmitted and received signals is described as the Fresnel zone named after physicist Augustin-Jean Fresnel.

If a signal is vertically polarised and it deflects off the ground the resulting signal will be inverted relative to the original signal. This means the high points of the sine wave are now low points, and vice versa. Hence the bounced signal will arrive out-of-phase, which will weaken the received signal.

If a signal is horizontally polarised and it deflects off the ground the resulting signal will be received in-phase resulting in a stronger signal.

Wikipedia has an interesting analogy. Place a mirror on the floor in the middle of a room, hold a flashlight on the other side of the room. The flashlight represents a signal and your eyes are the receiver. The mirror represents the ground. Move the flashlight move up and down representing vertical polarisation. Note that in the mirror, the flashlight moves in the opposite direction,

Vertical vs Horizontal Antenna Polarisation Benefits Questioned

by Hans van de Groenendaal

(Continued from previous page)

that is, it moves down and up rather than up and down. This is out-of-phase. Now have the flashlight move to the left and right representing horizontal polarisation. If you look in the mirror, the reflected image of the flashlight moves exactly in tandem with the actual flashlight. Left is left, right is right. This is in-phase.

For poor ground the modulus of the reflection coefficient for V-pol is lower than for H-pol. It is also dependent on the angle. For grazing reflections, the modulus premium of H-pol over V-pol is less. Antenna height also plays a part. The additional signal strength of H-pole over V-pole antennas has been calculated as between 3 – 4 dB, hardly noticeable for FM or SSB signals. The mathematical treatment of the ground wave reflection was developed some years ago by two European radio amateurs, Gaeten Horlin (ON4KHG) and Palle Preben-Hansen (OZ1RH). The 3 – 4 dB gain comes into play in weak signals modes such as in the WJT digital modes. Between the West Coast and St Helena, one would not notice the difference when tropospheric conditions are good. On the other hand, one would not use V-pole in attempting tropospheric propagation communication between the West Coast of South Africa and Brazil, here the 3 – 4 dB of the H-pole polarised antenna would come in handy. In theory a tropospheric contact on 144 MHz between the countries is possible but definitely using H-pole antennas.

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Authored by Hans van de Groenendaal

History of the N8XJK Battery Booster

by Dan Kemppainen

Voltage Drop. An unfortunate battle with resistance in 12-volt systems. Mobile operators everywhere are aware of it, and how detrimental it can be on the output power and operation of mobile radios. Every electrical connection, every fuse, every foot of wire has some resistance. This seemingly small number of ohms can add up. And when tens of Amps of current pass through those ohms, larger than expected voltage drops can appear. Combine this with internal resistance in batteries, and you have a recipe for low voltage and reduced transmit power at best, or at worst distortion and erratic operation.

Unfortunately, no one is immune to the laws of physics. Since the early days of the study of electricity, Georg Ohm clearly spelled a basic law; where current flows through a resistance, voltage drop will follow. It's just a simple fact of nature.

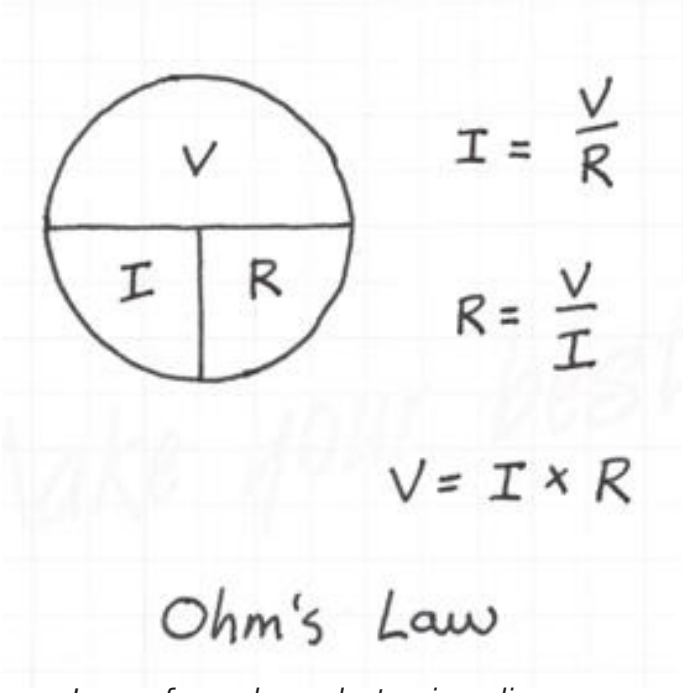


Image from - learnelectronicsonline.com

There are ways to combat these resistances to the flow of electricity. Simply reducing wire length, increasing wire diameters, and correctly selecting fuses and fuse holders can help. Using healthy batteries, and keeping them fully charged can also help. However, the reality is that not every battery is brand new, and not every wire can be short and large gauge. Even with a new battery, the battery AH rating is measured when the a full battery is drained down to 10.5V. Most amateur radios need at least 11.7V for transmit and even higher for full transmit power, leaving as much as half the energy in the battery. Emergencies do happen and long periods of operation are sometimes needed, squeezing every last bit of energy from those batteries could be important. Even the fuses, which are designed to operate by making a voltage drop, are devices we simply cannot live without!

Somewhere near 20 years ago, my father (N8BFL) was playing with a new mobile radio (one of many over the years!) and commented about the sensitivity of that new radio to low battery voltage. It would misbehave at voltages even approaching 12 Volts. This unfortunate discovery became the spark, literally, of a new project. The simple idea was to design a purpose-built switching regulator to convert battery voltage to something higher. Doing so would allow radios and equipment to operate from tired batteries and overcome the reality of voltage drops in wiring. Thus, the N8XJK Boost Regulator was born.

The very first version was quite humble, built from scrap PC power supply parts. It even lacked an enclosure (as many prototypes do.) It proved to solve the voltage drop issue by taking a little extra

History of the N8XJK Battery Booster

by Dan Kemppainen

(Continued from previous page)

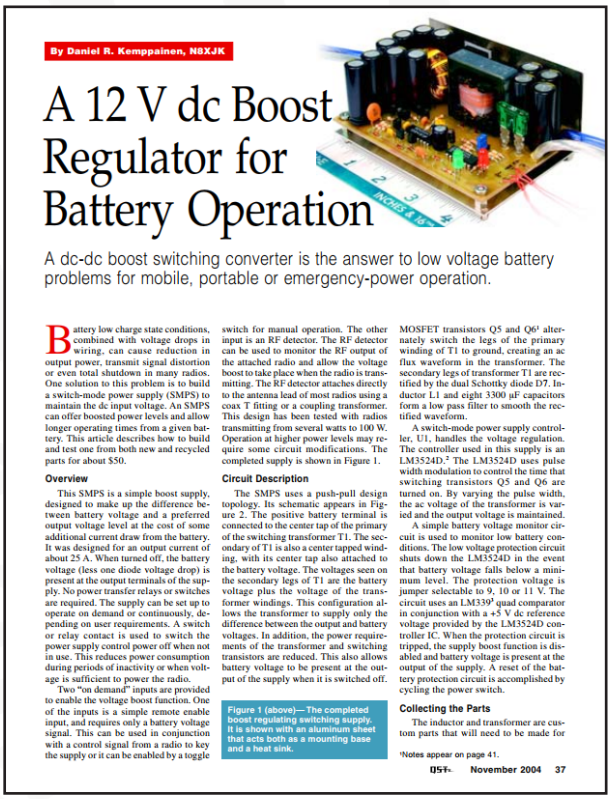
power from the battery and adding it to the battery voltage, to make a boosted voltage. Now that shiny new radio could operate from a battery many times longer with more output power than before.

As with all switching power supplies, there can be drawbacks, RFI being one of them. When discussing the problem, Dad suggested enabling the supply only when transmitting and maybe even by detecting the RF output of the transceiver itself. Boost usually is not needed when receiving, since receivers operate with low voltage much more agreeably than RF transmitters. The RF detect proved to be a good choice. Detecting transmit from current draw, or using a TR relay wouldn't always be reliable or easy. However, everyone has an RF connector on the back of their radio that sends out voltage when transmitting!

In all honesty, the second prototype wasn't much prettier than the first. It was, however, much quieter. It only turned on when needed, and wasn't much to look at, but it worked! Of course, this got the attention of another local ham, Jim (W8LTL SK) who also owned a mobile that would misbehave. So, another unit was built. It too was built into the power supply case that some of its parts were scrapped from.

One of the old TG Electronics Boosters

Under Jim's suggestion, an article was written and submitted to QST. Eventually, the article covering the build and operation of the N8XJK Boost Regulator was published in the Nov. 2004 issue of QST. Even later, an updated article was included in the 2007 ARRL Handbook. The proverbial snowball then began to grow.



By Daniel R. Kemppainen, N8XJK

A 12 V dc Boost Regulator for Battery Operation

A dc-dc boost switching converter is the answer to low voltage battery problems for mobile, portable or emergency-power operation.

Battery low charge state conditions, combined with voltage drops in wiring, can cause reduction in output power, transmit signal distortion or even total shutdown in many radios. One solution to this problem is to build a switch-mode power supply (SMPS) to maintain the dc input voltage. An SMPS can offer boosted power levels and allow longer operating times from a given battery. This article describes how to build and test one from both new and recycled parts for about $50.

Overview

This SMPS is a simple boost supply, designed to make up the difference between battery voltage and a preferred output voltage level at the cost of some additional current draw from the battery. It was designed for an output current of about 25 A. When turned off, the battery voltage (less one diode voltage drop) is present at the output terminals of the supply. No power transfer relays or switches are required. The supply can be set up to operate on demand or continuously, depending on user requirements. A switch or relay contact is used to switch the power supply control power off when not in use. This reduces power consumption during periods of inactivity or when voltage is sufficient to power the radio.

Two "on demand" inputs are provided to enable the voltage boost function. One of the inputs is a simple remote enable input, and requires only a battery voltage signal. This can be used in conjunction with a control signal from a radio to key the supply or it can be enabled by a toggle switch for manual operation. The other input is an RF detector. The RF detector can be used to monitor the RF output of the attached radio and allow the voltage boost to take place when the radio is transmitting. The RF detector attaches directly to the antenna lead of most radios using a coax T fitting or a coupling transformer. This design has been tested with radios transmitting from several watts to 100 W. Operation at higher power levels may require some circuit modifications. The completed supply is shown in Figure 1.

Circuit Description

The SMPS uses a push-pull design topology. Its schematic appears in Figure 2. The positive battery terminal is connected to the center tap of the primary of the switching transformer T1. The secondary of T1 is also a center tapped winding, with its center tap also attached to the battery voltage. The voltages seen on the secondary legs of T1 are the battery voltage plus the voltage of the transformer windings. This configuration allows the transformer to supply only the difference between the output and battery voltages. In addition, the power requirements of the transformer and switching transistors are reduced. This also allows battery voltage to be present at the output of the supply when it is switched off.

Figure 1 (above)—The completed boost regulating switching supply. It is shown with an aluminum sheet that acts both as a mounting base and a heat sink.

MOSFET transistors Q5 and Q6[1] alternately switch the legs of the primary winding of T1 to ground, creating an ac flux waveform in the transformer. The secondary legs of transformer T1 are rectified by the dual Schottky diode D7. Inductor L1 and eight 3300 µF capacitors form a low pass filter to smooth the rectified waveform.

A switch-mode power supply controller, U1, handles the voltage regulation. The controller used in this supply is an LM3524D.[2] The LM3524D uses pulse width modulation to control the time that switching transistors Q5 and Q6 are turned on. By varying the pulse width, the ac voltage of the transformer is varied and the output voltage is maintained.

A simple battery voltage monitor circuit is used to monitor low battery conditions. The low voltage protection circuit shuts down the LM3524D in the event that battery voltage falls below a minimum level. The protection voltage is jumper selectable to 9, 10 or 11 V. The circuit uses an LM339[3] quad comparator in conjunction with a +5 V dc reference voltage provided by the LM3524D controller IC. When the protection circuit is tripped, the supply boost function is disabled and battery voltage is present at the output of the supply. A reset of the battery protection circuit is accomplished by cycling the power switch.

Collecting the Parts

The inductor and transformer are custom parts that will need to be made for

[1]Notes appear on page 41.

QST • November 2004 37

The original 2004 QST Article

Fast forward a few years, and there was considerable interest all over the world, with many people needing these battery boosters. The need to combat the seemingly small voltage drops still existed. Ohm's law was alive and well! A chance conversation with Tim Gerdeen prompted him to express interest in building boosters for those who wanted them built and tested. Tim's small repair shop, TG Electronics, soon began selling tested boosters.

History of the N8XJK Battery Booster

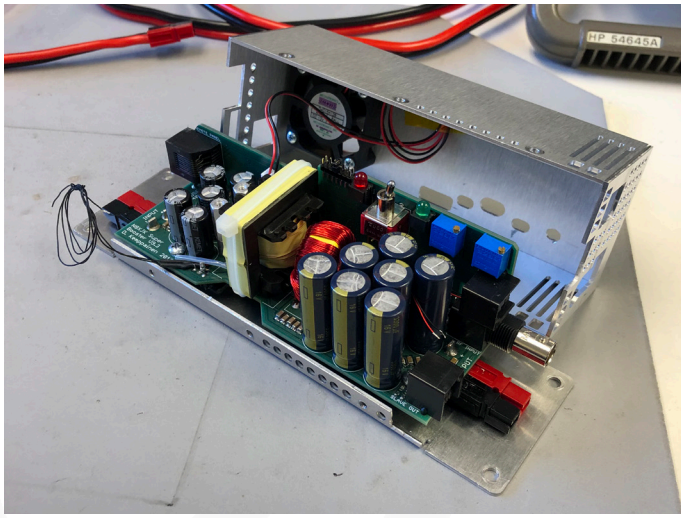
by Dan Kemppainen

(Continued from previous page)

Eventually we offered different versions from the standard 25 Amp N8XJK Boost Regulator, the 40Amp N8XJK Super Booster, all the way up to 80Amp and 120Amp boosters. They were shipped around the globe. At times, Tim hired others to help build and test the units, and for almost 15 years he took orders and shipped boosters. The need for the product continued. Unfortunately, Tim's health did not, and with his passing, TG Electronics had to be closed down.

They say things have a way of working out, and this is certainly true for the N8XJK Super Booster. There had been plans for a new generation of boost regulator, a design where all of the lessons of the last two decades could be combined. So this is where West Mountain Radio enters the picture. The folks at West Mountain Radio are no strangers to 12-volt power systems, and they understand the need for such a device. Through this collaboration with West Mountain, I was able to design and build a new N8XJK Super Booster.

The results of this design are really exciting. It's given me the opportunity to include many of the ideas dreamed up, many of the suggestions from users, and advances in electronics technology in the last 20 years. It is still the same basic booster, we are going to stick with what works. But this proven design has a lot of improvements that will really add up. The unit is smaller, includes Anderson Powerpole® Connectors, has a temperature controlled fan, thermal shutdown, and more voltage jumper selections for low battery voltage protection. It can even be paralleled for more output current!



Prototype of the new unit

In the last two decades it has always been neat hearing from people using the boosters. The feedback and stories have been fun to read. Operators have been using these boosters for years for radio communications in the amateur bands, as well as commercial users in fire and rescue, trucking, bussing, and police installations. It's good to know that this little design will continue to serve them well. After all, Georg Ohm's law isn't going to change any time soon!

73,

Dan, N8XJK

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