West Mountain Radio

# Fall 2012 Newsletter

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## UPCOMING HAMFESTS

| | |
|---|---|
| Mid-Winter Swapfest<br>Waukesha, Wisconsin | 1/5/2013 |
| *Winterfest*<br>*Collinsville, Illinois* | *1/26/2013* |
| *Hamcation*<br>*Orlando, Florida* | *2/8/2013* |
| *Mike & Key Electronics Show*<br>*Puyallup, Washington* | *3/9/2013* |

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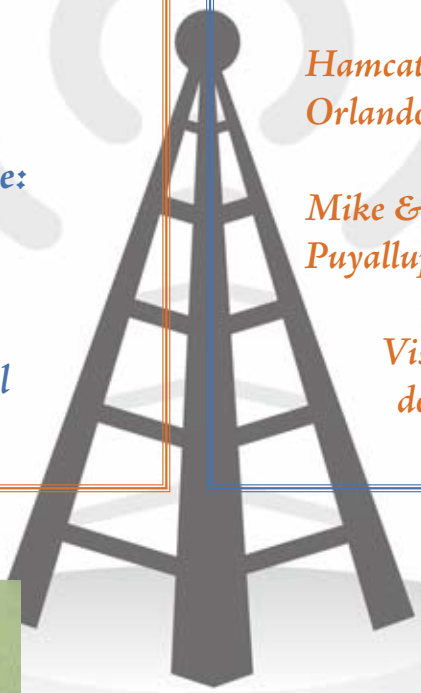


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# Battery Back-Up Power During An Emergency

by K7TMG - Sholto Fisher

With the recent events of Superstorm Sandy in mind, hopefully this article will cast a little light for using a battery for powering radio equipment during times of emergency.

First and foremost, the source of energy most useful to rely on is from the lead-acid storage battery. There are good reasons why this is so, including factors such as capacity, economy, safety and reliability.

An appropriate sized lead-acid battery can keep your radio and other equipment powered for long periods of time, especially if you understand some basics about lead-acid batteries.

As an example, let's take a look at the Power-Sonic PS-12350 battery we recommend for the West Mountain Radio "U1 Battery Buddy DC-to-GO box w/RIGrunner 4005" product.
See http://www.westmountainradio.com/product_info.php?products_id=u1_buddy

I like Power-Sonic batteries because they make comprehensive data-sheets for their products available on their website. Without such data it can be difficult to know whether your battery is performing within manufacturer's specifications. You can also ensure battery longevity by keeping within the parameters recommended in the data sheet.

The PS-12350 data sheet can be downloaded from:
http://www.power-sonic.com/images/powersonic/sla_batteries/ps_psg_series/12volt/PS-12350_12_Aug_27.pdf

One of the first things we note is that this battery is an AGM type (absorbent glass matt). It is a *sealed lead-acid battery* (SLA) and therefore is spill-proof and valve-regulated. This is important for safety considerations. It means that during charging the battery will not vent Hydrogen (an explosive gas) and should the battery be moved there is no chance that sulfuric acid will be spilled.

These are the main concerns you should have if deciding between a *wet-cell lead-acid battery* (automotive type) versus a sealed battery. Note that many "deep cycle" marine or RV batteries are actually wet-cell lead-acid batteries and will vent Hydrogen during charging. In my opinion, they aren't suitable for indoor charging as the risks of Hydrogen build-up and explosion are too great.

Going back to the data sheet for the PS-12350, perhaps the most useful parameter we are interested in is Nominal Capacity. This data tells us a lot about what we can expect from such a battery during emergency use.

One of the surprising things to note is that battery capacity is not a fixed value. For practical purposes it is primarily dependent on the current drawn from the battery. This is why most SLA battery capacity is defined "at the 20-hour rate" – i.e. *the value of average current you can expect to get from the battery over a 20 hour period*.

We can see the PS-12350 has a capacity of 35AH (amp-hour) at the 20 hour rate. This is further defined as supplying 1.75A (continuously) for 20 hours until the terminal voltage (under load) would reach 10.5V.

Note also the 1 hour rate. This battery could safely supply 25A (continuously) for 1 hour until the terminal voltage reaches 9V.

Let's now consider some typical radio equipment and determine whether this battery is a "good match" for emergency purposes.

A **typical 100W HF** radio will use approximately 1-2A on receive and up to 25A during transmission peaks. Most HF radios require 13.8V DC +/-15% (12V DC to 15V DC) for proper transmit operation.

As the battery terminal voltage will change under load, this would severely limit the transmit-operating time. Clearly a higher capacity battery would be called for if you expected to be able to transmit for any reasonable length of time at full power.

For receive only, you could expect the battery to last perhaps between 10 and 20 hours. **Our higher capacity batteries in group 24 and group 33 sizes would be recommended here – see our website for details**.

A modern **2m 50W "mobile"** transceiver will require approximately 0.6A on receive (while squelched) and up to 10A for transmit on full power. At the 10W level you can expect typically around 5A drawn.

Again, mobile rigs are usually specified as requiring 13.8V DC +/-15%. Extrapolating from the capacity data, we might expect this battery to power the radio for a full day with light duty transmit at the 10W level.

A **SSB/CW QRP** radio like the Yaesu FT-817 requires around 0.35A on receive and up to 2.5A on transmit peaks at 5W full output. Based solely on RX current we could expect the battery to power this radio for perhaps 2.5 to 3 days.

We have a longer operating time with radios like this because they are rated to operate down to much lower supply voltages (in this case around 9V) than other radios. Medium duty transmit will perhaps bring the figure to half that amount.

Many **handheld radios** have a 12V DC input. Depending on the make/model some will allow completely powering the radio from this jack. An example is the Yaesu FT-60R.

The input voltage can be from 6-16V DC and the radio requires as little as 45mA on receive (if the battery saver option is enabled) and up to 1.5A for transmit at 5W.

Potentially we might expect up to a full week's worth of use when connected to the PS-12350. You also have the internal HT battery which will extend operating time significantly.

These are some of the "back of the cigarette-packet" calculations I use when choosing a battery for emergency use. They can only be a guideline because so much is dependent on how you use your transceiver and any other equipment you expect to power.

As with many things in Amateur Radio, keeping it simple is often the best policy.

A handheld transceiver with a directional antenna may easily outperform a VHF mobile radio/whip

## Be Prepared with a DC-to-GO Box or a U1 Battery Buddy

*www.westmountainradio.com/content.php?page=battery_boxes*

# MARS HF Digital Communications to Military Standards using PC Sound Devices

by N2CKH - Steve Hajducek

MARS is now making use of the PC Sound Device as the hardware component for software based high symbol rate Military data modems to achieve interoperable communications with Military hardware based modems in support of DoD contingency communications. This is the most economical approach but one which presents challenges to both the software developer and the end user due to the high symbol rates involved, which requires audio quality, sample clock accuracy and sampling latency in the class of streaming audio applications.

A little or perhaps a lot of history is required. For many decades the MARS program used Radio Teletype (RATT) in the form of Baudot RTTY as did its Military sponsors and Government customers. However during the 1980's the Military moved away from Baudot RTTY to newer binary capable diversity FSK schemes, MFSK ALE waveforms and then to high speed single tone PSK data modems with optional 16 tone DPSK and 39 tone QDPSK waveforms on HF. MARS however could only continue use of MIL-STD Baudot RTTY, which the Military continued to use and which was the standard when I joined MARS in 1981.

MARS did however add modern RTTY mailbox operations as personal computers started to come into use by MARS members. MARS also began to allow the use of new Amateur Radio and Commercial protocols that were coming into common use on Amateur bands, to include 110 and 300 baud ASCII, which was next to worthless on HF. However this practice allowed MARS members that were embracing the PC in their stations to use AMTOR, derived from Maritime SITOR that was error correcting and far superior to Baudot RTTY on poor channels and later PACTOR which had the best of both Packet and AMTOR and was even better than AMTOR and then came GTOR, my personal favorite. By the mid 90's MARS was using both AMTOR FEC and PACTOR FEC heavily for peer-to-peer and ARQ, however FEC fit the MARS model better for nets as all hands could monitor the traffic without the confusion of monitoring the ARQ repeats. Although ARQ in nets was used by two linked stations for error free exchanges, it was more used with Mailbox and BBS operations using modified AA4RE and MSYS BBS software. Then the Sound Card revolution came about on the HAM bands with such new modes as MT-63 and later Olivia becoming MARS staples for peer-to-peer. During the same time the HF BBS system went from being radio-to-radio based to radio-to-Internet with the evolution of Winlink to Winlink 2000 and the eventual introduction of WINMOR on the sound device in addition to PACTOR.

All of these developments were advances for the volunteer MARS member and as they mimicked what they were using for Amateur communications, they were dual use and were relatively inexpensive when compared to the cost of Military modems. The Sound Device made things even more economical and MT-63 even started to replace the use of AMTOR FEC and PACTOR FEC for Voice/Data nets due to the cost of hardware TNC's compared to sound devices. Eventually MARS dropped the use of RTTY early in this century. About that time due to MARS support of SHARES, those MARS members that are authorized SHARES members had been acquiring surplus Military grade and used Commercial grade ALE radios and in addition to those equipment filtering into members hands, some members that could afford to do so where buying new commercial ALE radios.

Then use of ALE was authorized for use on MARS frequencies, however ALE radios were in very limited supply due to the cost of the used equipment, let alone the new ALE hardware. Many in MARS, to include myself, saw the need for MARS to have the capability of current Military standards based digital communications by all MARS members, even though the MARS mission at the time seemed to be moving further away from supporting its Military sponsors. We foresaw the requirement of interoperable digital communications to the current Military standards to at least to some level with that of our Military sponsors. Thus in 2004 I became involved with an effort of developing a software based ALE modem/controller under MS-Windows using the PC Sound Device as the modem's hardware. At first I reviewed the U.S. Government sponsored ALElite open source solution offering some basic ALE functionality. But thanks to collaboration with Charles' Brain, G4GUO, my efforts were ultimately based on his PC-ALE application and became known as MARS-ALE. Thanks to Charles work on the most recent version of PC-ALE at that time, MARS-ALE got off to a good start as he had just developed the latest version of MFSK ALE, Alternate Quick Call-ALE (AQC-ALE) with the optional AQC-ALE PSK Burst Waveform (a subset of the PSK burst waveforms used for PSK 3G ALE) which required the MIL-STD-188-110A PSK data modem. He also provided the FED-STD-1052 Appendix B Data Link Protocol layer for Broadcast and ARQ, features only found in the latest Harris Military Tactical ALE radios. I was able to successfully test both ALE and AQC-ALE in MARS-ALE against Harris tactical radios during Grecian Firebolt in 2005. Next a new Tri-Service MARS dedicated ALE network was created with pooled frequencies from all three MARS services and testing and training on ALE was undertaken.

The powers that be in MARS at the time were only interested in basic FED-STD-1045A ALE requirements to follow on with Voice and the TNC's modes MARS was already using, thus support of the radio equipments and TNC commonly used by MARS members was added to MARS-ALE. There was little interest in the advanced ALE features or the high speed MIL-STD data modem. An ALE specific interface to WL2K called BBSlink was also developed to support the ALE AMD and DBM ARQ protocols. But ALE within MARS was a tough sell for MARS-to-MARS as it faced the Amateur Radio mindset problem of hands on the VFO and the radio operator must be in control as well as the need for radio computer control and broadband antennas or fast automatic antenna tuners and quite frankly still does. In addition, it's not 2G ALE that is used to move message traffic in the Military or Government comms use of ALE, it's the MIL-STD PSK data modem after the ALE link on via non-ALE single channel operation. Then with MARS moving further and further away from supporting its Military sponsors at the time, ALE became less of an interest and as WL2K came into wider MARS use and training on it by MARS took focus, the point came where Army MARS even removed authorization for it on all Army MARS frequencies in 2007 but allow Army MARS members to use ALE in support of customers such as SHARES and for interoperability with Air Force and Navy MARS.

However, times have changed and both ALE and MIL-STD data modems are in demand by MARS. By Department of Defense Instruction 4650.02, dated 23 December 2009 the status of MARS changed from an Affiliate to an Auxiliary, equal in status to the U.S. Coast Guard Auxiliary and Civil Air Patrol. This change in status placed MARS into the position of once again having missions in support of its Military sponsors and requiring interoperability of HF digital communications and inquiries from MARS command levels coming my way by mid 2010 for stand alone software based Military data modem solutions for interoperability with Military modems. The first thing Army MARS did was reintroduced the use of ALE and then MIL-STD Baudot RTTY and authorize the use of MIL-STD PSK.

There are currently two main types of modems favored by the Military and Government users of HF digital communications in the free world. One is the FSK 8 tone 125 baud symbol rate 375bps data rate modem used for 2G Automatic Link Establishment (ALE) signaling and ALE data mode communications. The other is a single or serial tone 8PSK 2400 baud symbol rate class of modem used for 3G ALE PSK Burst Waveforms and for 2G ALE follow on or stand alone PSK/QAM Data Modem communications. The current U.S. Military standards that detail these modems are MIL-STD-188-141C and MIL-STD-188-110C. There are also various NATO Standard (STANAG) versions of what are basically the same modems and waveforms and two additional waveforms specifically developed for Broadcast applications, STANAG 4285 and STANAG 4529, the later being a 1200 baud symbol rate narrow bandwidth waveform. The use of ALE by MARS is being relearned and with many new MARS members, is being learned for the first time. The use of MIL-STD RTTY is familiar to the old timers and being learned by many of the new MARS members. What is new to all MARS members is the use of MIL-STD PSK RATT using 110A ASYNC, which is being used in a similar manor within MARS as was MT-63 and all other peer-to-peer modes that have previously been used, with the exception of being interoperable with the Military.

For those MARS members that are not able to purchase a hardware MIL-STD data modem, I have created the MS110A Data Modem Terminal (DMT) software application. It currently offers MIL-STD-188-110C 75bps-4800bps data rates or what is known as MS110A Serial Tone modem which modulates an 1800hz PSK carrier at a 2400bps symbol rate for a signal covering 300-3300hz requiring a 2.75Khz SSB filter with low group delay. The clock accuracy for generation of the 1800Hz carrier must be within +/-1 Hz. Since the transmit channel symbol duration is less than one cycle of the 1800Hz carrier, the waveforms controlling the sine and cosine components must be filtered to prevent severe aliasing. The “Coded” that is to say Forward Error Correcting (FEC) with Interleave option data rates are 75, 150, 300, 600, 1200 and 2400bps where 4800bps is “Uncoded”, that is to say no FEC or Interleaving. The 75bps data rate uses a Direct Sequence Spread Spectrum (DSSS) scheme where a low data rate signal is modulated with a high rate pseudorandom sequence producing a 3KHz signal with a small amount of noise for the conventionally modulated signal. The symbol rate in all cases is fixed at 2400bps and all data support is 8 bit. In addition to the internal data entry and display of messaging which is limited to ASCII only, at the screen bottom is a single line outgoing message window for rapid peer-to-peer messaging that sends on the Enter key stroke of up to 1024 characters of text.

I also implemented an external RS-232 Asynchronous serial data port as provided by some 110B class hardware data modems. The data port is coded to support the “High Speed ASYNC” operation that debuted as an option in MIL-STD-188-110B so that compatible 110A SYNC Over-the-Air (OTA) operation can be achieved using today’s common PC 9-pin serial ports without the need for expensive Synchronous interfaces. The DMT application provides a straight forward user interface with all the most used controls on the main screen to support easy setup even when changing between radios or ALE vs. non-ALE use. A terminal tool used for ACP-126 and ACP-127 Military messaging with hardware modems has seen extensive DMT use. A CRC block based terminal has been developed strictly for MARS-to-MARS comms that supports error free file transfer via the DMT data port where any missing blocks can be requested for resending.

The challenges with using the PC Sound Device and MS Windows are many and compounded by the use of 110A without using ARQ and its short packets. The user must mitigate Windows latency caused by such things as networking, especially wireless

networking. Then the sound device must have a low sample clock error, with good stability and low jitter, especially at the higher data rates, on board AC'97 in laptops for example are no good for more than 600bps, PCI sound cards may provide 1200bps, thus external sound devices provide better performance at and above 600bps. On the lower data rates below 300bps the worse the sample clock error the sooner sync is lost the longer the message is regardless of the channel conditions, the best results are had with sample clock error less than +/-10ppm. When using USB port external devices the port on the PC that provides minimum sample clock error must be used and the use of external hubs must be avoided.

The next modem planned for inclusion is STANAG 4285 which provides synchronization during the entire message transmission rather than just at the start of the transmission as does 110A, making it much better suited for RATT type operation. STANAG 4285 was designed for NATO NAVAL Broadcasts where it's basically transmitting for hours or days non-stop whereas 110A was designed for Adaptive ARQ operation and thus provides Auto Detect at transmission start of data rate and interleave settings and short packet transmissions, STANAG 4285 is not Auto Detect, which means all stations must be set to the proper data rate and interleave being used before hand.

To date the MS110A DMT software has been tested against a number of hardware modems using both ASYNC and SYNC modes and with the current external terminal programs being used in MARS with hardware modems via the DTM external data port and has been found to be interoperable in all cases. The MARS programs have used the software in numerous exercises and actual support roles over the last year during its development with excellent results.

To learn more about these MIL-STD data modems the following document was written from a MARS members perspective new to the subject matter:
http://www.n2ckh.com/MARS_ALE_FORUM/MIL-STD_MODEM_PRIMER.pdf

# Characterize a Solar Panel

**by West Mountain Radio Staff Engineer**

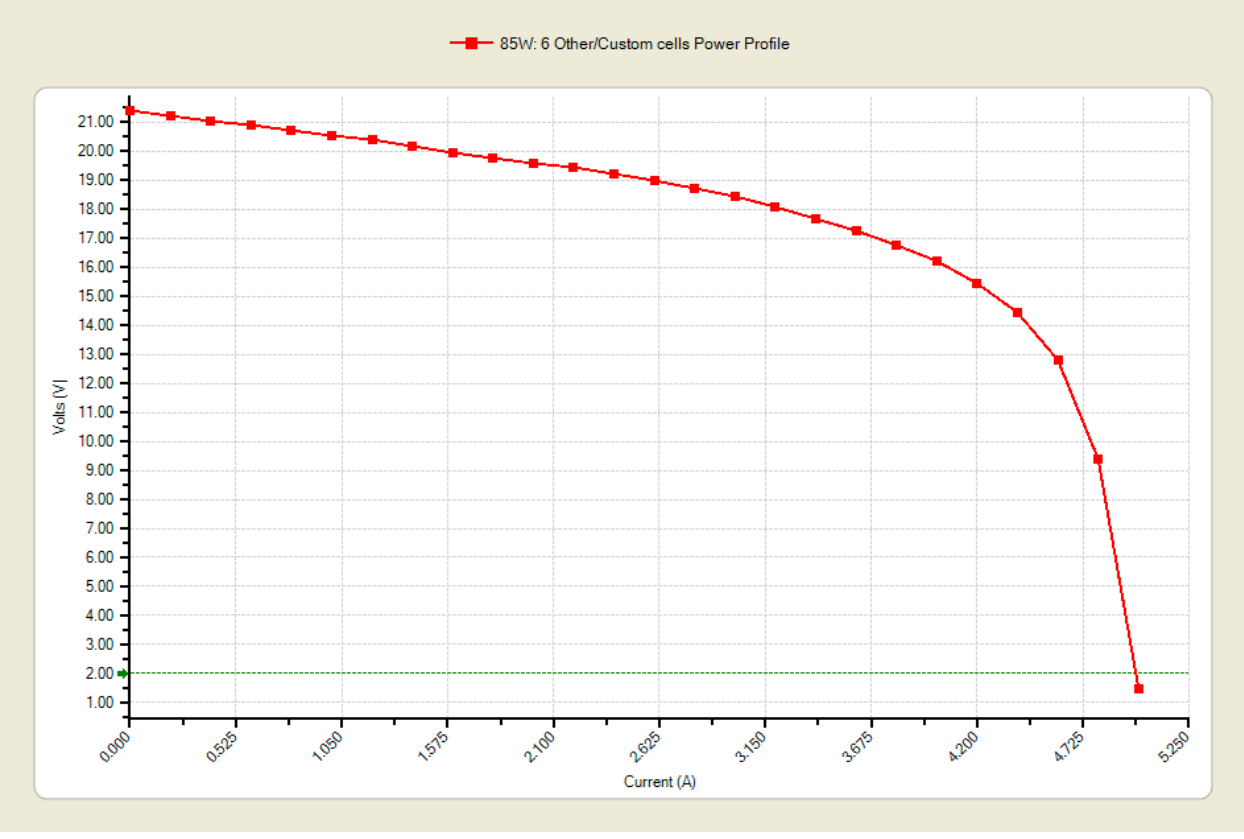
One of the exciting new features on the WMR Computerized battery Analyzer (CBA) is the ability to characterize a Solar panel. Solar panels have a dramatic drop in output voltage as the load increases. The CBA can sweep the panel by varying the load to see how the panel reacts. Figure 1 shows a simple current vs voltage chart in direct sunlight for one panel. Notice as the load gets greater the voltage drops until there is a point at which the panel is of no use.

An interesting characteristic of a solar panel is what is referred to as the maximum power point. If you take each point on the graph and multiply the voltage times current to get power then you get the chart shown in figure 2. You can now see that the power output from the panel has a sweet point (or semi-sweet range). It is in this range of a load that the panel delivers the most power. Using a solar panel to charge a battery this is the charge level you want to use.

When characterizing a panel you will want to try it under different sunlight conditions. For example bright sun directly to panel, bright sun at an angle to the panel, cloudy day, so on and so forth.

To charge a battery from a solar panel you may be able to just connect the panel through a diode to the battery. Controllers will regulate the charging to manage an optimum charging algorithm for the battery and/or to maintain the maximum power draw from the panel. Some controllers pulse the power from the panel at a low frequency to regulate the power and others are essentially a switching power supply to translate the voltage to the desired voltage and to regulate the current. The primary concern for radio use is to be sure to pick a controller with low RF noise.

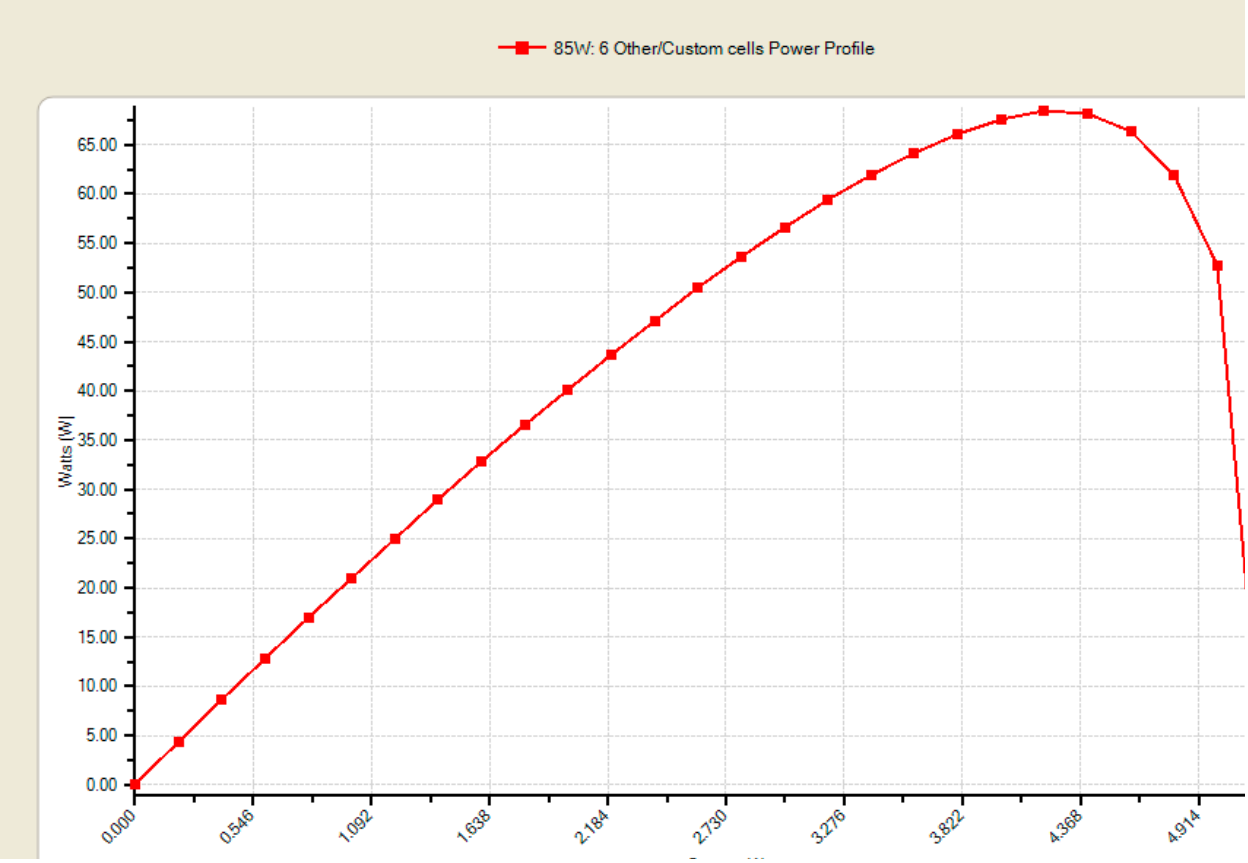
Figure 1



Many of our customers want to use a solar panel with the PG40S as an alternate way to charge the battery when away from AC. Connect the solar charger directly to the battery, along with the PG40S. Usually, you will want to use a controller between the panel and battery to get the optimum charging.

Details on solar panel testing, future products, testing charts and other information, visit: www.westmountainradio.com/solartest

Figure 2




# NEW PRODUCT

## CBA Charger

#58254-1424 $99.95


- Use with a CBA IV and your battery charger to automate life cycle tests, automatically alternating between periods of charging the battery and discharging the battery. By automatically switching between charge and discharge cycles of the battery, a hands-free lifetime test of the battery can be performed.
- CBA Charger interface requires a user provided battery charger compatible with your battery. CBA Charger interfaces to this external charger.
- Measure the current going from the charger into the battery, and this current is logged by the software.

For details and specifications: http://www.westmountainradio.com/product_info.php?products_id=cba_charger

# *The Antenna - Part 2 of Series*

***by W9TSQ - Michael Martin***

**Multiband Antennas:**

Today's state of the art radios seem to cover most all of the HF and lower VHF amateur bands just fine. The better ones have several antenna connectors that can be assigned to band specific antennas. The amateur then has a choice to have a good performing antenna for the particular bands of interest, or one that is designed to be somewhat useable on several bands.

The Log Periodic is a classic broad band directional antenna that was used extensively by the military and the FCC monitoring stations for broad frequency monitoring. With multiple resonant elements and phasing lines it will perform across a very broad band, …but not very well. This may be OK for receiving but it may provide for difficult and marginal matching for transmitting. Another detrimental side effect is that it will also work well at transmitting the unwanted harmonics of your transmitter.

The Multi Driven Element "Tri-band Beam Antenna" is one of the few multiband beams that can be a good performer. It's like a Log Periodic, but with the attention to band specific tuning for three bands, the parasitic loading is minimized with the active elements covering only a specific frequency range. Again, another detrimental side effect is that it will also work well at transmitting the unwanted harmonics of the transmitter on higher amateur bands.

The Multiband Vertical antenna for Amateur Service is another antenna designed for the all band radio of today. They are basically several ¼ Wave elements driven by, and matched into a single coax. Like any resonant antenna, it needs to be carefully tuned to a single frequency on each band.

The G5RV antenna seems to be another of the popular all band compromise antennas. It is a basic offset dipole fed with a resonant matching stub of Openwire Feedline or Twinlead, and a random length of coax. The resistive and reactive impedances can be extreme at some points of the antenna and matching section and is not constant for any band. It also needs to be noted that the internal tuners in the radio are good for tuning out that last bit of Feedline Mismatch but in most cases have range limitations. They may be too limited for feeding the G5RV Antenna directly on some bands. Count on having a good external antenna tuner handy to match into your transmitter. The resulting antenna patterns can be multi-lobed but with more predictable nulls on some bands.

The Random Long Wire Antenna, with a good external antenna tuner can be resonated to radiate on most any band. Again, care needs to be taken that the impedance seen by the transmitter's internal antenna tuner is within an acceptable range. The resulting antenna patterns can be even more unpredictable with many deep nulls. Keeping your station well ground referenced is very important with a long wire antenna to keep stray RF out of the shack.

With any of these antennas, be careful if you intend to run much over 100 watts of power. With extreme impedance matching can come extreme RF Currents and extreme RF Voltages. Station Grounding again is important to keep RF Currents off your fingers and lips, and going out the antenna where they belong.

We will have more on Antennas, Antenna and Station Management Products in subsequent newsletters. Like all new things from West Mountain Radio, they will be worth waiting for.

# Recent Notes from the Frontline . . . K7TMG - Sholto Fisher

**WinMOR/RMS EXpress**

For those interested in Winlink 2000 on HF using WinMOR you may be interested to know the RIGBlaster Advantage has recently undergone testing with Rick Muething, KN6KB of the W.D.T (Winlink Development Team). He made some interesting comments regarding the RIGblaster Advantage and I'll summarize them here:

"Using the VOX setup (most convenient) the Transmit to Receive latency as measured by WINMOR (measuring release of PTT or End of transmit audio to first received audio) was a very good 40-80 ms.

The WINMOR spec is < 250 ms. Of course one has to set the VOX delay to minimum ...just as in the SignaLink USB. My over the air connects were good and I had no problem setting the drive level to get full RF output without splatter. Receive audio level could be easily set using the radio's speaker and Rcv Level controls.

I will make sure we have the Rigblaster Advantage listed in the approved Sound Cards/Interfaces in the WINMOR and RMS Express Help."

**MARS ALE/MIL-STD-188-110A**

On a similar thread, two RIGblaster Advantages are with Steve Hadjucek, N2CKH/NNNOWWL for evaluation with his MARS ALE software. Full testing hasn't been done yet with the ALE baseline but regarding the use of the MIL-STD-188-110A modem, Steve is happy to report the units work very well.

We'll keep you updated on Steve's work as it progresses. For those interested in the 110A data modem, Steve has a very informative primer available from:
http://www.n2ckh.com/MARS_ALE_FORUM/MIL-STD_MODEM_PRIMER.pdf

**WSJTX**

Joe Taylor K1JT has released a new version of WSJT called WSJTX. This version includes a new mode called JT9 primarily designed for LF/MF. Similar to JT-65 but with a much reduced bandwidth the mode is also seeing use on the 30m band. Initial testing seems to indicate this mode is also extremely sensitive on HF and if you're interested, download the software and tune to 10.130 USB.

WSJTX is available from: http://physics.princeton.edu/pulsar/K1JT/wsjt.html

**Experimenting with digital text modes on 9450 kHz**

For SWL an interesting experiment is under way on 9450KHz from "The Mighty KBC" based in the Netherlands.

They are experimenting with a number of digital modes as a method to provide "Text Via Shortwave" during their regular Sunday broadcasts. The software in use is FLdigi and you can read more about the broadcasts at: http://www.kbcradio.eu/index.php?dir=news/detail&id=237