

# STATIC



November, 2008

## Watt's New? Living with PEP Watts New? The Power Struggle, and Living with PEP.

Steve Katz, WB2WIK/6

I see a lot of postings, and hear comments on the air, too, about power output and “talking the rig up” to its rated power. Maybe a short article is worth a write.

### Old Days vs. New Days

In days of old when men were men, rigs were most all rated for transmitter *input* power, not any particular output power. There was one technical reason for this, and many marketing reasons. The technical reason was that here in the States (and perhaps in other countries, too), our regulations stipulated only a maximum *DC input power to the final amplifier stage* as our legal power limit. Reason for that was that few hams owned Wattmeters, or any good ones that could be trusted, but most anyone could measure DC Input Power, since that's just a calculation of final amplifier voltage times current.

The Part 97 Legal power limit for licensees above the Novice level was 1000 Watts DC input power. If your final amplifier was 50% efficient, as most probably were, that would yield about 500 W output power. However, there was no distinction between modes: We could run 1 kW DC input on CW (probably 500W output), or on AM, which, with 100% modulation, would yield about 4000 Watts PEP input power, and maybe 2000W PEP output power (!). Then, SSB came about to muddy up the works. SSB had no carrier power to measure, so if you keyed your transmitter and didn't speak, you might be running a few hundred Watts DC Input power (the idling power drawn by the PA to remain linear) and absolutely no output at all!

So, it was deemed by the Powers That Be that a fair amount of SSB power should be 2000 Watts PEP, but still “measured” by DC input power. That's a tall order, and almost nobody could do this. But it was an interesting solution, and everyone who made a “1 kW DC Input Power” amplifier or transmitter now automatically rated it for “2000 Watts PEP input power,” without any way to actually measure that.

Since linear amplifiers are typically about 50% efficient, or most were in those days, hams pretty much figured if we measured PEP output power using an oscilloscope and a dummy load, we should shoot for 1kW PEP output, and we'd probably be right in there, using the maximum power allowed by law. By estimation!

If you own a transmitter or amplifier from the mid-1970's or earlier, it will be rated for DC Input Power, and not actual RF output power, because that's the way it was, at least until 1978

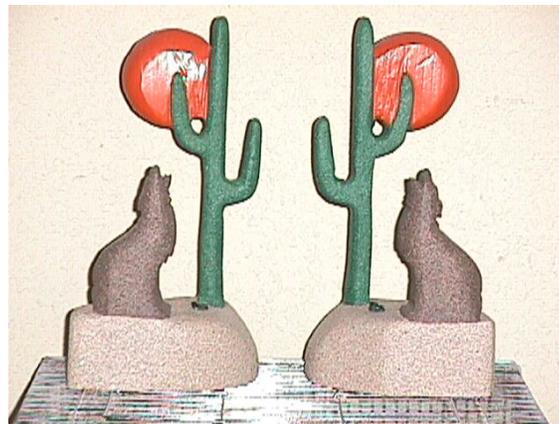
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## LBARA MEETING SCHEDULE

MONTH	BOARD	REGULAR
NOVEMBER	NOTE: BOARD	11/20
DECEMBER	MEETINGS WILL NOW	12/20
JANUARY	TAKE PLACE ONE	1/15
FEBRUARY	HOUR PRIOR TO THE	2/19
MARCH	REGULAR MEETING	3/19

### WANTED: LOST TROPHY

Someone out there is the current custodian of the Club's Fox Hunting Trophy. The traveling trophy to hunts that had years and we once again. Hope will jog someone's trophy will be re-



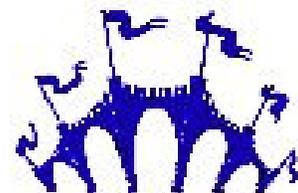
Club gave out this the winners of fox been held in past would like to do so fully this picture memory and the turned the Club.

The London Bridge Amateur Radio Association

Fox Hunt Traveling Trophy

### Monday Night Net (7 PM)

System	Location	Freq	Offset	PL
MCARS	Bullhead City	145.27	-	131.8
	Kingman	146.76	-	131.8
	Kingman	448.25	-	131.8
	Lake Havasu	146.62	-	131.8
	Willow Beach	147.12	-	131.8
CRRRA	Lake Havasu City	146.96	-	162.2
	Lake Havasu City	224.24	-	156.7
	Lake Havasu City	146.64	-	156.7
	Lake Havasu City	449.95	-	141.3
BARN	Lake Havasu City	447.54	-	136.5
	Las Vegas, NV	449.95		136.5
	Onyx(Palm Springs)	449.34	-	136.5
	Orange County, CA	447.54	-	100



## UPCOMING ACTIVITIES AND HAMFESTS

December 6 - Superstition Amateur Radio Club, Mesa Community College, Mesa, AZ (K7JLF)

January 10 - Westfest, Thunderbird ARC, Thunderbird School of Mgmt, Glendale, AZ (W1ADW)

February 2 - Ham Equipment Auction, Wes Valley ARC, St. Clements of Rome Social Hall, Sun City, AZ (WN7DRX)

February 20-21 - Yuma AR Hamfest Organization/Tucson Repeater Assn, Yuma County Fair grounds, Yuma, AZ (KC2LGR)

April 4 - Ham Desert-fest '09/Radio Society of Tucson, Kino Sports Complex, Tucson, AZ (KF0X)

May 30 - Annual Prescott Hamfest, Yavapai ARC/Verde Valley ARA, Granite Mountain Middle School, Prescott, AZ

## *WorldRadio* to Cease Print Publication

In a joint statement, *WorldRadio* Publisher Armond Noble, N6WR, and *CQ* Publisher Dick Ross, K2MGA, announced that *WorldRadio* magazine will no longer be published as a print magazine. According to the announcement, *CQ* Communications Inc has acquired *WorldRadio* and plans to continue it as an online publication on *CQ*'s Web site. *WorldRadio* subscribers will have their subscriptions transferred to *CQ* magazine. Readers will be notified of details as plans are finalized.

## MIKE BURSON (SK)

WE ARE SORRY TO ANNOUNCE THAT MIKE BURSON,  
KB7YKY, PASSED AWAY ON OCTOBER 30, 2008

MIKE WAS A VERY ACTIVE MEMBER OF OUR CLUB AND WAS THE  
TRUSTEE FOR BOTH THE 62 MACHINE AND THE 64 MACHINE. HE WAS  
ALWAYS THERE WHEN ANYONE NEEDED HELP AND HE WILL BE MISSED  
BY ALL OF US.

OUR THOUGHTS AND PRAYERS ARE WITH HIS WIFE, JO AND ALL HIS  
FAMILY.

REST IN PEACE MIKE

(cont. from page 1)

The “marketing” advantage of this rating method is that manufacturers could claim almost anything. A pair of 6KD6 TV sweep tubes, normally used in pulse service at about 30W or so in a TV set, could now magically run “300 Watts PEP” (input power) in SSB service. Or, almost anything anyone wanted to claim, since measuring PEP input power is something that almost nobody could possibly do.

That led to all sorts of crazy claims in rigs of the late 1960's and early 1970's, as the Japanese manufacturers were just beginning to import rigs to the U.S. to compete with the well-established American rigs, and everyone had to outdo each other. Collins Radio, with their KWM-2 and 32S-series of transceivers and transmitters, did not get caught up in the marketing balogna and continued to rate their transmitters, using dual 6146 power amplifier tubes, at 160W PEP *input* power, a conservative and very realistic rating. To their credit, Heath Company, with their SB-100, SB -101, SB-400 and SB-401 families, did likewise.

### **You Can't Hear Input Power**

Let's face it, it doesn't matter what your DC input power is, nobody can hear it. It's the Watts that make it to the antenna that count. I think it was in 1978 that the FCC changed the power limit from 1000W DC input power to 1500W PEP output power, and that re-defined what we're really doing. It took a while for hams to conjure that 1500W PEP (output) is also 1500W carrier output power when working CW, RTTY and FM. But 1500W PEP output on AM (standard full-carrier, old-fashioned double sideband AM) was only 375W carrier power for a 100% modulated signal. Hmph! This is the only mode where the “higher power level limit” actually *decreased* the amount of useful power hams could use.

(This discussion pertains to American hams at this point. I realize legal limit power levels, restrictions, license classes and other things vary country to country.)

### **It's the PEP, Boys**

Most hams don't own accurate PEP measuring instruments. Some do. But the ones that don't are the ones who are always trying to “ahhhhh” or “whistle” up their output power. You can tell. Anytime you tune across someone “helllllooo”ing or “ahhhhhh”ing, or whistling into their microphones, there's a good chance that someone is watching his average-indicating Wattmeter and trying to figure out why his peak output power isn't anything close to what the book said it should be.

Cut it out, guys, it's silly.

Unless you have a true peak reading Wattmeter (a PEP meter), which is designed to display PEP power and requires an external source of power to operate, you can't evaluate how much power you're really running when using SSB. One way to have a pretty good guess is to switch your transmitter to the CW mode, close the key, and transmit. Look at the power indicated. Then, switch to SSB and forget about the Wattmeter reading. Your output power on voice peaks should be just about exactly whatever the “CW” power indicated. The meter won't show this.

An oscilloscope *will* show it, and was the primary output measuring instrument for years after the SSB mode became popular. If you tune up on CW and your scope shows your forward power to be “ten cm,” or whatever - and then switch to SSB and your voice peaks hit the same amplitude (10 cm), your SSB peak envelope power and CW carrier power are the same. It's easy to do, easy to watch, easy to learn. But unless you're using a scope, or a real PEP instrument, you can't tell anything about PEP output power.

The cheapest PEP HF meter on the market that I can think of offhand is the Autek WM-1A, at about \$150. It's a bargain\*, and reasonably good through the HF spectrum. But it does require a DC power source, and you have to add that, yourself. I also have a couple of Bird model 43P meters, which are the standard 43 “ThruLine,” with a peak reading circuit added. That circuit is powered by two 9V batteries, or an external power supply, and adds about \$100 in cost to the model 43 - so by the time you have the meter, the PEP adapter, and one plug-in detector element, you're up there in the range of \$500 to make your first measurement. Still, not a bad investment.

The little desktop meters that have an AVG/PEAK switch, and do *not* use a power supply to power them, have no useful peak reading functionality.

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# JAMBOREE ON THE AIR

On October 18th and 19th the World Organization For Scout Movement held the 51st Jamboree On The Air. This event is an annual event in

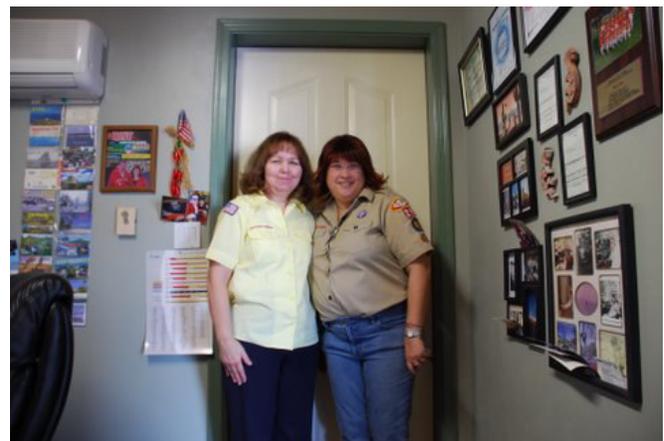


which Boy and Girl Scouts and Guides from all over the world speak to each other by means of ham radio. Since 1958 when the first Jamboree-on-the-Air was held, millions of Scouts have met each other through this event.

This year the local scouting organization contacted our Club asking for help in creating a JOTA event here in Lake Havasu City. Garry Fisher, K9WZB, and Jerry France, K7LY, operated JOTA from their respective homes and enabled 40 Boy Scouts, Girl Scouts, Cub Scouts and Brownies to experience the thrill of talking to other hams and other Scouts around the country.



Local Scout officials would like expand this event next year using more Club members.



But isn't it *average* power that the guy on the other end hears? Umm, no, not really. SSB is a peak mode, for both transmission and reception. Here's a CW analogy:

If you tune in a CW station transmitting at 20 words per minute, and he's 599, that's good, right? Now, that same station can space his sending differently, so he pauses several seconds between every single element sent. His average power, averaged over a time period (let's say one minute) is now about 10% of what it was before, but his peak power is the same. Is he weaker now, or still 599?

In the example given above, if you measured average vs. peak power, the difference would be amazing. A very accurate way to measure average power is by dissipating it in a load and measuring thermal rise in that load, as all Thermistor or Bolometer type power measuring instruments do. In fact, it's the most accurate method of all, because this technique is not related to waveform or distortion - the load dissipates all power applied, regardless of waveform, and generates heat, which is measured by the instrument. Precisely.

In our example above, the average power of a 1500W output transmitter might be 150W, because the transmitter duty cycle was only 10%. If we return to the normal method of sending code, the duty cycle would be about 50% (average power 750W). That's a five-to-one difference in average power, and the Thermistor-mount, lab-grade, 100% accurate power meter would indicate that astounding difference. But the received signal at the other end of the path would remain exactly the same. If you're S9 with a 50% duty cycle, you'll still be S9 with a 10% duty cycle. Thus, signal reception is not predicated on average power, but rather on peak power.

### Keep It Clean

So, PEP is really all that counts for working SSB.

But not entirely! The other thing that counts is signal fullness and fidelity, often described as “punch” and modulation clarity or crispness. Best clarity is rarely achieved with “high fidelity” modulation. It is most always accomplished with modulation quality that is equivalent to how your voice really sounds if it were unaltered by the electronic circuitry of your transmitter and the other station's receiver.

“Punch,” or fullness, is something reasonably easy to achieve in modern SSB transmitters having Automatic Level Control circuits, which they all do. ALC is a control loop, with usually one or more adjustable elements and other preset ones, that allows one to maximize transmitter output power without creating signal distortion, and if you use your ALC within its design limits, you can have all the punch and fullness of a broadcast station, without the undesired side effects of booming bass or piercing treble.

Transmitters and transceivers vary by design, but I've always found the best way to adjust ALC is to follow the manufacturer's recommendations, and then listen to myself with a separate receiver (using tight-fitting headphones to prevent acoustic feedback) and adjust for the sound I like best. The controls that most closely guide how the ALC loop responds, and how you sound on the air, are your mike gain and speech processing controls. Those usually interact to some degree. Another component that guides the way you sound on the air is your microphone, and of course anything you do externally to your transmitter to alter it. Monitoring, and headphones, help a lot. And believe what people tell you when they provide on-the-air reports. If you get a few complaints of crappy audio, believe them.

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**Are you looking to upgrade your license?**

**Give our VE Exam Team a call.**

**See Ed Gillespie, AB7EM at #453-7412**

# FOR SALE/TRADE

PLACE YOUR AD HERE (SEE K7LY)

(cont. from page 6)

If you're one of the Newbies (or even a not-so-Newbie) who likes to watch your Wattmeter as you operate SSB, stop that. Lousy habit, and for the tenth time, the meter reading doesn't mean anything unless you have a real, honest PEP meter. "Talking up" your transmitter to increase the power indicated on the meter results in lousy sounding audio that will *not* help you get through any better.

## ALC Your AMP

And do it PDQ. Amplifiers which have an ALC output that is compatible with the ALC input of your transmitter work best when that loop is connected, and everything's adjusted properly. It makes a *lot* of difference, usually.

**To Be Continued**

## **LONDON BRIDGE DAYS PARADE**

**Our Club had provided communications assistance to the London Bridge Days Parade for many years and this year was no exception. Club members assisting with this year's parade were: Ted Taft (WA7WBM), Ed Gillespie (AB7EM), Dick Jernigan (W7DXJ), Lyle Ross (W6TPT), Cliff Baril (W7IRC), Jim Gould (KF7X), Dale Larson (W7DLL), Jim Varner (AE6N)**

**Thanks For Your Help**

### LBARA OFFICERS AND DIRECTORS

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	Vice-President
Reiner Schick	Treasurer
Lyle Sibbald/Lyle Ross	Secretary
Dick Jernigan	Director (2 YR)
	Director (2 YR)
Jim Gould	Director (1 YR)
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Ed Gillespie	Web Master
Jerry France	Static Editor

### **VISIT OUR WEBSITE**

[www.lbara.net](http://www.lbara.net)

### FROM THE EDITOR

If you have anything you would like to see included in these issues, please let me know. I'm always looking for articles, news items, construction articles, or anything that might be of interest to our readers. You can contact me at 928.855.7941 or email at [grf@unedspeed.net](mailto:grf@unedspeed.net) or [francej@ajsinsurance.com](mailto:francej@ajsinsurance.com).

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# STATIC

## ATTENTION READERS

Please note that this issue represents a “work-in-progress” and there are a number of changes to be made in subsequent issues. I would greatly appreciate your comments, both good and bad, as well as any suggestions for future issues. This issue also begins our first attempt to deliver the **STATIC** to your doorstep electronically. Please keep me abreast of any email address changes you may have and I promise to have this delivered promptly and accurately. Also, I still have a number of articles awaiting publication and will do so in the future. This is your newsletter, so keep the articles, letters, and pictures coming. I can be reached at home (855.7941), at work (855.3081) or via email at [grf@uneedspeed.net](mailto:grf@uneedspeed.net) .

## EQUIPMENT FOR SALE

**EDITOR'S NOTE:** List your items for sale here. Ham radio related only, please. Include a picture if you like (please use a jpg format). Email all to me at [grf@uneedspeed.net](mailto:grf@uneedspeed.net) along with your name and phone number.

