

The NEWSLETTER

MAY 2014 VOLUME 14, No. 5

Mercury Amateur Radio Association - MARA
North America - North East

MAY is
OLDER
AMERICANS
Month



Treat us
nice.

There's
a **LOT**
of us!

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E-mail your comments, ideas, or submissions to marane@mara.net or to ve1vq@eastlink.ca

Grandma Mara's RAMBLINGS

New Operator App Note

2014-2

by a contributor who, for job related reasons, requests anonymity until retirement.

Tweaking HF Rig Output Power

Will It Help To Tweak It For An Extra 5% to 20% Output?

The search for the most effective station possible leads the Op to an evaluation of the stations Output Power. During the critique many Ops will discover various notes and articles raving about the dramatic improvement the author was able to achieve by simply tweaking the tuned circuits, adjusting an internal factory set gain control, and/or disabling the manufacturer's integral ALC¹. These hidden tips typically will increase the output power by about 10 to 20 watts on rigs with a rated output power of 100 watts. This amount of increase seems pretty significant from an arithmetic perspective initially. But before going off and tweaking your rig for that extra 20% or less improvement ask yourself the following questions:

1. Will the increased output power increase my communications range 20% for a 20% power increase?
2. What thermal changes will the additional 20% increase in output power create?
3. What happens to harmonic output levels, spurious performance, intermodulation products, and 1 db compression point?



¹ Automatic Limiter Control – typically some form of a directional coupler and other active/passive components to limit the transmitter's output power to an established output power determined optimal by a skilled design team.

I don't know what it is, but when the end of April, the first part of May comes around, there is a feeling in the air, and it's not the smell of lawns and farms being fertilized. It's more a feeling of optimism. Even the (usually) grumpy old codger who sits at the back of the room at the monthly radio club meeting, complaining he can't hear, is a little cheerier when we discuss plans for the upcoming Field Day operation. Instead of loudly telling everyone their ideas have all been tried before, never worked then and won't work now, he grudgingly admits that their suggestions just might work - if he's there to lend a hand!

Maybe it's the smell of fresh-cut grass triggering the production of some endorphin that does it! Regardless of the reason, it certainly is nice to have a little optimism back again.

Wendy, with a little help from Walter and I, has "our" radio class at the seniors' home underway. The "students" formed themselves into a group and approached the home's manager, arranged for an unused storage room as their meeting place, even gotten permission for a wire receiving antenna at the rear of the facility. With some manuals and other study guides that Walter scrounged up from local club members, we are teaching a class once a week, on very basic electronics and antenna theory, regulations, and operating practices. He and Wendy have made posters, charts, and teaching aids, some serious and some humorous to demonstrate subjects from Ohm's Law to two meter repeater DOs and DON'Ts. I have to smile 'cause all I have to do is sit at the back of the room and look wise. I don't even have to provide refreshments. The two ladies in the course seem to be competing to outdo each other in that department. One of them has some pretty darn good chocolate cake, not as good as mine Walter informs me, but almost.

Even the (usually) grumpy old codger who sits at the back of the room at the monthly radio club meeting, complaining he can't hear, is a little cheerier when we discuss plans for the upcoming Field Day operation.

... see GRANDMA MARA on page 4

Perception vs Reality

The general conceptualization of radiated power by many ops is one of a linear relationship. If you double the power then you double your communication range. However, the Laws of Physics reveal otherwise as shown in Equation 1 below. Examine the formula for calculating the power per square meter at a given distance from the transmitter.

$$P_r = \frac{P_t}{4 \times \pi \times r^2} \quad \text{Eq 1}$$

where:

P_r	is the power spread over an area of 1 Square Meter for receiving at a distance r
P_t	transmitter power (100 watt nominal output power of generic SSB transceiver is used here)
π	3.14
r	is the radius from the transmit antenna to the 1 square meter surface area distant from the transmit antenna

Assume for the moment you have a receiver at 10 meters distant from the transmitter which just barely operates at that distance. If you move it further away you can no longer recover the signal. You want to move the receiver to a distance of 20 meters. What transmit power will you need for the receiver to operate at that point to match the 10 meter distance performance?

Using the above equation you calculate a power of 79.6 milliwatts at 10 meters distance in the 1 square meter area. We assume the same power will be needed at 20 meters to allow the same signal detection. Rewrite the equation to solve for P_t as follows:

$$P_t = 4 \times \pi \times r^2 \times P_r \quad \text{Eq 2}$$

$P_r = 79.6$ milliwatts or 0.0796 watts

$r = 20$ meters

yielding:

$$P_t = 4 \times \pi \times 20^2 \times 0.0796 \text{ watts}$$

$$P_t = 400.1132 \text{ watts}$$

The math indicates that to double the distance one must quadruple the transmitted power. As it works out you will need a 400% power increase (from 100 watts to 400.1132 watts) to double the distance for a specified power density in the 1 square meter area.

So just how much extra range can you expect for that 20% power increase? Referring again to the Equation 1 we change the P_t value from 100 watts to 120 watts.

Rewriting Equation 1 to solve for r (radius) yields:

$$r = \sqrt{\frac{P_t}{4 \times \pi \times P_r}} \quad \text{Eq 3}$$

$$r = \sqrt{\frac{120 \text{ watts}}{4 \times \pi \times 0.0796 \text{ watts}}}$$

$$r = 10.95 \text{ meter}$$

In other words, your effort to push the amplifier for the additional 20% power increases your range by about 10% best case.

Another Perspective

In audio work, "1 dB" is considered to be the smallest amount of change in amplitude that normal human hearing can perceive. In an amplitude system (SSB is a varying RF Amplitude system) the question would seem then to become just how much increase the receiving operator would observe at his station for the 20% power increase?

Switch from working with power levels in watts to decibels for convenience at this time to determine how much improvement the receiving operator will observe. This is done using the formula for calculating gain or loss:

$$A_p = 10 \log\left(\frac{P_1}{P_2}\right) \quad \text{Eq 4}$$

where:

A_p = Power Gain in decibels

$P_1 = 120$ Watts

$P_2 = 100$ Watt

yielding: 0.79 dB

In theory, given the 1 dB standard used for minimal audio change perception the receiving operator would not be able to perceive the increase in power you pressed the transmitter to produce. In reality, you will need approximately a 26% increase in power to achieve a 1 dB increase in amplitude.

If you have a signal generator and a transceiver or receiver for the HF bands try injecting a test signal and note the amount you have to raise the signal generator output to hear a perceptible increase in the recovered

audio. Try this with no external signal source attached and then with the antenna attached. Note the difference in what you can detect in level changes when the radio is attached to an antenna on the 80 meter band.

The "S Unit"

Early on, radio operators recognized the need for being able to measure the received signal level for comparison purposes. One of the earliest measurement techniques pressed the analog meter into service. It was wired to the radio AVC² or AGC³ line. The meter was calibrated in "S Unit"⁴. One (1) S Unit is defined as a change in the signal level of 6 dB. Thus for your less than 1 dB change in signal level with the tweaking of your transmitter for a 20% power increase you will observe only a 1/6 S Unit change in the meter display at the most if the meter scaling and AVC/AGC linearity are close to linear.

Thermal and Intermodulation Effects of the Tweaks

Many solid state finals in modern radios are running near the rated component limits. Ask yourself if you are ready to repair and replace the transmitter finals given the typical high part costs (in excess of \$100.00 for a matched pair), the labor costs for repairs which can approach \$200.00 rapidly and the two way shipping costs for the rig? (In my case it cost nearly \$175.00 for shipping the rig round trip for a microcontroller failure.)

Will the transmitter still comply with the FCC (or your regulatory agency) requirements after tweaking? Unless you measure the transmitter performance, and document your measurements you open yourself up to potential enforcement actions.

Lastly consider why the design engineers limited the output to 100 watts or what your particular rig is specified to produce. If the rig could safely produce 120 Watts, meet spectral purity rules, and not increase failure rates due to additional thermal stress, then why do they not go ahead and market the radio as producing 120 Watts?

Is the potential mischief worth the extra 20 watts to you? 

GRANDMA MARA - continued from page 2

One of their weekly classes dealt with the different two meter hand-helds, either single or dual band, that are available. Being as most of these seniors are on fixed incomes, the price point becomes a serious issue. They wondered if a group buy would give them a bit of a discount. Fred said that once the decision had been made on a particular model he would phone the different dealers' toll-free numbers to inquire.

Everyone in the class attended the last ham club meeting as our guests, and were warmly welcomed (even by the codger). Several of them knew some of the members, making it even better. They talked about the meeting at the next week's class, and were quite excited to think that once they got their [Technician's ticket](#), they could participate in the communications side of things at local events.

These folks might be in their "golden years" but they obviously (and rightly so) still feel they have a lot to give.

TO ANY OF GRANDMA'S READERS OUT THERE - DO YOU HAVE ANY SUGGESTIONS FOR GOOD, LESS EXPENSIVE HAND-HELDS -EITHER NEW OR USED?

Send them to Grandma's attention to marane@mara.net

TECH AND OTHER STUFF

by VE1VQ

Last month, I mentioned that I had purchased a Ten-Tec 506 dual band QRP cw transceiver. I powered it up on the kitchen table with only a clip lead for an antenna. The noise level in the headphones rose whenever I touched the end of the clip lead, so I figured I would soon hear signals if I tuned around. Not a thing! When the noise skyrocketed any time I put my hand near the 12Vdc 1A wall-wart the light dawned. I had a switching type power supply and it was doing a fine job of radiating garbage into the receiver's front end. A search of my junk box revealed several conventional direct wall plug-in transformer style supplies. That's why you should never throw out any of these old supplies, even when whatever it powered goes to that place wherever busted electronics stuff goes.

The forty meter band wasn't very good the morning I tried the rig. Even on my 500 foot horizontal loop there were not a whole lot of CW signals to be heard. I checked with my regular HF rig just to make sure the new receiver wasn't dead.

² AVC - Automatic Volume Control

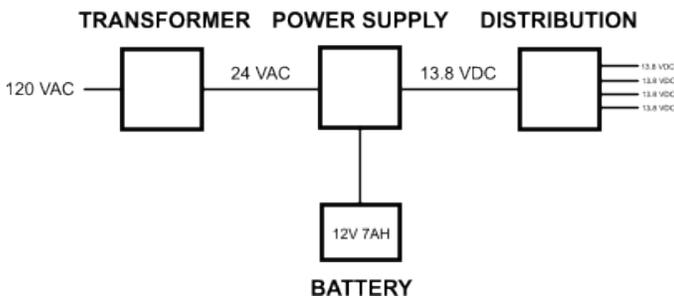
³ AGC - Automatic Gain Control

⁴ In 1930 it was agreed that S9 would indicate a signal level of 50 microvolts at the receiver input terminals.

Another problem I had was with the audio control being very touchy with a high level of sound with it set at just above minimum. Turning to the manual, I found that one has to change the position of a jumper on the receiver pc board to use headphones. It places resistors in audio output lines to drop the level.

Besides the BOSE noise-cancelling headphones I use when on a plane, all I had was an old set of Radio Shack cans that always seem to pinch my ears whenever I wear them. I was scanning the weekly flyer from Staples office supplies and saw a set of ear buds on sale for about 50% off. Don't you love it when a solution is on sale? So, for under \$8, I added a pair of JVC ear buds. These seem quite comfortable in my ears, although I haven't worn them for any extended time period. The volume control now works like it should with the rig's jumper in the right place and no additional amplification from the headset.

I've been investigating a better power source than the wall wart from the junk box. It is a little under the recommended voltage (12 vdc compared to the preferred 13.8 vdc - absolute maximum of 15) and a little lighter in current than I would like. I may pick up a small conventional (non-switching) supply circuit board from



one of the alarm suppliers I use, and also a distribution board providing current limited outputs for other accessories. That way I can add a gel type battery for backup or operation on battery alone.

Now, if we can ever get some warmer weather and the time for further experimentation with the SQUID POLE vertical...

ARRL Field Day

June 28 and 29th, 2014

“ARRL Field Day is the single most popular on-the-air event held annually in the US and Canada. On the fourth weekend of June of



each year, more than 35,000 radio amateurs gather with their clubs, groups or simply with friends to operate from remote locations.”

Are **YOU** doing anything for Field Day this year? Perhaps you will be part of a well planned, multi-antenna, multi-kilowatt, multi-station, multi-etc. operation. Or perhaps, you will be the *only* part of a spontaneous QRP station with a random hunk of wire hurriedly thrown over a limb in a back-yard tree.

Whichever you choose to do, make sure you have fun and enjoy yourself. And, let us know what you do, and maybe send us a note, and some pictures, for the newsletter. AR

QUOTE OF THE MONTH

“I have tried to teach my children that success in life is not based on what happens to us but on how we handle what happens to us - what we choose to make out of our individual circumstances”

Jeanna Jolly

ENIGMA MAGAZINE, OCT. 2013

DI-DAH-DI-DAH ^P_T

I see from media reports that various boards of education across the land are either eliminating or thinking about eliminating the requirement to learn cursive, or handwriting. Seems that educators have the idea that since we all seem to be inseparable from our smart phones, our tablets and our PCs, that we no longer need to know how to take down anything in written form. If we need to record something for future reference then we can tap it into our electronics, or snap a picture, or record a video.

On another educational front, it had been determined by *the experts* that memorizing multiplication tables was passé. Forcing students to memorize such things was stifling to their creativity (or some such drivel). And what about those who simply could not remember their “times tables”; how did that make them feel? -

what did it do to their self-esteem? And isn't that what we have calculator apps on our cell phones for?

On the other hand, it seems that *other experts* have determined that there are benefits to have students memorize those pesky tables. Not only does it now seem that kids who know those tables off by heart have an advantage over those who don't (obvious to most of us!), especially when the batteries die, but it seems to help their brains develop in ways that we weren't aware.

**Nothing you ever
learn is wasted.**

It is a fact that letter and card writing is way down in popularity. The post office is always moaning about it anyway, and likely are trying to think of ways to tap into the Internet to generate a revenue stream at our expense.

I suspect that one of these days, another study will determine that learning how to write is also beneficial to the individual. Knowing how to write as well as print is to open up the horizons of your knowledge.

Nothing you learn is ever wasted. Guaranteed you will someday use it. Even those times tables!

Until next month,

VEINQ