Communications Systems (continued from April 2010)

By Bob Wexelbaum, W2ILP

Before I continue discussing communications systems let me talk about *decibels* (dBs). Most engineers know about dBs, but I can not assume that all of the readers of this article do. Decibels are important when discussing gains and losses, Signal-to-Noise Ratios, dynamic ranges, skirt selectivities, and many cheerful facts about non-linear compressions or expansions. In the analysis of any communication system we often must deal with a wave form which we can call v(t), or even better, the quantity of v(t) which v is time averaged and called v(t) with a bar over it. We can then imagine that if v(t) bar appears across a one Ohm resistor the resistor will dissipate a power of one W where the number $W = v^2(t)$ bar which is the means-square value of v(t), and it becomes known as the *normalized power*. Keep thinking that normalized power is volts squared and not Watts and you can ever drop the "normalized" term and just call them Watts in communications systems. The ratios of normalized power in our analysis are usually more important than the values of currents, volts, or ohms when we work with system parameters. Suppose in some system we encounter at some point or another normalized powers S1 and S2. If we are interested in the ratios we may want to calculate S1 divided by S2. The *ratios* would be the same even if the unit Watts was used instead of normalized power because the term in the denominator would cancel out the term in the nominator in either case. It turns out more convenient to specify the ratio more directly, so let us first call it K, so that $K = 10 \log S2/S1$. The quantity K is dimensionless because it is unlike Volts or Amps or Watts themselves. In order to know if we are talking just about S2/S1, and we are communications engineers, we use the term decibels (abbreviated dB) to signify K, as K was defined above. Suppose S2/S1 = 100, then log S2/S1 =2 and K = 20 dB. The reasons for using dB are twofold. First, a very large power ratio may be expressed by a small number. Second, power cascaded ratios need not be multiplied, but can simply be added. In another case, suppose that S2 and S1 are the normalized power associated with sinusoidal signals of amplitude V2 and V1 then $S2 = V2^2/2$ and $S1 = V1^2/2$, and $K = 10 \log [V2^2/2$ divided by $V1^2/2] = 20 \log V2/V1$. The decibel was first used by Alexander Graham Bell for specifying ranges of real powers on telephone lines, not normalized powers and this has led to some confusion. To try to avoid such confusion let us talk about a real amplifier that has an input resistance Ri and an output resistance Ro. We apply waveform of Vi(t) to the input and we measure an output waveform of Vo(t). The real input power is $Pi = Vi^2/2Ri$, and the real power delivered to the output load resistor is power $Po = Vo^2/2Ro$. The real power gain of the amplifier is expressed in decibels as $Kreal = 10 \log [Vo^2/2Ro$ divided by $Vi^2/2R]$. If Ri = Ro then this simplifies to $Kreal = 20 \log Vo/Vi$, but if Ri is not equal to Ro then this can not apply for real power gains but it does still apply to normalized power gains because the impedances of Ri and Ro are absolutely irrelevant for normalized power. Kreal can only be equal to Knorm when Ro =Ri . Are you still with me? Decibles were so important to communications engineers that many important ratios became memorized. For example a power gain of 2 times works out to being 3dB. Other gain ratios became more challenging and engineers were forced to carry tables of logarithms to figure them out. This was aided greatly when a company called Ballantine gave out free cardboard slide rules at the IEEE shows that converted voltage or power gains or losses to dBs with the slide of a cardboard insert. Those slide rules became obsolete when the pocket scientific calculators, which are commonly used today, were developed. Now that we have defined

normalized power we can go on to conceiving normalized power in a Fourier expansion. We know that Fourier analysis involves the relative distribution of a fundamental waveform with its harmonics. Without going deep into the calculus involved, let us see that if the coefficient of the fundamental term is C1 and the coefficient of the first harmonic term is C2, math students can calculate a normalized power S1 of v1(t) and loose cross product terms that are determined to be *orthogonal* because when such products are integrated over a complete period the result is zero, which simplifies to: S1 = C1^2/2 + C2^2/2. Extending beyond the first harmonic we can say that S = Co^2 + [the sum of Cn^2/2], when n is incremented an infinite number of times by units of 1. These calculations depend on normalized power being associated with *real* waveforms but not with *complex* waveforms. The complex domain requires that S = the sum from + infinity to − infinity of VnVn*VnVn* when we realize that [Von e^(j2pi nt/To) V-n e^(j2pi nt/To] = VnV-n = VnVn* …which depends on the understanding of * being a complex conjugate. If you are lost now don't complain when I arrive at the fact that the power associated with a particular real frequency n/To = nfo where fo is the fundamental frequency and it is associated neither with the spectral component at +nfo nor with the spectral component at –nfo, but rather with the combination of spectral components, one in the positive range and one in the negative range. There is always a one-sided and a two-sided spectral amplitude pattern that may be constructed from this sort of analysis and they are both to be considered when filters are to be designed, unless we want to take Chebychev's filter equations as gospel; in which case you may not have to understand anything beyond the meaning of decibels in this article. Next we must go on to Power Spectral Density, which I will attempt to define next month without compressing the below President's message too much. (To be continued)

PRESIDENT'S NOTE by ED GELLENDER, WB2EAV
May 2010

We are getting ever closer to Field Day. Hold the date – The actual contest part runs from 2 PM on Saturday June 26 thru 2 PM on Sunday June 27, but we need a few hours before to set up and a few hours after to clean up. We are planning to hold it at the Dix Hills Park and Golf Course for the third year in a row. We must like the place. It is now time to get organized.

The Field Day site is at Dix Hills Park and Golf Course, which is a Huntington Town Park, on the north side of Vanderbilt Parkway, 0.8 miles east of Deer Park Road (NY231). You get to Deer Park Road from either the LIE at exit 51 or head north, or use Northern State exit 42 South. We have been in the first building on the left (parking is a bit further).

For the last six years or so, on Field Day we have been using a gasoline powered generator that Northrop Grumman gave us. While I really do not like the idea of looking the proverbial gift horse in the mouth, I have to say that the generator is quite large and awkward for us to use. Transporting it requires some kind of truck or trailer which makes it a real nuisance to work with. We are toying with the idea of possibly using two smaller units that would fit into a car trunk. Our generator is rated a 5 KW and ones that are portable and "cute" are rated at 1 KW. Funny thing is that 1KW generators come in two price ranges - $100 and $400…and I am not sure of the significance of the 4-to-1 price range. Renting such things for one weekend a year sounds very favorable, but I hear rumors that no one rents the small ones, so we're back where we started. If anyone in our reading audience has some knowledge to share, please contact me.

The other day I got a widely circulated e-mail from the ARRL that a change in the IRS regulations in 2006 has suddenly become very important. Back in 2006, the IRS decided that 501c3 non-profit organizations like us now have to file an annual form, but nothing was actually required for the first three years. Well, the grandfathering-in time runs out in a couple of weeks and the ARRL tried to let all their members know. I looked into it and it really is nothing-with-nothing. I expect to fill it in the next day or two. 73, Ed Wb2EAV
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GRUMMAN AMATEUR RADIO CLUB
MINUTES OF GENERAL MEETING 4/21/2010
By Karen, W2ABK, secretary.

The meeting was called to order by Ray at 5:40 PM.

TREASURERS REPORT – Ed, WB2EAV

 Finances continue to be in good shape.

REPEATER REPORT - Gordon, KB2UB

The repeaters are working fine.

VE REPORT – Bob, W2ILP

Amateur applicants did not show up. There were two commercial applicants. One passed Element 1 (MROP), one failed Element 3 (GROL) VEs/CEs were: WB2EAV, W2IU, W2ABK, AB2ZW and W2ILP.

NET REPORT - Zack,WB2PUE

Thursday night net had a good turn out. Sunday net had a few check ins.

OLD BUSINESS

The Field Day site is available for us at the Dix Hills Golf Course.

NEW BUSINESS

We are seeking guest speakers and ideas for future programs.

We are now possibly the only amateur radio club on Long Island that is certified to administer FCC Commercial Radio Operator Exams, under the new requirements that began on January 2010.   Certified VE are not necessarily certified Commercial Examiners. To become a CE you must hold a Commercial License, and/or must have held an Amateur Extra Class license before the Morse test requirement was eliminated. We need more CEs.

PROGRAM

Karen, W2ABK did a presentation about an event called Radio and TV day at C.W. Post College. She reported about the speakers, displays and demonstrations that were there.

The meeting was adjoined at 6:45 PM

GARC NETS:

40 Meters: 7.289 MHz at 7:30 AM EST Sundays.

Net Controller: Eugene, W4JMX

2 Meters (via repeaters): 146.745 MHz (-.600 kHz) at 8:15 PM EST Thursdays.

145.330 MHz (-600 kHz) at 8:30 PM EST Thursdays

Net Controller: Zack, WB2PUE

[Tone for both repeaters is 136.5 Hz]   (ARES/RACES) Mondays

MEETINGS

General Meetings of the GARC are held on the third Wednesday of each month, starting at 5:30 PM.   The meetings are usually held at the Ellsworth Allen Park in Farmingdale.   Driving directions and maps can be obtained from http://www.mapquest.com   It is suggested that the GARC Web Site be checked to be certain of meeting location, which may change after this newsletter is distributed. Board meetings are held a week before the General Meeting at the Bethpage skating rink.

GARC WEB SITE

The web site of the GARC can be found at http://www.qsl.net/wa2lqo/ Webmaster is Pat Masterson, KE2LJ. Pictures of GARC activities, archives of newsletters, roster of members, and other information about the GARC may be found there.

INTERNET LINK OF THE MONTH FOR INTERNERDS

This is a must see for any hams who haven't seen it. It is a video made by a German company, named Liebherr. It involves the construction of an antenna tower in Austria and the mechanized climbing and testing for the angular momentum stresses of the tower. The expert climber is a very steady worker named Rupert. Note that there is as ladder inside the tower where another worker climbs to make the video of Rupert. His work is as dangerous as Rupert's, but he doesn't seem to get equal credit. The antenna at the top of the tower is not a real working model (just a simulated one), but it is easy to believe that the tower could safely support a rotating log periodic HF beam of any practical dimension. Be sure to listen to the audio, even if you don't understand the German language. There are a few sentences in English. One can only wonder how the Gothic classical European towers of the past were built before the modern age….and long before anyone needed to elevate and rotate heavy HF antennas…. or tractors.

Go to:-

http://www.youtube.com/watch_popup?v=RobaJKGMMiE

That is a long URL address but well worth the effort.

PUZZLE

Here is another Cryptogram:

ALLEIB C VQWMLW DI FLJLKEAEDI HCI XLJG UDWY DSS DIL'A CIFCBDIEAVA.

CIM ES ODQ XCKLI'F CIO CIFCBDIEAVA, FXL HDVVWHECJA UEJJ BEKL ODQ

ADVL.   –CJSWLM XEFHXHDHY--

Solution to the April 2010 Cryptogram: WEASELING OUT OF THINGS IS GOOD. IT'S WHAT SEPARATES US FROM THE OTHER ANIMALS – EXCEPT WEASELS. –HOMER SIMPSOMN—

I dunno how I can weasel out of the extra M in Simpson. It's what separates men from animals – except for my mouse. –w2ilp--

EDITORIAL

In this newsletter I wrote about an FCC form called FCC605. Few people who take the ham or commercial tests read all of the instructions that are parts of the forms. Few people have read all of the instructions that pertain to RF hazards or FCC Rules and Regulations. In fact few people read all of the stuff in the books that they had to use in college or high school… for all I know, few people read all of these newsletters. We tend to filter out stuff that we know we will forget even if we did read it. It is hard to evaluate whether this kind of selective filtering results from superior intelligence or lazy ignorance. To some extent we might judge a person by what kinds of books, newspapers and magazines he or she reads, but to be accurate we might have to find out exactly which parts of the publications are actually read and comprehended…or dismissed as uncertain opinions or hoaxes. The end result is - You are what you eat and you can judge the world only by what you may have read and understood in the pubs, media (radio, TV, etc,) or experienced in your real life. Life may be too short to read long poems, tomes, theories and instructions, but there can, in my humble opinion, be no short explanation for the meaning of life itself or the evolution of the universe. We can't usually make such long stories shorter.
73, w2ilp (Ignoring Long Pubs?)

GARC VE EXAMS

We are continuing to proctor exams for all classes of ham licenses on the second Tuesday of each month, starting at 5:00 PM.
The present exams are:-
Element 2: Technician
Element 3: General
Element 4: Amateur Extra Class
The fee for 2010 is $14.00 for all exams taken in one sitting. The ARRL-VEC now charges $15 but W5YI-VEC has decided not to change the required fee.
Applicants for upgrades should bring their present license and a photocopy of it and know their FRN number.
New, first time applicants should be aware that their Social Security number will be required on their application form, unless they register with the FCC for an FRN.
All applicants should bring picture ID such as driver's licenses.
Until further notice exams will be given at:-
Briarcliffe College
1055 Stewart Avenue
Room: Long Beach #5
Bethpage, NY
Briarcliffe, Bethpage is located in a building that was formerly part of the Grumman complex.
All applicants should contact W2ILP to register, so as to confirm location. If no applicants apply, the exam session will be cancelled.
For any related information e-mail w2ilp@optonline.net or phone:-
(631) 499-2214
Study material is available at the web sites of the ARRL:-
http://www.arrl.org
or W5YI:-
http://www.w5yi.org
All VECs use the same Q &A pools.
Since the beginning of the VE program the GARC has provided opportunities to take the ham exams monthly, during all 12 months of every year.

CE EXAMS

We are certified by the National Radio Examiners to administer exams for all classes of FCC Commercial Radio Operator Licenses. All CEs use the same Q $ A pools.
To register for commercial exams contact W2ILP.

FIRST CLASS

<u>DO</u> <u>NOT</u> <u>DELAY</u>

FCC FORM 605

About 15 years ago the FCC decided to save paper and time by making a single application form, called FCC 605 serve not only for amateur and commercial radio operator applications, but for licensing of ships, aircraft and general mobile radio services. This do-all form was supposed to eliminate the need for different forms and to take an average of 0.44 hours to read its instructions. This idea was soon recognized to be as impossible as McNamara's dream of an all-purpose, Air Force-Navy GD–G fighter-bomber that was to be named an F-111. Let me begin by explaining about the form that must be used by applicants who want to take tests for ham radio licenses or upgrades. Is it an FCC605? No…Not exactly. It is called an NCVEC Quick-Form 605. At the bottom of the form it says "Do not send this form to the FCC – This is not an FCC Form." These forms can only be sent to a VEC (such as the ARRL or W5YI). The VEC in turn then fills out official FCC 605s and sends them to the FCC. OK…but what about commercial radio operator applicants? Well…the applicants for commercial licenses must use the official FCC605 form, even though in our case the forms must be sent to a Commercial Operator License Examiner Manager (COLEM), such as National Radio Examiners (NRE). The official FCC605 consists of only two pages, but there are also other pages that must be added to it called Schedules. There are different Schedules for different services; even one for applying to the FCC directly for a vanity ham call sign. The one that I am most concerned with is Schedule E for the commercial radio operator licenses, which is another two pages. I recently called the FCC to order 50 FCC605 applications with Schedule Es. I found out that the FCC could send out free 605s; so that I wouldn't have to buy them from NRE or copy-print them myself. The man who I spoke to said, "No problem…" He did not ask me for any ID or why I needed the forms. I soon received a large box of only 25 605s…but they each were entire 605s, complete with all possible schedules and instructions. Each official FCC605 is 38 pages long; some of which are officially blank. Reading any of the instructions to determine what applies to any Schedule would take more than 0.44 hours, even for a speed reader. Is this how our FCC designed a do-all form to save time and paper? It is no wonder that our congressmen can not have the time to read everything that gets into the critical bills that are many pages long! Enuf sed.