Communications Systems (continued from May 2010)

By Bob Wexelbaum, W2ILP

The next subject that I will write about is *power spectral density*. Power spectral density is important because it differs for each communication mode. Before going into the calculus involved let me try to define it in simple terms. Suppose that we have a perfect spectrum analyzer and can see all of the spectral components of a signal. If we add all of the normalized spectral components, which are contributed by each Fourier line, to the signal fundamental, but start below the signal center frequency, we will be able to make a graph of the cumulative normalized power which will be added to by each spectral line. The graph will look like a stair case and it will represent the sum $S(f)$ of the normalized power of all spectral components from $f = -\infty$ to $f = F$ [the fundamental]   The spectral power density, $G(f)$, is found by differentiating $S(f)$. Between harmonic frequencies we would have $G(f) = 0$, but at any harmonic frequency $G(f)$ would yield an impulse of strength equal to the jump in $S(f)$ on the cumulative staircase. So, let me summarize by explaining that a periodic waveform may be expressed in terms of its normalized power to the individual spectral components or as the spectral power density of the distribution of all of its components. We are up to now talking about a periodic wave which repeats every cycle. This is usually a continuous sine wave. Audio signals from microphones do not produce periodic waves. The mathematicians use calculus to expand the math that is used for periodic waves for non-periodic waves. They can do so by assuming that the non-periodic waves are periodic if the sample period is expanded to an infinity of time. This is like saying that the audio waves will repeat if we wait forever. Mathematicians get away with this sort of reasoning by constructing infinite series with finite sums or finite series with infinite sums all the time. Next I must remind you about the concept of Energy. Power x Time = Energy. Remember that we buy energy by KWhours not by KWs. Power is only a static potential. The Fourier expansion of the sampling equation is:

$V'(t) = C1 \cos [2\pi t/To - \phi1] + C2 [2\pi t/To - \phi2]$. When we transform this equation to a form that includes time as part of true Energy and we include non-periodic cases, we get what is known as *Parseval's theorem,* which is expressed by: *E = the integral from + infinity to – infinity $[v(t)^2]$ dt.* The validity of these equations relies on the fact that the spectral components are orthogonal. In the periodic case they are orthogonal over the time period To. In the non-periodic case the interval extends over the entire time axis from minus to plus infinity. From this we get the *Energy density Ge(f)*, which is simply: *$Ge(f) = dE/\delta f = [V(f)]^2$.* Why do we need to know this? We need to know how bandlimiting a signal using filters will affect the signal. We need to know about this stuff to further compare AM, SSB, FM, and digital modes. All waveforms have spectral components which extend to infinite frequencies. Periodic waveforms may or may not have DC components which raise their center line. For any waveform to pass through a network without changing its shape it must not in theory discriminate among its spectral components. All spectral components must be amplified or attenuated by the same amount, and each spectral component must be delayed by the same amount. A network which introduces no distortion has a transfer function of: $H(f) = ho e^{j\omega Td}$ in which ho is a constant and Td is the delay time introduced by the network. Omega is always $2\pi f$. An example of a network which produces no distortion is a coaxial transmission line of uniform cross section, having low losses and properly terminated. A specific signal may have spectral components which extend in the upper frequency direction to a maximum frequency f sub m. Such a signal is described as being *bandlimited* at the high frequency end. If this

signal is passed through a filter network for which $H(f) = 1$ for f less than or $=$ to f sub m, the signal will be transmitted without distortion. If the signal is not precisely bandlimited to f sub m, but a very large part of its power or energy (say 99%) lies in spectral components below f sub m, then we can reasonably expect that the filter will introduce no serious distortion. Similarly, a signal may be bandlimited at the low-frequency end to a frequency f sub l. If that signal is not so precisely bandlimited, but if a negligible fraction of the signal energy or power lies below f sub l, a filter with low frequency cut-off at f sub l will produce negligible distortion. Real hardware engineers must deal with real waveforms that are usually not of themselves bandlimited. They may be passed through filters that can introduce bandlimiting and hence produce distortion. Mathematically it can be shown that there is an applicable transfer function for filters. The simplest filter configuration is an RC filter. An RC low-pass filter is made of a series resistor and a parallel capacitor. An RC high-pass filter is made of a series capacitor and a parallel resistor. A step function is simply the front of a square wave or a digital pulse. In reality no signal can snap from zero to any voltage in zero time because any circuit device must have some initial limiting inductive or capacitive reactance…but in theory a step function can. Circuits within modern microchips are almost (but not quite) as fast in rising as theoretical step functions. By using theoretical step functions, we can blame filter reactance alone for the integrated or differentiated shapes that a resulting signal will look like on an oscilloscope.

(To be continued next month).

PRESIDENT'S NOTE by ED GELLENDER, WB2EAV
June 2010

Field Day is almost upon us. It will be from 2 PM on Saturday, June 26 thru 2 PM on Sunday June 27, but we need Saturday morning to get everything set up, and then a few additional hours Sunday afternoon to disassemble everything and clean up. We will be at the same location for the third year in a row…we must like the place. It is now time to get moving on it.

The Field Day site is 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 on deer Park Road from either the LIE at exit 51 and head north or the Northern State exit 42 South. Alternately you can take Vanderbilt Parkway 2 miles west from Commack Road, just south of the Northern State interchange. We will be in the first building on the left (parking is a bit further on the right).

For the last six years or so, on Field Day we have been using a gasoline powered 5 KW 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 it is quite awkward for us to use. Bill N2SFT always steps up and brings his trailer for the purpose, but I don't like to impose on him. We looked into the possibility of using two smaller generators that would fit into a car trunk, as renting such things for one weekend a year sounds like a good idea. However, I hear that the cute small ones are never available for rent – so we're back to where we started. If anyone in our reading audience has any last-minute suggestions to save wear and tear on Bill and his trailer, let me know.

I have been checking our Post Office Box for what must be five years now and have just noticed something new. For the first time ever, within the last couple of months two club members have contacted me that they mailed dues to the PO Box and their check was never cashed. I am scrupulous about such things and can not see how anything that makes it to the box can get past me. I wonder if perhaps the Post Office is getting sloppy. I guess that people mailing stuff in should be careful to properly and neatly address envelopes to make sure that the Post Office gets it right. Remember: P.O. Box 644   Bethpage, NY 11714-0644

73, Ed WB2EAV

GRUMMAN AMATEUR RADIO CLUB
MINUTES OF GENERAL MEETING 5/19/2010
By Gordon. KB2UB, VP

The President/Treasurer and Secretary were absent.
The meeting was called to order by Gordon at 5:25 PM
There were nine attendees.

REPEATER REPORT - Gordon, KB2UB
The repeaters are working fine.

VE REPORT – Bob, W2ILP
Two applicants: Member Bill Savage, N2SFT upgraded to Extra Class. Congratulations Bill!
A second applicant upgraded from Tech to General. There were no commercial applicants.
VEs were W2ABK, WB2EAV, WB2IKT and W2ILP.

OLD BUSINESS
Field Day: Ray, W2DKM reported progress with same schedule as last year at Dix Hills Golf Course.
Jack, WA2PYK will provide Subway heroes and soft drinks.

NEW BUSINESS
We are seeking guest speakers and ideas for future programs.

PROGRAM
Gordon, KB2UB presented a history of Maklin model railroading, including a model of a German
electric locomotive from his collection and Maklin's patented track. Modern era digital control and
sound effect features were discussed. A DVD summarizing the Maklin Insider Club activities for 2009
was shown.

The meeting was adjoined at 6:30 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.

OBITUARY

We note with sadness the passing of Georgann Sammis (nee Marino), the wife for 51 years of G. Gordon Sammis, KB2UB, our vice president. She passed away on Monday, May 31, 2010, in her 74th year.

INTERNET LINK OF THE MONTH FOR INTERNERDS

This month I will remind all about the 'new and improved" ARRL website. The address is:-
http://www.arrl.org/home/
I used to be able to automatically log on to the ARRL site as a member. I think that I had a cookie for that. Apparently the new site or the cookie no longer got me logged in automatically, so I had to re-register, giving my ARRL Member ID number and getting a temporary password, which I changed to an easily remembered new password. I was told that the new website could enable members to read archives of QSTs. I wasn't able to do so, but that may be because I'm not fully aware of how to maneuver on the site. I was able to use the call sign/name look-up feature, but it offers nothing that can not be found via QRZ. I dunno if some features are only available to "Diamond" grade members. There wasn't a detailed profile for me there yet. I'll have to send mine in when I get time. I suggest that all ARRL members send in their profiles, or at least give them information about your ham activities, whether you are a VE, or hold office in a club, etc. Toot your own horn as the others do. As always, they list our scheduled VE exams, even though we use W5YI-VEC. There is a link to our section (NLI)'s webpage. You can also go there directly. The NLI webpage carries the NLI newsletter and archives of same. As I did last year, I will see that the GARC Field Day location gets listed on the NLI list (if this wasn't already done). We need to do that if we want to be visited by ARRL leaders.

PUZZLE

Here is another Cryptogram: *This is a short one for the experts.*

HV SDIV ZSV AOKK XC TOUSZN HSDZ HV MVVF ON D AOKK XC

 TVNEXMNOAOKOZOVN.

--AOKK JDSVT--

Solution to the May 2010 Cryptogram:

SEEING A MURDER ON TELEVISION CAN HELP WORK OFF ONE'S ANTAGONISMS.
AND IF YOU HAVEN"T ANY ANTAGONISMS, THE COMMERCIALS WILL GIVE YOU SOME.
 --ALFRED HITCHCOCK--

EDITORIAL

Computer Internet operating has supplanted ham radio as a hobby that enables chatting with strangers worldwide, but there is a big difference between these two communications hobbies. Ham Radio, is of course the older of the two hobbies and it carries some old baggage that evolved out of good reasons for communication security, that were prevalent during hot and cold wars. It is now impossible for the FCC to monitor even a small part of what goes over the Internet. It is also impossible to determine what gets communicated that involves large or small profit-making business dealing. There is now a proposal going to the FCC that may reduce the restriction pertaining to commercial workers, who are being paid while operating as hams for emergency purposes or drills. In my opinion such rules should be unnecessary, considering that they are limited to amateur radio operations that non-hams need not observe…However, I do hope that the FCC will continue to prevent hams from broadcasting commercials. We get enough commercial ads from TV or the Internet. Somehow ads for Yahoo, AOL, etc. even get attached to many of our e-mails. Ham radio must remain free of commercial advertisements. Hams must continue their old tradition of being good for nothing.

w2ilp (I Like PBS)……but even they carry ads. -- Drink your Ovaltine --

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-VEC:-http://www.arrl.org or
W5YI-VEC:- http://www.w5yi.org
All VECs use the same Q &A pools.
The Technician exam Q & A pool will be changed after July 1, 2010.
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>

HOBBIES

Gordon, KB2UB, told us about his hobby of model railroading at the last GARC meeting. It seems that people who get serious about their hobbies often are serious about more than one hobby. It is interesting to find that hobbyists continue to be active in their retirement with hobbies that they began in their youth. Ham radio alone is a very diverse hobby. Few can operate all modes on all bands and get involved with Amateur Radio TV, Moon bouncing, Satellite com, new digital modes, spread spectrum, direction finding, etc. We tend to do what we can with limited antenna space, limited resources, limited cash, etc. We still remain active in some, but not all, of the modes that we may have tried….BUT getting back to the fact that we are, after all, avid *hobbyists*, and some of us are nerds that never got very serious about outdoor sports, we still may be drawn to hobbies that remind us of our youth or we may have become attracted to new hobbies that keep our minds busy in our senior years. Ham Radio was my first hobby, if you concede that it started when I built crystal sets and vacuum tube radios, and was an SWL, as far back as I can remember. I also built model airplanes; both flying models and scale models. I never could afford any model engines, but I built large rubber band powered planes, and even a tow line glider. In addition to that I had other hobbies, including raising tropical fish, water color and oil painting, poetry writing, house plant growing, and stamp collecting. Aside from Ham radio, there remains only one hobby which I continue to this day. That is stamp collecting. I started believing that I could collect all of the postage stamps of the world when I was a kid. I did realize that I would have to collect used stamps because unused ones would be too expensive. The hobby evolved into trying to fill four gigantic Minkus albums. I continued to buy supplements for the albums until 1975, when I was working and going to school, and there was no time for stamp collecting. Minkus went out of business. I now have picked up the hobby again, looking for the stamps that were issued prior to 1975, which I am missing. Stamp collecting is like DXing. You can get involved with people all over the globe, who will trade stamps with you. This helps you get something for the many duplicates that you amass at little or no cost. I have traded with hams and non-hams worldwide, and I learned some history and geography from both of my hobbies.   –w2ilp--