Communications Systems (continued from February 2010)
By Bob Wexelbaum, W2ILP

Spectral analysis is a branch of mathematics that is of great value in the study of communications systems. In practice a spectrum analyzer is used to attempt to display the frequency domain. The theoretical frequency domain of a sine wave of a single coherent frequency is a line of zero width at the fundamental frequency of that sine wave. A sine wave is an example of what is called a periodic wave.   A periodic function of time v(t) has a period T0 which can be expressed as an infinite sum of sinusoidal waveforms. This is what is called a *Fourier series.* There are many forms of equations which can mathematically define a Fourier series. We can simplify the concept of harmonics for a ham, while the math student wrestles with the math. The ham may know that a wave at a fundamental frequency f0 = 1/T0 will also generate harmonics, nf0, where n is a series of integers from 1 up. Coefficients of the relative amplitudes of the harmonics are called *spectral amplitudes.* A theoretical plot of spectral amplitudes of a periodic waveform will show a line at each harmonic frequency with its relative spectral amplitude. That being said, let us now analyze the first mode of radio communication both for telegraphy and for ham radio. Hams call it "CW", but CW means "continuous wave". A CW transmitter can only emit continuous sinusoidal waves. It could be used as a beacon, but would not be capable of transmitting messages. What radio telegraphers, as well as the hams have used and still use is *keyed continuous waves.*   The sine wave is keyed by a serial code adopted from the code that Morse had devised for land-line signaling. This is a true digital binary code. It basically involves only key down to transmit dots and dashes and key up to designate spaces. There is optimally a sign wave during key down, and nothing transmitted during key up. Thus the next question is: What happens when the sine wave is keyed? This depends on how the transmitter is configured, as well as how fast it is being keyed. Switching from key on to key off and vice versa is performing what is mathematically called a *step function.* If the switching is randomly done to the sine wave there are cycles of the wave that will get distorted. Now it is possible to switch coherently at the zero crossing of the sine wave and this makes matters much simpler. Before the vacuum tube was invented, keying of spark gap transmitters could produce a real sloppy signal. This was because the early spark gap transmitters did not generate pure sine waves and there was very poor frequency regulation when they were keyed. These conditions were somewhat improved by synchronously keyed rotary sparks. After vacuum tube transmitters were used, obstacles remained which also limited the purity of radio telegraph signals. Keying a transmitter's master oscillator could cause it to drift in frequency. Better results were achieved by keying transmitter multiplier, buffer and /or power amplifier stages, and permitting the frequency controlling oscillator to remain isolated, but shielded from radiating itself. We learn from AC network theory that switching a reactive load will not cleanly occur in the real world. Differentiated spikes will usually occur at the rise and fall of switching, which are known as *key clicks.* These can be smoothed away by an RC network called a key click filter. Typical filters of that type involve time constants that are as long as 5 ms in duration. With the advent of transistorized transmitters the key click spikes became lower in voltage amplitude than with vacuum tubes, simply because the transistors operated at lower supply voltages. Technically the ability to build what are called transmission gates with discrete components did not change these limitations very much. Now we have computers that utilize microprocessors that are clocked at microwave frequencies so that it is possible to

generate almost perfectly uniform waveforms. In a mode called Hellschreiber, keyed continuous waves are programmed so that they generate not dots and dashes but pixels. The rise and fall of each pixel is not simply a case of filtering the rise and fall. The pixels are shaped by software. It is now possible to use an SSB transmitter to generate very clean keyed CW, by keying a tone (usually 900 Hz), rather than switching the transmitter circuits. When a SSB transmitter is modulated by a single audio tone it transmits a single radio frequency. When it receives no tone it transmits nothing; thus it performs exactly like a keyed CW transmitter, only a lot cleaner. We will discuss SSB transmitters in detail later. A spectrum analyzer instrument has many limitations which can limit what can be seen on its display. The object is to see real signals in the frequency domain, with some idea of their bandwidths and their harmonics. Old analog spectrum analyzers could not do a very good job of doing that. If they had no capability of storing images they would have to depend on the persistence of the CRT to have a reasonable "after glow", so that singular events could be seen. Spectrum analyzers are actually scanning radio receivers. They are thus limited to the bandwidths, sensitivities, and parameters that the receivers have. Spectrum analyzers have to scan frequencies at linear rates determined by the operator. Their ability to sample signals is also a special part of communications theory. If they go too fast for example they might miss a signal, but they may need to scan quickly when there is limited storage capability. Now we have digital spectrum analyzers that are run by a microprocessor in a similar way that microprocessors are used in PCs. Sampling theory can now mathematically prove results that are closer to those that are seen on digital spectrum analyzers. [*To be continued*]

PRESIDENT'S NOTE by ED GELLENDER, WB2EAV
March 2010

Last month, I said here that we were expecting some news about our repeaters becoming involved at some level with linking to other repeaters via IRLP. As promised, Bill N2NFI came to last month's meeting with a proposal and an explanation of the process.

First, what is repeater linking via IRLP? Someone sets up a computer connected to a transceiver near a repeater. This is referred to as a node. Nothing actually touches the repeater. The computer is programmed with specialized software that allows people to access the computer at the node via the internet, and correspondingly get on the air remotely; in theory from anywhere in the world.

Now, you are probably saying, who wants that? It opens up the flood gates to every idiot on the planet. Obviously it doesn't work that way or it wouldn't have become as popular as it is. The key is that to access the node computer you must have the same programs installed in your computer, and each computer has an address and other characteristics. Now, here is the interesting part – the node operator specifically allows only those computers that meet his criteria. For example, if a member moves to Podunk he can set up a computer with a microphone and speaker, and ask if he can access the repeater node from his new home. Alternately, if his local repeater also has a node station affiliated with it, he can ask that his local repeater be allowed. That way he can continue to ragchew with the same people like he did before he moved. .

What Bill has in mind is much smaller in scope. He is coordinator for Suffolk County ARES (Amateur Radio Emergency Service) and uses our Hauppauge 145.33 repeater for their Monday night net. He would like to open the coverage to include all of Suffolk County, which our repeater doesn't quite cover. He has selected a few other repeaters in Suffolk that not only provide coverage where we don't, but have IRLP nodes associated with them. He wants to only allow those specific repeaters access to our repeater…and only during the net.

Not only do we support valuable resources like ARES, but Bill is the caretaker for our repeater…and takes tender loving care of it. Can't say no to that.   73, Ed WB2EAV   Page 2

GRUMMAN AMATEUR RADIO CLUB
MINUTES OF GENERAL MEETING 2/17/2010
By Karen, W2ABK, secretary.
The meeting was called to order by Ed at 5:40 PM.

TREASURERS REPORT – Ed, WB2EAV
 Finances continue to be in good shape.

VE REPORT – Bob, W2ILP
There were five applicants.
Three passed Technician exams.
Two upgraded to General. VEs were
 W2ABK, WB2IKT, and W2ILP.

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

NET REPORT - Zack,WB2PUE
 Thursday night net had a good turnout.
Sunday morning net is on 7.289.

OLD BUSINESS
Liability forms for 2010 are being collected..

NEW BUSINESS
Discussing repeater noise. Noise on the 5.33 repeater may be due to wind blowing on a fractured weld on an antenna element.

Ray, W2DKM will provide a special DVD to be shown at our March meeting

PROGRAM
Bill Schiebel, N2NFI, was our guest speaker. He spoke about the possibility of using IRLP on the 5.33 repeater and explained how the system works. The primary possible use could be only for ARES/RACES emergency preparedness nets. The GARC membership must agree to this use of our repeater and whether we would want to use this feature for our own nets. Bill may be writing an article for this newsletter explaining in detail how a host station can link the repeater to the internet via a computer.

The meeting was adjoined at 7:00 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 the week before the General Meeting.

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

A special facet of amateur radio is a method of contacting other ham stations by bouncing signals off the Moon. This is called EME (Earth-Moon-Earth). Although various methods have been tried, presently microwaves are being employed. This enables using directive dish antennas that can be pointed at the Moon when it is in optical view. Schedules are made between stations that prepare to use this mode at specific times and frequencies. The internet link of this month shows a typical EME station operating in the CW mode.

The link is : http://www.youtube.com/user/ok1dfc

This shows a recent QSO between OK2DL and G4CCH. Be sure to turn on your audio and plug you earphones into your computer. The CW is slow and clear enough for me to copy it.

The HF transceiver shown is an IC-7700, which has its own spectrum analyzer. The HF transceiver is operated in the 10 Meter ham band. There is a transverter which down converts the 1296 MHz signal to a frequency within the 10 Meter band and up converts the 10 Meter transceiver RF output to 1296 MHz for replying. You can find more information about EME operation at this site and also link to other youtube videos of EME operations.

PUZZLE

Here is another Cryptogram:

XKTKBFCFQM FC JM FMBKMXFQM XVJX WKYHFXC PQE XQ AK KMXKYXJFMKL FM

PQEY TFBFMS YQQH AP WKQWTK PQE RQETLM'X VJBK FM PQEY VQHK .

–LJBFL NYQCX--

Solution to the February 2010 Cryptogram: TIME IS THAT WHEREIN THERE IS OPPORTUNITY AND OPPORTUNITY IS THAT WHEREIN THERE IS NO GREAT TIME. –HIPPOCRATES--

EDITORIAL

I just realized that as of last month, I have been editor of this newsletter for five years. That is longer than I thought it had been, maybe because I do enjoy the job. It keeps my mind busy and it is thus mental therapy for me. Aside for GARC members, there are others who read CQ de WA2LQO on the website, and I want to thank Pat, KE2LJ for posting each months edition. There are a few that are missing and when I can find them I'll send them to Pat. Last Sunday I was in contact with K2RIW on the LIMARC repeater. Dick commented that my signal was weak and noisy. My 2 Meter antenna is in my attic and the roof was wet from snow. Dick told me to use another repeater that he was also linked to. I think it was up on 146.???, I was full quieting there. The repeaters are linked by IRLP and can be accessed by hams in other states, many of which benefit by listening to the K2RIW Tech talks. It is a net and thus K2RIW can not be accused of broadcasting.
I can remember when the GARC added PL tones to the repeaters and I had to buy a little modification PC that I added to my HT. As technology changes stuff gets added and it becomes common for everyone to install the same stuff. Enuf Sed.
73, Bob w2ilp (I Like 'Phones) …but not dial-up modems.

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.

Bob Wexelbaum, W2ILP and the GARC VE team.

FIRST CLASS

DO NOT DELAY

SOMETHING DIFFERENT AT THIS MONTH"S MEETING
By Ray Schubnel, W2DKM

To ward off the coolness of winter, we are having a "Guest Speaker/ Performer" via DVD from Las Vegas. Our DVD guest, Terry Factor, is the winner of "America's Got Talent", and a great showman. He performs most nights as a headliner at the Mirage in Las Vegas, and has recorded a professional DVD highlighting much of his show. This DVD will be shown at our March meeting, so come on out and join the fun!

MORSE CODE PERIOD EVALUATIONS

There is a word that is used as a standard for timing Morse code transmissions. It is the word "PARIS" which is an average word that gets used to define the "w" in "wpm". In Morse PARIS is:
.--. .- .-. .. ...
To set time standards we use one period for each dit and three periods for each dah, one period for the space between elements, and three periods for the space between characters, and we add 7 periods for the space between words. PARIS totals to 50 periods. My call sign W2ILP totals to 66. The club call sign, WA2LQO totals to 83!

WA2LQO is definitely longer than the average call sign and thus it is a handicap in CW contests or on FD. It is also hard to get through QRM on 'phone because of its length. Nobody wants to change the club call sign although we could easily get a shorter vanity call. That's a 'Tradition' , which makes it hard to debate...but ham radio is also a progressive technological hobby for some people and as such might be technically untraditional if it complies with the rule of Information Theory, which says that a call should not be longer than it needs to be.
-de w2ilp (I Like PARIS)