CQ de WA2LQO

The official voice of the Grumman Amateur Radio Club

February 2011 VOLUME 85 NUMBER 2

COMMUNICATIONS SYSTEMS (continued from January 2011)

By Bob Wexelbaum, W2ILP

There is always a carrier at the center of a conventional AM broadcasting signal. Audio modulation develops varying sideband spectral distributions on each side of the carrier. Now we come to another type of signal which is quite different. It is *Frequency Modulation* (FM). It may seem simple to understand that for AM we vary the sidebands and for FM we vary the frequency of the carrier itself. FM is known as angle modulation, when described graphically. Armstrong, who invented FM, initially did not understand the spectral bandwidths that FM signals would generate. FM bandwidth was mathematically calculated by a professor named A. Bruce Carson. (It is believed that the A stood for Adolph.) Texts describing FM have often been confusing because of the loose use of terminology. The *center frequency* is often confused with the carrier frequency. They are not the same. The center frequency is where the FM carrier would be when there is no modulation, or where it may instantaneously be, when the audio modulation waveform crosses the zero axis. The carrier frequency varies to follow the analog audio. Confusion also occurs when FM is related to *Phase Modulation* (PM). At the receiver it is impossible to detect any difference between FM and PM. When the frequency of the carrier is varied, the phase is varied and vice versa. The instantaneous value of the carrier frequency from the center frequency (delta f) is called the *frequency deviation.* The instantaneous value of the phase of the carrier referenced to the phase of the center frequency (delta phi) is called the *phase deviation.* This may confuse students because the center frequency does not exist at the time that frequency or phase deviation is referenced to it! FM and PM are described by different equations: PM methods feed the modulating signal to an integrator and then to a phase modulator, while FM methods feed modulating signal to a differentiator and then to a frequency modulator. In actual practice the circuitry in the transmitter determines whether the transmitter is FM or PM. Originally, generation of true FM required that the master oscillator, which is the original source of the RF frequency, must be modulated. In most modern transmitters (both amateur and commercial) this is no longer the case. The prime frequency source is usually a crystal oscillator that is a part of a frequency synthesizer in a phase locked loop (PLL) system. Modulating of the prime reference or of the voltage controlled oscillators (VCO) that are in PLLs could be disruptive to loop frequency stability. Thus reactance modulation methods are usually implemented after the frequency synthesizers themselves and circuit wise most modern "FM" transmitters are technically PM transmitters. Modern transmitters utilize stages of RF frequency multiplication. A very small phase shift produced by reactance modulation at an early stage is multiplied as many times as the prime frequency is multiplied, which can then provide the final desired deviation. When amateurs were given permission to use FM by the FCC it was agreed that they could not use bandwidths greater than 10 kHz, which was the same bandwidth required for an AM signal. This became the bandwidth that is now called Narrow Band FM (NBFM). It

was easy to implement, since the modulation would only be voice frequencies between about 300 and 3000 Hz. Although telephone quality is defined as being from 30 to 3000 Hz, the 300 Hz lower limit suffices for ham voice communication. Lower frequency tones can then be added for repeater control and filtered in the receivers so as not to be audible. An FM signal is always a sine wave whose deviation causes its period to vary. I won't go into heavy math but I need to define several factors that are needed to explain FM theory. A term called the *modulation index* is notated by *beta*. The maximum frequency deviation is *delta f*. The angular (and thus the frequency) variation is sinusoidal with frequency *f sub m.* By definition the frequency deviation *delta f* is given by: (delta f) = beta (f sub m). So we see that beta = delta f / (f sub m). For NBFM beta is much less than 1. While the instantaneous frequency *f* lies in the range of center frequency plus or minus delta f, it can not be concluded that all spectral components of the signal lie in this range. Not going into an analysis of the spectral components of angle modulation here; I will now go on to defining the bandwidth of FM signals. For sinusoidal modulation the bandwidth (B) required to transmit or receive such a signal is equal to 2 (beta +1) (f sub m). Carson's Rule is expressed as *The bandwidth is twice the sum of the maximum frequency deviation and the modulation frequency.* This is simply: B = 2 (delta f + f sub m). *(To be continued)*

PRESIDENT'S NOTE by ED GELLENDER, WB2EAV
February 2011

As you probably know, Ham Radio University 2011 was held at Briarcliffe College in Bethpage on January 9th. I had to come in late, but enjoyed the second half. This year it was really crowded, probably because it was a nice day after a lot of snow.

I attended the new ham forum, led by my old friend Lew, N2RQ, who I first met when we started college in….1963 (wow). A really pleasant surprise was that Lew brought two of his prize students - high school juniors who recently went out and got their ham licenses on their own…no family members pushing or anything. When I was that age it was a common sight. Today it is as rare and beautiful as a perfect jewel. Quite delightful.

The club remains affiliated with Northrop Grumman and is part of Company Recreation, which is a shadow of what it once was. For the past few years the company has not been too serious about the clubs, so it was great when they asked for receipts ofr qualified expenditures and they actually reimbursed a reasonable amount of money. Not enough to really change anything, but enough to allow us to continue our easygoing approach to lapsed members, as well as helping pay for those unqualified expenses…like insurance for example.

Speaking of lapsed members, your mailing label shows the last year your dues are paid for. If you are not up to date, now is the time to mail a $20 check to: Grumman ARC, P.O. Box 644, Bethpage, NY 11714. (Retired and out of town $10; two at the same address $25) If you have any comments at all about your financial status, please give me a call at 516-575-0013. We just want to hear from you. We are easy and just want our newsletter read. But if we hear nothing long enough, even we run out of patience.

GRUMMAN AMATEUR RADIO CLUB
MINUTES OF GENERAL MEETING 1/19/2011

By Karen, W2ABK, Secretary

The meeting was called to order by Gordon at 5:25 PM.

TREASURER'S REPORT – Ed, WB2EAV

Finances continue to be in good shape.

REPEATER REPORT – Gordon, KB2UB

Both repeaters are working.

NET REPORT – Karen, W2ABK

Thursday night net at 8:30 PM on 145.330 MHz had a few check ins.

Sunday morning net at 7:30 AM on 7.289 MHz suffered from poor conditions.

VE REPORT – Bob, W2ILP

No VE session in January due to a lack of applicants.

OLD BUSINESS

Karen W2ABK told about some of the forums at HRU 2011, which was held at Briarcliffe College on January 9th. Kay Craigie, N2KN, ARRL vice president, was the keynote speaker. She said that hams should have fun with ham radio. They should try to do new things with ham radio, but it was most important to have fun.

NEW BUSINESS

Dave, AB2EF brought in 5 Volt and 12 Volt power supplies that he is giving away.

PROGRAM

Gordon KB2UB brought in an emergency marine radio, land radio, power supply and antenna that are used by the Coast Guard. They can run off AC or a car battery. He showed how it worked and could be set up in less than ½ hour. It is neatly stored for easy access in a water proof box. He also brought in a DVD that showed a RE66 electric locomotive in Switzerland and a high speed train in Paris that can travel at 200 mph in
safety and comfort.

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 EXT Thursdays
Tone for both repeaters: 136.5 Hz.
GARC Net Controller Karen, W2ABK
ARES/RACES NETS: Mondays

MEETINGS General Meetings of the GARC are held on the third Wednesday of each month, starting at 5:30 PM, at the Ellsworth Allen Park in Farmingdale. Driving directions and map 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.

WEBSITE The GARC web site 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

As a member of a flying hams chat group, I receive information about some interesting websites. This month I want you to visit the radio deck in a WW2 B-29 bomber. There you will probably recognize many of the units that once were sold as surplus on Cortland Street and often modified for ham usage. Perhaps you have owned some of them yourself. I still own a modified BC-458. Only now, after visiting this site, do I realize how all this stuff was connected together. Be sure to click on the links that you will find on this site to see more old units and detailed explanations about them.
http://aafradio.org/flightdeck/b29.htm

On page 6, I write about FRACTAL GEOMETRY based on the PBS Nova video presentation. I also mentioned that Nathan "Chip" Cohn, N1YV, who was seen on the PBS video, had been chatting with hams, including yours truly, in several QRZ threads, some of which were moved from the RAGCHEW area to the ANTENNA FORUM area. Some of the hams got unruly and heckled Cohn and now the threads have been deleted by the QRZ moderators. I had originally wanted to make those threads the Internet Link of this month…but unfortunately they are no longer available. Cohn promises to write an article for QST and also to write a book about fractal antenna design. Some hams bet that he won't follow through. Cohn also is planning to manufacture antennas. We will see how his business works out. Skeptical hams are a tough group to sell stuff to. Ham antenna experts seem to know (or think that they know) more about practical antennas than PhDs. Every antenna is not fractal. Everything that looks fractal is not an antenna. This subject needs lots of clarification in my humble opinion.

PUZZLE
Here is another cryptogram:

PIS GFP KO QWAWZM QWSD QSDD WZ SQWBWZGPWZM KYF

PFKYTQSD PIGZ WZ MFKHWZM HWPI PISB. –TSFZGFE B. TGFYNI--

Solution to the December 2010 cryptogram:
THE TROUBLE WITH THE WORLD IS THAT THE STUPID ARE COCKSURE AND THE INTELLIGENT FULL OF DOUBT. –BERTRAND RUSSELL—

Editorial

The snow and cold weather has kept me indoors lately and has given me time to do some ham related stuff. I have not been active on the air but I have been busy on the Internet, and preparing this newsletter. I have been researching fractal geometry and also the new high intensity LED light bulbs. See page 6 about fractals geometry. I hope to discuss the new LED lamps next month.

GARC Officers

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1 Yr. Board Member: Dave Ledo, AB2EF
1 Yr. Board Member: Bob Cristen, W2FPF

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Contributing writers: All GARC members (we hope). To submit articles or ham equipment advertisements contact the editor. Articles will only be edited when permission is granted by the author.

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GARC VE Exams We normally proctor exams for all classes of ham licenses on the second Tuesday of each month, starting at 5:00 PM. The exams are given at Briarcliffe College, 1055 Stewart Avenue, Bethpage, NY in room: Long Beach #5.
Ham Exams are: Element 2 – Technician, Element 3 - General, Element 4 – Amateur Extra Class. All applicants must pre-register by contacting W2ILP (see above). Time and location of exams are subject to change. If there are no applicants VE sessions will be cancelled. The fee for 2011 is $14 for all exams taken at one sitting. New first time applicants should be aware that their Social Security Number will be required on the application form unless they register with the FCC for an FRN. Applicants for an upgrade should bring their present license and a photocopy of it. All applicants should bring picture ID such as a driver's license. Study material may be bought from the ARRL-VEC or W5YI-VEC http://www.arrl.org or http://www.w5yi.org All VECs use the same Q & A pools.

Commercial FCC Radio Operator Exams We are certified by the National Radio Examiners to administer exams for all classes of FCC commercial radio operator and maintainer exams. All Commercial Operator License Examiner Managers (COLEMS) use the same commercial license pools. Administrating fees vary. For information or to register contact W2ILP.

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FRACTAL GEOMETRY

There was a PBS NOVA Series TV broadcast that described fractal geometry. It originally aired on October 28, 2008. It is available at http://video.pbs.org/video/1050932219/ If you don't see this video then you won't know what I am talking about. Basically it shows that fractal designs are found everywhere intrinsic to nature. For art to appear natural it must be drawn or computer generated with fractal geometry. The branching of plants, roots and trees is fractal. The shapes of snowflakes are fractal. Our veins and capillaries are fractal. A mathematician named Mandlebrot generated an iterated set that depicts his classical fractal design. A ham named Nathan Cohn, W1YV, who goes by the handle of Chip, introduced his experimental work with fractal antennas. Chip has been active on several threads on QRZ that explain fractal antennas that he has made. Deciding if conventional antennas are fractal is not as clear cut as one might suspect. I pointed out that the vanes of the super-turnstile antenna that was used for VHF TV broadcasting starting in the 1940s are fractal. That antenna was designed before fractal geometry became a buzz word. Some hams on QRZ said that a log periodic beam is fractal. I was among those who disagreed. It is now "in" to say that an antenna is fractal and some hams and antenna makers are saying that every antenna is fractal. Chip and others have been trying to design a fractal antenna that would work on 160 or 80 meters, or even on all HF ham bands and be fractal. So that one of the uses of fractal design is to design smaller antennas than full size dipoles, and another hope is to make antennas that can efficiently cover very large frequency ranges. The fractal printed circuit antennas used for microwave cell phones have been proven practical but making antennas for VHF and HF ham use offers greater challenges. As yet nobody has made anything that has better or equal forward gain than the Mosley tri-band beam that was designed in 1938. I have some ideas of my own that I shared with Chip but my dream antenna, which is a conical antenna with arms that branch like those of trees might not be practical because of mechanical limitations, wind loading, etc. –73, w2ilp—