



LONG ISLAND MOBILE AMATEUR RADIO CLUB, INC.

SERVING THE AMATEUR RADIO COMMUNITY SINCE 1965

LIMARC



www.limarc.org

April 2018

Volume LIII No. 4

**Next meeting to be held:
Wednesday, April 11, 2018
8:00pm Levittown Hall**

Main Topic

Low Budget Ham Radio

New Ham radio gadgets you can't live without for \$50 or less.
Hands on presentation and door prizes!

EXTRA !! EXTRA!!

AFTER VE SESSION GETS GALACTIC VISITORS - See pg. 10

Save The Dates!!

Outdoor Hamfest—Briarcliffe College - June 10th - pg. 18

Field Day 2018 - June 23-24



Greetings!

There are many things that LIMARC does that go under-reported or not reported at all. Welcome to the Media Age and Facebook, Twitter, and Instagram. Letting our members and others know what we do, and the contributions of amateur radio in general, is something that is really important, particularly in keeping amateur radio alive.

The International Space Station is a combined effort on the part of many countries to promote science as well as the peaceful use of space. In almost every case, there is a ham radio operator on board who may come from just about any country. The ham astronauts are free to use the radio during their break time, just as we do. It is a pretty big event when a school or museum for example, can schedule a QSO with the ISS. When a ham radio operator is on the air from the ISS, it becomes know as ARISS, or Amateur Radio on the International Space Station.

LIMARC has been the sponsoring radio club for several QSO's, just recently at Freeport H.S. Thousands of students had the opportunity to listen as several of their classmates asked questions of the astronauts and heard their answers. Lost sometimes is the fact that this is strictly a ham radio operation. The ham astronaut connects to an earth station operated by a ham radio operator. We impress that on the students so that they understand that they are transmitting their signal through a ham radio station. All of the excitement and great public relations for the space program generated through these contacts, simple would not exist if it were not for ham radio.

We are proud of LIMARC's contributions to the program and very proud of amateur radio and all that it can do.

Happy Easter and Happy Passover!

73

Richie, K2KNB
President

LIMARC Board Meeting Minutes

March 07, 2018

The March 7 board meeting was cancelled due to the severe weather warnings. Since there were no time critical items needing attention status and committee reports were submitted via email.

From Richie K2KNB: We are prepared for the demonstration station after the VE session on Saturday March 10. The only thing preventing the station from being set up is snow on the ground. Even if snow prevents station setup we should still be able to hold the VE session.

We will be assisting Freeport HS with their ARISS event at the end of this month.

Use of the Rosemary Kennedy field for Field Day is approved. We are waiting for the permit. We may have the use of a garage for storage of Field Day equipment. It is located near the site.

We were approved for the Special events stations May 20th and July 20th, at the Cradle of Aviation Museum.

The outdoor Hamfest has been approved for June 10th.

From Jerry WB2ZEX: Treasury: checking account \$17,938.91, PayPal \$809.12, Education/Memorial \$2099.59 for a total of \$20,847.62

Hamfest: About 315 buyers and 50 vendors brought in \$2916 at the door (there were other income such as 50/50, membership and equipment apparel sold not included in the above). There was \$510 in advance payments for a total of \$3426. Expenses were just the tables for \$526 for a net gain of exactly \$2900.

Compared to Feb. 2017: total income was \$3274, expenses were \$516.66 for a net profit of \$2757.34

Membership: Currently 340 members paid for 2018 or higher. As of March 5th of last year we had 354 paid members.

From Bill KC2SYL: A high-level plan for Field Day has been prepared showing items that must be resolved at the Field Day Committee meetings:

- Verify and validate permissions and insurance coverages

- Create registration and staffing timeline roster

- Schedule a date, identify the team and secure a location for pre-testing and assembling equipment

- A plan to develop invitations, signage, press releases, literature

- Complete welcome table arrangements

- Staffing - welcome table, transportation, loading, set-up and take down

- Infrastructure needs - tents, power supply, lighting, food and refrigeration, giveaways, sanitation

If anyone can help in any of these areas or has anything else they can contribute to our Field Day effort please contact Bill or any board member.

From Craig KD2CXK: The Subway Simplex Project is on the side burner for the next week or two as I have an overload of my business work to pile through and taxes.

I have been approached by a friend who is the scoutmaster of a very large local Boy Scout troop in Forest Hills asking for Jamboree On The Air guidance. I'm going to find out more tomorrow or the next day as he has invited me to his Thursdays den meeting. Any input or direction would be appreciated from the board or other members.

At the general membership meeting on March 14 I plan on presenting the continuation of last Tuesday's astronomy net pertaining to our sun and its effects on propagation. I will require the projector. I'm going to thoroughly test a laptop tonight to make sure it works with VGA as that was my problem in the last slideshow.

Respectfully submitted;
Ken Gunther WB2KWC
LIMARC Secretary

LIMARC General Meeting Minutes

March 14, 2018

LIMARC General Meeting Minutes 2018-03-14

This was the annual Membership Appreciation meeting with pizza being served starting at 7:38 PM.

The business portion of the meeting started at 8 PM with the recitation of the Pledge of Allegiance.

President: Richie K2KNB said that there were approximately 33 people who signed the attendance sheets, we appreciate all who came down and hope you enjoyed the opportunity to socialize with your fellow hams. The 85 repeater is down because of antenna problems, Steve WB2WAK has lent us an antenna and we are scheduling its installation with our landlord. Thank you to Steve Druckman WB2ZSE for putting his repeater on the W2VL frequencies so that complete outage was minimized. The cause of the antenna failure seems to be the high winds we have been having which caused the antenna to crack where it was connected to the hard-line. Thank you to Billy KC2ROB, Eric KE2EJ, Steve WB2WAK, Steve WB2ZSE and Elliott KB2TZ for their help in minimizing the outage.

Vice President: Craig KD2CXK said that tonight's program will be a continuation of the astronomy net discussion of the relationship between the sun and RF propagation.

Treasurer: Jerry WB2ZEX reported \$17,884.33 in the checking account \$352.50 in the PayPal account and \$2099.59 in the Memorial funds for a total of \$20,336.42. Hamfest gross receipts were \$3426; expenses were \$526 producing profits of \$2900.

Membership: Jerry WB2ZEX reported that we have 342 members for 2018.

Richie K2KNB reported that after the March 10th VE session we operated two stations, one voice and one digital. This offered an opportunity for those who just earned or upgraded their license to get on the air. We will be doing the same thing after the next VE session which will be on May 12th. Upcoming events include the operation to commemorate the solo transatlantic flight of Charles Lindbergh which will be on May 20th. Our stations will be set up in the Cradle of Aviation Museum exhibit hall under the Spirit of St. Louis. We have confirmed that the June 10th outdoor Hamfest will be held at the Briarcliffe College site. Field Day 2018 is June 23rd and 24th with setup beginning on Friday, June 22nd. After Field Day takedown, equipment will be stored at a new location about 2 miles from the Field Day site.

Public Service: John KD2AKX is the new DEC and will be giving a presentation next Thursday (March 22nd) which is part two of his NBEMS presentation; it will be held at the Red Cross building. For those who schedules do not permit full ARES participation an ARES Reserve class is being offered. This class will provide sufficient training for you to participate in ARES events such as the Long Island Marathon or the MS walk.

School Club Roundup: Lew N2RQ told us there were 73 entries in the February 2018 session of the School Club Roundup. This number is slightly down from last February probably due to extremely poor band

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conditions. Lew thanked Ken WB2KWC for checking for scoring using custom software that he wrote.

Field Day: Bill KC2SYL said that he needs people to help load, unload, set up, and operate Field Day as well as bring the equipment back to the storage site after Field Day is over (the new storage site is about 2 miles from the Field Day site). We can offer community service credits to students, scouts, etc.

As part of the membership appreciation celebration, awards were given for the following membership milestones:

25 years: Diane K2DO (former LIMARC President), Steve WB2HOZ, Rich N2PPN, Karl N2RLD, Nancy N2TKA (former LIMARC webmistress), and Len N2ZQ.

35 years: Bob WB2DNG, George WA2NIF, Lee N2EMF, and AL K2ES.

40 years: Bill WB2CUK (net control of the Swap 'n Shop net), Doug N2EJ, and Steve WB2WAK.

Homebrewing: Neil W2NDG had an update for people interested in the BITX transceiver that he demonstrated at a previous LIMARC. The manufacturer is catching up with their order backlog. Kits are being delivered approximately six weeks after receipt of order. This project cost Neil approximately \$200 including all parts and case (see <https://fofio.blogspot.com/2018/01/bitx-kits-limarc-pre-meeting-discussion.html>).

Greensky Project: This project uses computerized monitoring devices to determine the source of a radio signal. We use it to pinpoint sources of interference to our repeaters and have had discussions with the FCC about how they might use Greensky to support other services. If you are interested in hosting a Greensky node please contact Richie at K2KNB@LIMARC.org.

The business portion of the meeting ended at 8:32PM and was followed by Craig KD2CXK giving a presentation on how our sun affects radio propagation. This was the second part of a presentation that began on the Astronomy Net.

Respectfully submitted;
Ken Gunther WB2KWC
LIMARC Secretary

GOOD AND WELFARE

Happy Passover and Easter to Everyone !!

Enjoy!!

MEMBERSHIP AWARDS GIVEN - MARCH GENERAL MEETING



Robert Loysch, WB2DNG, received 35 year membership award from Membership Chairman, Jerry Abrams, WB2ZEX.



Diane Ortiz, K2DO, and Nancy Rosner, N2TKA, receive their 25 year membership award.

Unable to attend the Membership Recognition Night:

25 Year Members

Steven Lomasky WB2HOZ

Richard Ser N2PPN

Karl Johnson N2RLD

Len Goldstein N2ZQ

35 Year Members

George Dyer WA2NIF

40 Year Members

William (Bill) Capitman WB2CUK

Douglas Frie N2EJ

Steve Schuck WB2WAK

What is Field Day?

The objective of Field Day (FD) is to work as many stations as possible on any and all amateur bands (excluding the 60, 30, 17, and 12-meter bands) and to learn to operate in abnormal situations in less than optimal conditions. Field Day is open to all amateurs in the areas covered by the ARRL/RAC Field Organizations and countries within IARU Region 2. DX stations residing in other regions may be contacted for credit, but are not eligible to submit entries.

How does LIMARC participate?

For many years, we have used the field behind the Rosemary Kennedy BOCES Center, entrance from Oakfield Avenue at Midland Place, Wantagh. To practice operating in “abnormal situations and less than optimal conditions” we bring all of our equipment to the field on either Friday evening or Saturday morning. We set up several antennas for HF, VHF and UHF bands. We usually have one or two CW, 2-4 SSB phone, and digital HF stations. VHF, UHF, satellite, packet, solar powered stations may also be used and some earn bonus points.

We do not use commercial electricity, but mostly gasoline powered generators.

There are computers for logging at each operating position. (Paper should be used for notes and backup.)

We need to set up shelters, usually tents for operating as well as for eating.

Some food is catered and some is prepared on site. (We need a cook.)

FD is an opportunity to try something that you do not normally do. This is a time to learn and share experience.

How do we accomplish all of these things?

LIMARC has accumulated a diverse inventory of antennas and radios. Nearly all of them are used for FD weekend only. We need to inspect and test our equipment in advance of FD. Who does all of this? Too few of us. We need more members to share this.

Last year’s FD operation faced a number of challenges that should have been a wakeup message. Richie, K2KNB, who often supervises many parts of FD was away, on the west coast. Lew, N2RQ, who stores a number of our radios and some antennas needed to be at Memorial Hospital with his daughter. Torrential rain and wind were major challenges too. We need more members to be familiar with our equipment and how we set it up.

In the past few of years, we have responded to the changes in our membership age profile, by trying to make the physical workload lighter. We use lightweight Honda generators. We replaced our RG-213 cable with lighter RG-8X. We have been replacing linear power supplies with lighter switching units.

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Although Field Day is several weeks away, it is not too early to plan how you will participate. What would you like to do? Assemble, and test stations? Test and assemble antennas? Are you less experienced and would like to try HF operating? You can operate under our Extra Class control operator(s). Each station should have an operator and a logger. Listening and logging along side an experienced operator is a good way to become a better operator.

Please let us know what you would like to do. You can be very helpful even if you cannot attend on FD days.

Field Day 2018 will be on the fourth full weekend in June, 22, 23, 24.

Contact the FD committee at fieldday@limarc.org

REMINDER FIELD DAY PROJECT LEADERS:

Review your requirements and compose a first draft of their operating and team member schedules.

73

Bill KC2SYL

LIMARC Membership Report – April 2018



Please welcome the following new/returning members:

Barbara Grocki KD2PIH

John Bihn KC2RBI

Rob Henrichs W1RHH

The LIMARC 2018 Roster is being prepared. Please look at the introductory email you received with this eLOG to verify that your information is correct. There are still about 30 members whose ARRL Membership is unknown. In order to remain a Special Services Club, we have to meet certain requirements, one of which is over 50% ARRL Membership. So if your introduction states ARRL Membership as a "U", for unknown, please email me with your ARRL status (Life Member, Regular Member, or not an ARRL Member). Thank you.

The Care and Feeding of Our Repeater System

Recently the winds of 3 successive Nor'easters contributed to the demise of our 21 foot vertical antenna mounted on Glen Oaks. While everyone was more than patient and understanding, still some asked as to why it took so long for what seemed to be an easy fix. So I want to take a moment to walk you through the process.

First of all, as the power levels went down on the 85, there was a process of elimination to determine where the problem was coming from. The transmitter, power amp, duplexer, feed line, and antenna were all suspect. When the feedline was replaced as the possible cure, only then was it apparent that the connection at the base of the antenna had been damaged. The constant flexing of the antenna had most likely caused the integrity of the connection to fail and arcing was the subsequent result. The result also included arcing that caused interference to many other services located at the site. Therefore we shut down. From that point we were up and running at full power within 5 days having lost one day to snow.

We are very fortunate to have members that do really great things for us. Normal delivery of a new antenna could be several weeks. Steve Schuck, WB2WAK, had an exact replacement that he was holding on to replace an antenna at one of his sites. He contacted site manager Billy Davies, KC2ROB, who immediately gave Glen Oaks the required 48 hour notice that they would be bringing an antenna to the roof. Steve arranged to meet Billy and give him the antenna and the new feedline that was on Friday. Installation would then be on Tuesday, but was delayed until Wednesday because of the snow.

Meanwhile, Steve Druckman, WB2ZSE, took time on Sunday to reprogram his repeater to the LIMARC frequency so that the interruption seemed to be that much less. When our site was back up and running, he shut down his repeater. Then Eric Spiegel, KE2EJ, our tech chairman, went to work to bring all of the other components back up to optimum working condition.

Please know that access to all of our sites is limited by the circumstances of the world in which we live. Glen Oaks is a residential building where access to the equipment is through a Penthouse area. It is a sensitive area and everyone who goes there, and to any of our sites, must now be vetted. Access to the roof of Glen Oaks is even more severely restricted. Winds can be in excess of 100 miles per hour.

We owe a big thank you to the individuals who did so much, and to our landlord, Communications Leasing for the great support.

Richie, K2KNB

MINI STATION SET UP AFTER VE SESSION ON MARCH 10, 2018
WELCOMED THE VISITORS !!!



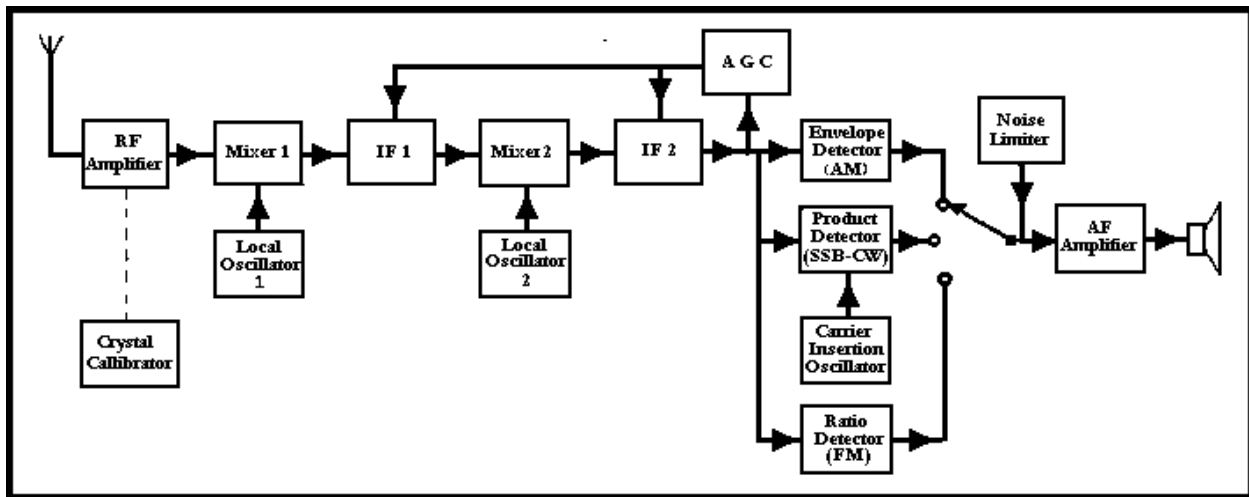
Software Defined Radio – A Technical Discussion

Let's first return to the definition of a Software Defined Radio – there are many floating about, and more than a bit of confusion about the term. It was so confusing that those bright engineers over at the august Institute of Electronic Engineers (IEEE) took the trouble to codify their definition of SDRs:

"Radio in which some or all of the physical layer functions are software defined."

Not "software controlled," or "software enhanced," but "software defined."

Let's just review, for a moment, the block diagram stages of an old legacy analog radio – these pretty much define radios from 1928 all the way to your shiny new Icom IC-7851, that I am sure is a steal at the price of \$12,499.95, being offered this past Holiday Season!

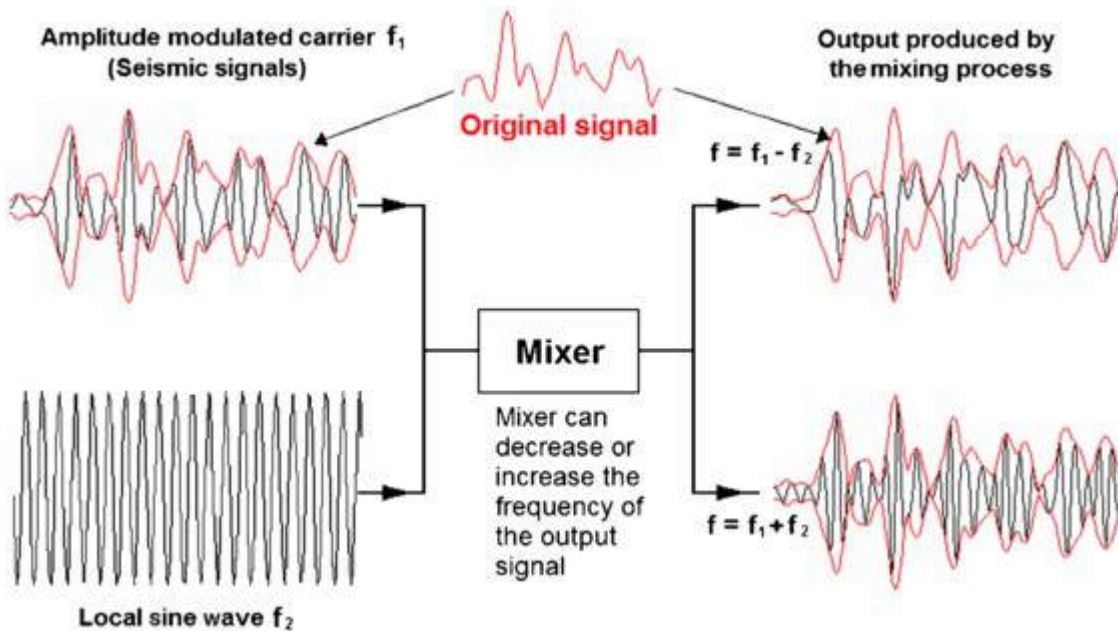


Legacy radios usually are designed similarly – the parts on the high end might be of finer quality, with better accuracy, and better structural integrity, but they are all fundamentally the same.

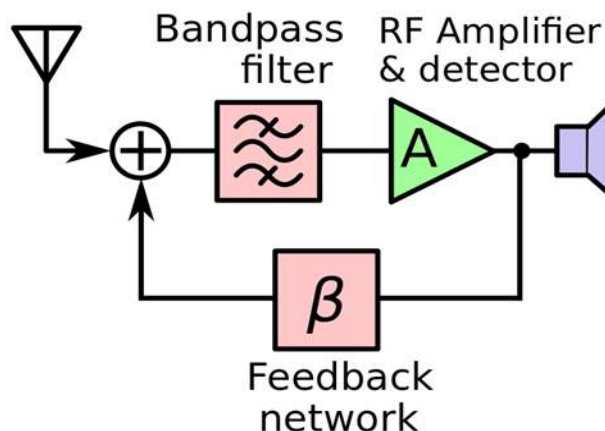
Radio design was revolutionized by the modified Audion Tube – the first triode vacuum tube, and the first way we figured out how to amplify an electrical signal. There were two other important advances in the design, brought forth by the brilliant if a bit eccentric, and unfortunately suicidal Edwin Armstrong. It is thanks to him that we had FM modulation/demodulation, Superheterodyning, and Superregeneracy.

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Superheterodyning mixed the received signal with a local oscillator and then filtered the results, leaving a fixed Intermediate Frequency, for which any good engineer could design filters and amplifiers optimized for that one single signal frequency. You may have noticed that your old transistor radios had these 455 kHz filter cans all over their boards. 455 kHz was an extremely common frequency chosen as an intermediate frequency. If you could afford the extra components and the design costs, you could get a radio with TWO Intermediate Frequencies, one hooked up past the next, to improve your radios technical specifications even more! Or maybe even THREE IF stages!



Superregeneracy was a cute trick – you fed back part of your amplified signal into its own input! Too much and you get an oscillation, like when you use a microphone too close to the amplified speaker output of a public-address device. But if you get the amount of positive feedback just right, you get more gain for your initial received signal.



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Almost every high-end radio from 1928 on is basically:

Antenna feed -> Low Noise Amplifier -> Bandpass filters -> Local Oscillator/Mixer -> Intermediate Frequency filter-> Intermediate Frequency amplifier-> another filter -> and perhaps another Local Oscillator/Mixer/Filter/IF Amplifier, if you want a dual conversion radio -> demodulating detector -> audio circuits.

Every mixer, filter, and amplifier add nonlinearity and distortion. Every local oscillator adds noise, no matter how well shielded. This is just the price that Physics demands that we pay.

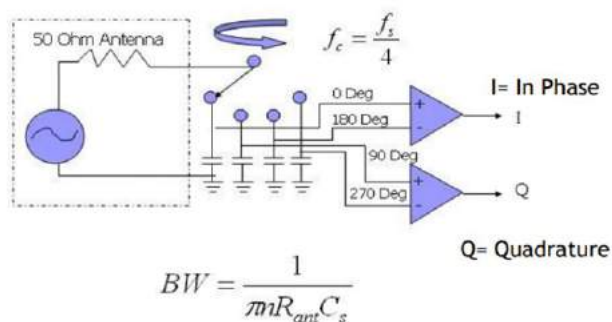
Up until recently, there was nothing more that you could really do, but recently digital signal processing chips have become available, and more importantly, they have become affordable. These are commonly used either in the audio stage or just before the demodulation detector stage to decrease the amount of noise in a given signal. Some work better than others.

Software Defined Radios are stratified into “Tiers” where Tier 0 is an old legacy analog radio that your grandfather would recognize in a heartbeat, all the way up to a mythological Tier 4 radio, where only their specifications exist on paper, waiting for technology and some bright engineers to bring them into being.

We will be discussing the less ethereal Tier 3, fully programmable SDRs.

The very “heart” of the first generation of SDRs is a device known as a Quadrature Sampling Detector, sometimes called a Tayloe Detector, after its designer. Once past the Quadrature Sampling Detector, the signal is fed into an Analog to Digital Converter, either inside the radio or outside of it, on a PC’s sound board. For reasons that you will be glad to learn, we won’t get into here, right now, the simplest way to juggle all the bits around efficiently is to have a pair of digitalized received signals. The original, in-phase “Incidence” waveform, is usually designated “I,” the second waveform is delayed by 90 degrees of its phase or one quarter of the period of the clocking speed of the Analog to Digital Converter (ADC). This quadrature delayed waveform is usually designated “Q,” and that is why these devices are called Quadrature Sampling Detectors. By using the digitalized I and Q values, you can determine the input signal’s amplitude, for CW, AM, and SSB detection, as well as its phase, for FM or any phase shift keying detection mode. With the information available from the digitalized I and Q signals, you can demodulate any modulation scheme imaginable, all in programmable silicon – no extra hardware required! Where you get to put the Quadrature Sampling Detector determines how much of a Software Defined Radio, you really have!

Quadrature Sampling Detector



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SDRs also get further classified into “generations.” 1st generation SDRs were, obviously, the earliest. In first generation SDRs there was an analog mixer/local oscillator/filter stage before the signal got to the Quadrature Sampling Detector. All of the early commercially available “SDRs” were really legacy analog radios, until you got past the first IF stage – Flex 3000, 5000, 1500, Elecraft KX3! The bandwidth limitations for their panadapter and their other SDR goodies were not, necessarily due to the speed of their silicon, but were limitations of the IF bandwidth that they were given to manipulate (in the Flex 5000 that was 192 kHz). These SDRs were called “Direct Conversion SDRs.” This design created a reasonably wide frequency range signal to be digitally manipulated, but it also exacerbated an ever-present problem. These radios required brawny “fat-client” PCs to do all the digital manipulations, and many PCs were not quite “up” for the job!

Some manufacturers offered built in PCs, like the Flex 5000C, but it turned out to be a band aid on a festering wound. No, the engineers would have to be more innovative than slapping one of Intel’s finest and calling it a day. They came up with using something called a “Field Programmable Gate Array” (FPGA). In short, it is a piece of silicon that has its hardware re-wired through software, to make a kind of CPU optimized specifically for the type of algorithms that an SDR would need, rather than making generic spreadsheet applications, or watching a movie. All the bit fiddling could be performed in this Third Generation SDR, leaving your PC to serve as a “thin client” something that most PCs can do without really trying!

Somewhere around the 2nd or 3rd generation, the Quadrature Sampling Detector got pushed all the way back. It became incorporated into the Analog to Digital converter and Field Programmable Gate Array, which possessed the digital equivalent of a mixer/local oscillator, just after the antenna feed’s analog low noise amplifier and bandpass filters, generating a quadrature delayed signal in digital form. And thus, was born the Direct Digital Sampling SDR”.

So, we’ve touched upon the present third generation of SDR design and two of its required components a Field Programmable Gate Array, and an Analog to Digital Converter (ADC) or vice versa – ADC’s work in both directions!

There are a few more components that round out the third generation SDR design. There is the generic Central Processing Unit (CPU) or a Reduced Instruction Set Chip (RISC), for the more boring control duties. There’s the Digital Signal Processor (DSP), for the same reason that they are in almost every radio these days – to digitally try to mitigate background noise. Include a couple of odds and ends, some interfaces to communicate via USB, or even better, an ethernet gigabit connection, a power supply, and a few other things, and you have a third generation SDR, like the Flex 6000 series, or the Anan 200 and beyond!

There are some experts in the field that describe FOUR generations – for them the thing that defines a fourth generation SDR is its use of Direct Digital Sampling, as opposed to an analog circuit form of Quadrature Sampling Detection. I didn’t want to muddy the waters, but I just want you to be aware of this discrepancy in the literature if you come across it. Whether you want to define 3rd generation SDRs as a very smart 2nd Generation SDRs and fourth Generation SDRs as possessing digital sampling, is up to you.

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We shall try to explain how your signal, presented to a 3rd (or 4th?) Generation SDR's antenna input deals with this signal.

Unfortunately, we need a little of that old analog magic at first, a nice old low noise analog RF amplifier, some bandpass filters, and a switchable attenuator, so that very powerful off-frequency signals will not oversaturate our ADC and lower our receiver's sensitivity. De-sensing of the front end of a radio receiver is a widespread problem that has happened to most of us. But after that little bump, its "digital" until we get back to the analog audio output!

Next stop is the Analog to Digital Converter, followed by the Field Programmable Gate Array's software based Local Oscillator/Mixer/Filter/Quadrature generator to generate a digitized stream of 1's and 0's that define the signal that your radio is receiving. The quality of your ADC/DAC will determine many specifications of your radio. It's clock speed limitation will determine the bandwidth that you will be able to evaluate at one time, and the number of bits that can be stored will determine your signal's resulting maximum dynamic range. There are tricks to get more out of your DAC/ADC, but you always have to pay Nature back in some way.

The theoretical maximum dynamic range for a 16-bit ADC is 96 db. For a 24-bit ADC, it is 144 dB, although in the real world the best you can expect is 130 dB, which is a lot better than the common dynamic range of 75-80 dB seen in a typical receiver. Old radios make up for this poor dynamic range by using their Automatic Gain Control (AGC) to shift that limited range up or down. SDRs only use AGCs to limit the audio being outputted.

As an example, the Flex 6700's DAC can decode 30 kHz to 72 MHz using a sampling rate of 245.76 Msps (million samples per second). Tricks like "aliasing," which amounts to the removal of a low pass filter before the ADC can trick your receiver into operating on what's called its "second Nyquist frequency" – this is how a Flex 6700 can operate on the 2 Meter band. There are other "tricks" that designers can employ. They can introduce "dither" into the ADC input – pseudo-random noise is injected into the input and subtracted from its output. This dithering can improve IMD (Inter-Modulation Distortion) without too much additional noise being added to the signal. A similar "trick" is to use a random function to randomize the output of the ADC in case its more regular output interacts with other regular local signals, and then converts it back into useable form inside the FPGA. Many times, these tricks are not necessary for good reception on the Ham bands, though. But they are available if needed.

When the signal gets to the FPGA, things get rather technical. First, if randomization was used earlier, the FPGA must "de-randomize" it before it does anything else. Then the FPGA uses an algorithm given the name CORDIC – it generates a mixer, a filter, and a pair of sine and cosine local oscillators in software. It is a Quadrature Sample Detector, purely in silicon bits! Since you are doing this within the silicon of your FPGA, there is no nonlinearity nor phase error that you would get with a real physical Tayloe Detector! Now, we are back to a digitalized stream of "I" and "Q"

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data, that we mentioned earlier. Usually, you don't need the entire spectrum of HF at one time so that you can get rid of some of it with a benefit. There is a process called "decimation" which effectively gets rid of extra, unnecessary information from the data stream. There is a price, though. It generates spurious noise, but that can be filtered out, in software. Your FPGA uses another algorithm with another lovely acronym called Cascaded Integrated Comb (CIC) filters. They are small and quick, but they are a bit "dirty" and leave a bit of a mess after themselves. We'll need a few computer simulated CIC filters to deal with the mess that the decimation caused. What to do with the mess that the CIC filters caused? Why, use another filter algorithm at the final stage – the Compensating Finite Impulse Response (CFIR) filter. A Finite Impulse Response (FIR) filter is a much more complicated, but much cleaner filter, but you still need to get the mess created from the row of CIC filters used before – that's where a Compensating FIR filter comes in. It is specifically designed to compensate for the mess that the row of CIC filters left behind!

But why go to this trouble? Well, it lessens the amount of math that you need to push all around your silicon, but also decimation has an amazing effect – by taking the digital stream and decimating it, you improve the dynamic range for the smaller frequency range that you are left with! Win-Win!

I won't bother you with all the details of how the FPGA deals with your transmitting signal, except to say that it uses another CORDIC mixer/local oscillator/filter to do "up converting" (your receiver did the opposite, "down-converting"). Your FPGA uses another algorithm called an Interpolating Cascade Integrated Comb (ICIC) filter, which does the opposite of decimation, with some loss of your dynamic range (Nature always requires pay back!).

There are other filtering algorithms in an SDR programmer's bag of tricks, like the Infinite Impulse Response (IIR) filter, which is better suited for audio frequency filtering.

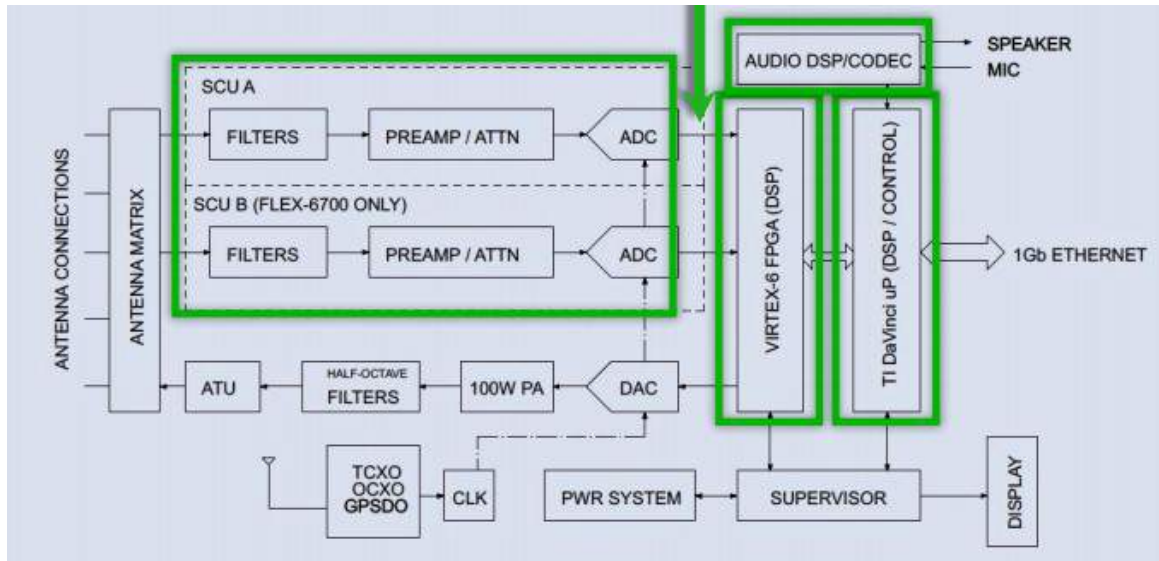
There are FPGA algorithms that allow the FPGA to take the resulting decimated and filtered I/Q streams of data and juggle them into a demodulated FM, or AM, or SSB, or almost any other demodulated information stream. Further filtering, equalizing, and noise reduction can be performed within the FPGA or farmed out to a DSP chip that might be included in an SDR's design. From there it's back to analog, where the data stream runs through a DAC and an audio amplifier. That CPU or RISC is sitting in the background, making sure that your connection with your control surface is going fine and handling the I/O stream going into and out of your radio! An ethernet connection, preferably a gigabit ethernet cable will be a thick enough pipe to share as much information as your PC will ever require.

Where the receiver side uses "Digital Down Conversion," the SDR's transmitter uses "Digital Up Conversion," which allows "pre-correction" of any nonlinearity detected, to lower the resulting IMD amount even more! There are just a lot more "tricks" that you can employ in the digital domain, than in the good old analog domain!

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What does all this look like? Well here is a block diagram of what's going on under the hood of a Flex Radio 6700:



With analog radios, the price you pay for clever tricks is additional components that introduce nonlinear distortions, or more noise, or BOTH. With SDRs the price one pays, other than the cost of the fancy silicon and using up too many CPU cycles is something called “latency.” Latency is the delay introduced by the processing time required for digital devices to do their magic. All things being equal, filters with narrower skirts and little to no ringing artifact add milliseconds of processing delay from that signal being received, to you hearing it for yourself. This latency delay isn't just a problem with SDRs, DSPs have caused this long before SDRs were around. Algorithms with more finesse, or just more powerful, albeit more expensive silicon, are possible solutions. It will all get better, cheaper, and smaller over time. That isn't the case for “boat anchors.”

So, can you take these notes that you've scribbled down and build your own SDR? I seriously doubt it, but I hope that you got a sense of what was going on under the hood of this new, and exciting technology, that I believe will be the face of radio technology in the future.

73,

Roy AC2GS

(When Roy AC2GS isn't writing informative articles, or puttering around with some concept that seems strange, but beautiful, he can be found hosting an informal Technical Net (where this article was originally presented) every 2nd and 4th Wednesday of each month at 9 PM on the KC2RC Repeater 146.730 MHz, the PL tone is 88.5 Hz – we stream it live on the Internet (<http://stream.kc2rc.com>) and have archived links to audio recordings of them (<http://archive.kc2rc.com>) - you are all welcome! In addition, he also is in charge of the LIMARC TechNet's new ScienceTalk segment, which now includes any Physics or general science questions. You may pose a science question or a topic for discussion by emailing Roy at mailbag@AC2GS.com.

Long Island Mobile Amateur Radio Club

Long Island Outdoor Hamfest

Sunday, June 10, 2018

Briarcliffe College

1055 Stewart Ave., Bethpage, NY 11714

Doors Open at 9AM to Buyers

Vendors Set Up at 7:30AM

Amateur Radio Dealers & Equipment ~ Tune-Up Clinic (Get you Rig Checked!)

Television, Computer, CB Equipment, ARRL Information

Long Island Mobile Amateur Radio Club Information

DXCC and WAS Card Checking

General Admission \$6

Entry at 9:00 AM

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Bring your own table, chair, or umbrella!**

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SELLERS MUST PACK UP THEIR OWN GARBAGE AT CLOSING

Talk-In on W2VL Repeater 146.850 (136.5 PL)

For more information, see www.LIMARC.org

or contact our Hamfest Chair at 516-694-4937, or email us at Hamfest@limarc.org

Richie K2KNB

Directions

From Long Island Expressway: Take LIE to exit 44S (Seaford-Oyster Bay Expressway-Rte 135) South to exit 9 (Broadway, Bethpage). Make a right turn onto Broadway and bear right onto Cherry Avenue. Go past Bethpage High School and at the light make a right turn onto Stewart Avenue. Go past the flashing light and look for Briarcliffe College on your left - watch for the Hamfest entrance.

From Northern State Parkway: Take the Parkway to exit 36A South (Seaford-Oyster Bay Expressway-Rte 135) and follow directions above.

From Southern State Parkway: Take the Parkway to exit 28AN (Seaford-Oyster Bay Expressway-Rte 135) North to exit 9 (Plainview Road). Make an immediate left at the bottom of the ramp (under the Expressway) onto Broadway and follow the LIE directions above to the college.

*** <http://www.limarc.org> &/or <http://www.limarc.org/fest.htm> ***

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REMINDER

If You Hear Something, Tell Someone

Those of you who use the repeaters on a regular basis are all too aware of the fact that there are certain individuals who have nothing better to do with their time than to interfere with people on the repeater. An organized effort is underway to locate and identify these individuals. **YOU CAN HELP.** If you hear malicious interference on any of the LIMARC repeaters, please hit the reverse (HM/RV) button on your radio and see if you are able to hear them on the input. Please email your findings to rfi@LIMARC.ORG. Indicate whether you heard them on the input or not. Please include the time of day, the repeater, your location and type of antenna (if you have a beam, include the heading).

Thank you for your cooperation.

DOOR PRIZE DONATORS

Below is a list of individuals, organizations and companies that contributed to the 50th Anniversary celebration.

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Nassau County A.R.E.S. meets on the second and fourth Thursdays of the month. All are welcome to attend! ARES meetings are held at the Nassau Co. Red Cross, 195 Willis Ave in Mineola.



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VE Testing Schedule for 2018



LIMARC VE Test Sessions are held on the second Saturday of every odd numbered month at the Levittown Hall, Levittown Parkway, Hicksville, NY. Please remember to bring **two** pieces of identification (one with a photo), your **original** license **and** a copy of it, any **original** Certificates of Successful Completion of Examination (CSCE's) **and** copies of them. *Also remember to bring the proper fee in check made out to ARRL VEC or exact change (NOTE: the 2018 fee remains at \$15.00).* The LIMARC VE Team will supply the FCC Form 605. For further information, contact AI W2QZ at (516) 623-6449 or Jim W2KFV at (516) 997-6023.

2018 SESSION DATES AND TIMES AS POSTED

May 12 1:00pm July 14 9:00am

Sept. 8 9:00am Oct. 28 Hamfest 10:00am Nov. 10 1:00pm

2018 Meeting Schedule

All general meetings are held at: Levittown Hall 201 Levittown Parkway, Hicksville, NY. Meetings start at 8:00PM.

All Board meetings are held at the Levittown Library 1 Bluegrass Ln, Levittown, NY. Meetings start at 7:30PM.

LIMARC AT A GLANCE-2018

Month	Bd. Meeting	General Mtg	VE Session	Hamfest	Other
Jan	3rd	10th	13th		SATURDAY 6 - HRU
Feb	7th	14th	25th	25th	
March	7th	14h	10th		
April	4th	11th			
May	2nd	9th	12th		Lindbergh event - 20
June	TBA	6th		10th	FD - 23 -24
July	TBA		14th		Apollo event - 20
August	TBD				
Sept	TBA	12th	8th		
Oct	TBA	10th	28th	28th	
Nov	TBA	14th	10th		
Dec	TBA	12th			

LIMARC Repeater Nets
(W2VL 146.850, unless otherwise noted)

Monday: Info Net, 8:30 PM

Net Control Operators

Week 1-Lew N2RQ; week 2-Richie K2KNB; week 3-Ceil W2CTG; week 4-Harry KC2FYJ; week 5-Rick K2RB

Following the Info Net

Stay tuned for the Swap – n – Shop Net, 8:45 PM (approximately)

Bill **WB2CUK**, Net Control

3rd and 4th Wednesday, Computer Net with Ken **WB2KWC**

Sunday: Tech Net, 8:00 PM – Dick **K2RIW**, Net Control

1st and 3rd Tuesday, Astronomy Net, 8:30 with Craig **KD2CXK**

Any month with 5 Wednesdays, Nostalgia Net, 8:30 with Richie **K2KNB**

LIMARC Repeaters: W2VL 146.850 – IRLP node 9126;

W2KPQ 147.375 - IRLP node 9126;

W2KPQ 224.820; **W2KPQ** 449.125- IRLP node 4969; **W2VL** 1288.000

WA2LQO 146.745; Digital Mobile Radio **W2KPQ** 449.375 (No PL)

All analog PL tones are 136.5

Ceil Gomez, W2CTG Editor of The LOG,

W2CTG@LIMARC.org

LIMARC PO Box 392 Levittown, New York 11756-0392

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From The Editor

Please send all items for entry into the LOG to W2CTG@LIMARC.org. I will be glad to accommodate all appropriate requests. If you miss a deadline (the deadline is the 15th of the month) I would be glad to place your item in the LOG next month, space permitting.

Thanks, and 73, Ceil W2CTG - Editor, The LOG