Sussex Repeater

November 2023

Sussex Amateur Radio Association

Local Weekly Nets

SARA Club Net: Tuesday 8pm
147.090 (+) 156.7

Nanticoke Club Net: Monday 8pm
146.715 (-) 156.7

Lewes Club Net: Wednesday 7:15pm
147.330(+) 156.7

Delaware Traffic Net: Mon – Sat
5:30pm Freq: 3.905

Delaware Emergency Net:
Sunday, 5:30pm Freq: 3.905

Sussex ARES Net: 1st & 3rd Wed.
7pm 147.090(+) 156.7

Monitor SKYWARN weather on
147.090(+) 156.7

System Fusion repeater frequencies:
Millsboro 449.825
Seaford 145.210

MT Joy Repeater (fusion capable)
443.200 (+5) 156.7 PL

County Emergency Simplex
145.510
144.915

Winlink Simplex 145.050 & 441.00
Winlink peer to peer 145.020

www.sussexamateurradio.com
https://www.facebook.com/SARAHamRadio
Email: SussexAmateurRadio@gmail.com

President: Butch Wlaschin (WAØCIE)
Vice Pres: Deborah Libertore (A3JL)
Treasurer: Stuart Banta (KC3MAL)
Secretary: Donna Spencer (KC3IHV)

November Meeting

This month's meeting will be on Thursday, November 16, 2023. FCC testing begins at 6:00 pm. You can purchase dinner beginning at 6:00 pm and the meeting will begin at 7:00pm. Annual election of officers will be held.

There will be no SARA meeting in December

2023 HOLIDAY PARTY
December 7, 2023

All the pizza you can eat. $ 15.00 per person
Bring a Guest
Grottos Pizza
30201 Commerce Dr, Millsboro, DE
302-663-1155
5:30 pm – 7:30 pm

Winter Field Day
Save the date
January 27, 2024

BEFORE thanking our outgoing officers for 2023, we want to give a special thanks to, Deborah Libertore (A3JL), who has agreed, if elected, to continue in the position of Vice President.

Thank you to SARA officers

The officers of the Sussex Amateur Radio Association spend a lot of their personal time making sure that there is a program or speaker every month and that the minutes are filed, that the bills are paid, dues are collected and financial reports are recorded as required for the club to be a 501(C)3.

We thank our outgoing President, Butch Wlaschin for his dedication and good judgement in assuring that the business of the club is conducted in an orderly manner. Butch was first licensed in 1962 while in Scouting as WNØCIE, and then received a General Class license in 1963 as WAØCIE. He operated from home in Western Nebraska for several years In the late 60's he traveled up and down the west coast mobile using a Galaxy, with various stops in Oregon, Colorado and Texas. After graduating from college, his career allowed him to operate mobile from all 50 states during the 70's, adding numerous county contacts for the County Hunters.

He retired from USDOT in 2014 where he was a Project Manager. He passed the Extra Class exam in the spring of 2017. Butch is a Life member of ARRL since 1970 He was elected President in 2019 and has lead the club through a Covid pandemic and back to well attended, in-person, interesting and educational monthly meetings.

Butch likes to spend time on CW (80-10mtrs), but over the last couple of years Parks on the Air has also become one of his favorite ways to spend air time.

Our outgoing Treasurer, R Stuart Banta (KC3MAL) became an Extra in 2018 and has held the Treasurer position for five years. Stuart was an analyst for the Federal Deposit Insurance Corp. His club duties include handling the finances of the organization, and filing the required reports and documents to keep us legal. He has been an invaluable assistant to the Hamfest Committee each year.

In addition to being a member of Sussex Amateur Radio Association (SARA), Stuart serves as an ARRL Official Relay Station, RRI digital traffic relay station, the Delaware Traffic Net Manager, and served as a past AEC for Sussex County ARES.

Stuart is an FT8 fan and spends an hour on the Traffic Net each evening.

Having spent more than ten years as Secretary of the organization, Donna Spencer (KC3IHV) submitted her resignation this year also. Donna has recorded the minutes of the organization and overseen the 50-50 drawing each month. She is also diligent in keeping an accurate record of who attends our monthly meeting. Donna has a new grandchild on his way in late December and plans to spend a LOT of time doing grandmother things.

Any organization is as good as it's leadership and this group has seen to it that we are the best.

Therefore, we say to each of you: Thank you for your years of service and dedication. Your contributions of ideas, energy, and enthusiasm have been invaluable."

Delaware Section Manager

John Ferguson K3PFW

Ten percent, a dime on a dollar

Is that enough activity to maintain a viable, trained, responsive auxiliary communication support organization? I think not, yet recently in the amateur radio domain, it's what we're seeing. The ARRL sent out a survey on dues and QST. Did you as an ARRL member respond? It was a very small sample that was returned to headquarters, a little over ten percent. This past month of October, we had activities across the section, in all three counties. There were five activities, fifty one participants in total, which is about ten percent of the ARRL members in the Delaware Section. Even less if you subtract the duplicate participation, with several operators participating in multiple activities.

Ham radio is a hobby of doing; you have to "do" to get something out of it. Therefore the more you put into it (not necessarily money) the bigger the return, like DXCC for example. Ham radio is a service, per the FCC rules. The "Funny Candy Company" expects us to serve the public need in times of disasters. Auxiliary communication support in a disaster scenario is a lot like racing a bicycle on an event course, "ya gotta practice or you'll fall on your butt!" That's why we have exercises. That's why we serve the public in community events. A benefit of doing public service events is that the public gets to see ham radio in action. Ham radio is also supposed to "advance the art". We've certainly done that, and the current hobbyists benefit from that. We can also say, "Use it or lose it". Encroachment by commercial interests is already on the horizon, in action before the commission to put high power digital service adjacent to some of our current HF bands. If we don't have activity on the privileges we currently have, we won't have them long. The RF spectrum is a finite resource that is getting crowded and polluted with man-made noise. So what are you going to do, that you can do, to make this great hobby thrive and be there for future hams?

73, John, K3PFW

Lewes Amateur Radio Society meets the first Wednesday of each month at Grottos Pizza on Rt 1 near five points at NOON.
No Dues, just good food and friendly people. Please join them if you can.

EMERGENCY SERVICE NEWS

CROSSING BORDERS

On October 14th, twenty volunteer amateur radio operators hit the ground in Bridgeville to help with the 2023 Apple Scrapple Festival, an annual Sussex County event. The rainy conditions provided some challenges, but the group did a commendable job in covering the event. Communications were clear and reliable, the several NET Control operators managed traffic well, and a last-minute change in tasking was coordinated smoothly. Significantly, almost half of those volunteers came from Kent County. Some were the familiar faces who regularly participate in Sussex County AUXCOMM events, and some were brand new. We are very thankful for all!

When it comes to serving the public (one of the tenets of amateur radio) borders don't (and shouldn't) matter, and these volunteers from Kent County get that. Hams regularly deploy to locations across town, across the state, across the country, or across the oceans to help the public somewhere with disaster recovery events. It doesn't (or shouldn't) matter whether "borders" are political, geographical, philosophical, or organizational; all amateurs should be prepared and willing to step across and volunteer their help if they are able.

An opportunity to do just that is approaching on Saturday, December 2nd. The Rehoboth Seashore Marathon will kick off at 7am from the boardwalk in Rehoboth Beach. This is another annual Sussex County event. Sussex County AUXCOMM will again be seeking volunteers to help cover the half and full marathon courses to monitor race progress and assist with reporting any runners in distress. It takes a lot of volunteers to adequately cover a 26-mile marathon course, especially where almost half of it is on state park trails. Anyone able to help should reach out to ws3eoc@gmail.com in order to receive further information about this event opportunity. All are welcome and appreciated, no matter which side of which border you hail from!

73's!
Bill, N3ID

Analog FM Repeaters — an Overview

Why your local voice repeater acts the way it does, and how to get along with it.

Steve Sant Andrea, AG1YK

Repeaters have become the essential tool of modern FM communications. Individual repeaters allow V/UHF mobile and handheld transceivers to communicate with each other over much larger areas and more difficult terrain than would be possible with direct simplex contacts. Repeater linking has enhanced this ability even more. Linked repeater systems connect repeaters with each other through direct radio or Voice over Internet Protocol (VoIP) connections. Here in Connecticut, one club has built a system of linked repeaters that covers the entire 100-mile length of the state. You can access this repeater network near Connecticut's New York border and chat with another station in Rhode Island, using just a handheld transceiver.

Two in One

Many thousands of hams use repeaters every day without really understanding them. There's lots of chatter about frequency pairs, shifts, tone codes, courtesy beeps, transmit timers, and link delays. What does all this stuff actually mean to you as you operate, and why are they necessary for using the local repeater?

Hardware-wise, a repeater is one receiver and one transmitter, which are operated by a controller and connected to the same antenna. "Okay," you say, "I've got a transceiver, which is a transmitter and a receiver, connected to one antenna at my shack, but it doesn't act like a repeater. So what's the difference?"

When you use your rig at home, whether it's a base station, mobile, or handheld transceiver, you switch between the receiver and transmitter, using each *alternately* to communicate with another ham. In a repeater system, both the receiver and transmitter must be operating *simultaneously*. A repeater functions by hearing your signal with its receiver, demodulating your signal to extract your voice, transferring your voice audio to its transmitter, which then retransmits your signal *through the same antenna where it is being received*.

Those of you who see a problem here get a gold star; for those who don't, let me give an example. Let's say that instead of a receiver and transmitter doing all that modulating and demodulating, we just have a microphone, amplifier, and speaker. If you place the microphone directly in front of the speaker and turn on the amplifier, two things will happen. First, you get a really ugly squeal that keeps getting louder and louder, commonly known as feedback. Second, at some point, either the microphone, amplifier, or speaker will fail, putting an end to the squeal — and a dent in your wallet when you buy its replacement.

Unless we take certain hardware precautions, feedback will occur with a repeater, but in a repeater the feedback loop would occur in the RF circuit instead of the AF circuit. The retransmitted signal, if coupled directly to the common antenna, would quickly overload the receiver's front end. Obviously, a system that fries the receiver's front end every time the power is turned on cannot be considered a reliable means of communication. Steps need to be taken to prevent this eventuality. Enter the *duplexer* (see Figure 1).

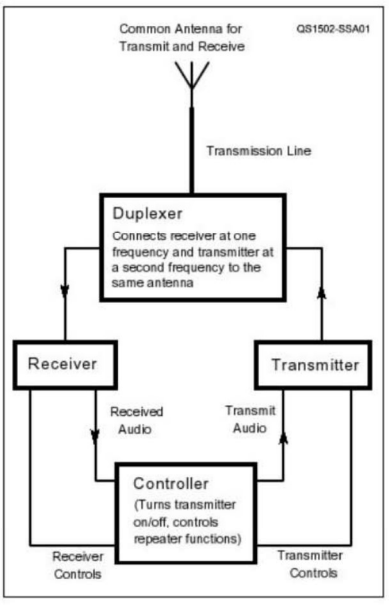

Figure 1 — This is a block diagram of the essential components of a repeater. Most practical repeaters are more complicated than this, but all will have these basic components.

A Divided Highway

The duplexer uses a series of tuned circuits to allow the 100 W output of the transmitter to flow to the common antenna while keeping that same powerful signal from doubling-back into the microwatt sensitive receiver front-end. Of course, the duplexer's tuned circuits aren't the whole story. By separating the transmitter and receiver frequencies by some nominal amount, the design requirements — and cost — of the duplexer are greatly reduced. Enter the *offset* or *shift*.

Small Change

The receiver and transmitter in a repeater are fixed-frequency devices. Unlike your rig at home, which can tune to thousands of individual frequencies, a repeater's transmitter and receiver must be locked to a particular frequency — or more accurately, a *frequency pair*. A frequency pair refers to two frequencies separated by a fixed amount — the *offset* or *shift*. Each V/UHF band has a standard shift. On 2 meters, the offset is 600 kHz; so for any 2 meter repeater, the transmit frequency is shifted from the receive frequency by 600 kHz. It's customary to refer to a repeater by its transmit frequency — *your* receive frequency. For example, the W1AW 2 meter repeater transmits on 145.450 MHz. The repeater's receive frequency — *your* transmit frequency — will be 600 kHz away.

"Hold on," you say, "doesn't that leave us with two different repeater transmit frequencies, 144.850 and 146.050 MHz?"

Yes, it would, which brings us to shift's little brothers, "+" and "–," which define the direction the offset has for a particular repeater. Remember, the shift is often the same amount on a given band, but the di-

rection of that shift, up or down, is specific to a particular repeater. For the W1AW repeater, it is designed for a "–" offset, so the repeater's receiver frequency — your transmit frequency — will be at 144.850 MHz. If it had a "+" offset, the receiver frequency would be at 146.050 MHz.

If you go through a list of the 2 meter repeaters in your area, you'll see + and – symbols scattered all over. These shift directions aren't random. They usually follow the pattern shown in Figure 2. For each band where repeaters are used, certain segments are defined for repeater outputs (transmit frequency, T) and inputs (receive frequency, R). Where the repeater's transmit frequency is and what other repeaters are on adjacent frequencies determines a particular repeater's offset.

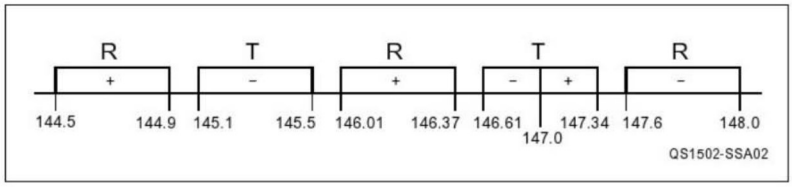

Figure 2 — This diagram shows a typical arrangement of offsets for the 2 meter band. These frequency segments and offsets vary regionally, so check the local repeater listings for your area before programming your radio.

Keeping Things Organized

So you see, each repeater needs a frequency pair in order to operate. To keep things organized, frequency coordinating committees have been formed throughout the country to assign frequency pairs to new repeaters. These local committees operate under the umbrella organization the National Frequency Coordinators Council (**nfcc.us**).

These frequency coordinating groups aren't legal bodies, but operate under the "self-regulation" aspect of ham radio. Note that there are uncoordinated repeaters in operation, but the vast majority of repeaters are coordinated, especially in urban areas where there can be dozens of repeaters competing for band space.

Even with this coordination, there can be unintentional interference between repeaters in neighboring areas. Propagation conditions can create an "opening" that will carry a signal far beyond the local area. It's possible to have two repeaters, operating on the same frequency pair in two different but nearby cities. Under normal conditions they are outside each other's range and both operate without interfering with the other. Then a really hot opening comes along and the two are stepping all over each other. To solve this problem, *tone encoding* (sometimes referred to as *PL*, a Motorola trademark) was introduced.

A Sonic Separator

Tone encoding is a system that was borrowed from the commercial sector. The most common system is the Continuous Tone Coded Squelch System (CTCSS). CTCSS consists of 49 discrete tones ranging from 67 – 254.1 Hz. When a repeater is placed on the air, the owner sets the repeater's controller to scan any signal received for its assigned tone. If the controller detects the correct tone, it activates the repeater's transmitter and retransmits the received signal. If the controller receives a signal, but without the correct tone, the transmitter is not activated and the received signal is not retransmitted.

The tones used are referred to as "subaudible" tones, even though they are in the audible frequency range. They are called subaudible because the repeater's receiver filters them out before passing the audio to the transmitter. The tones are not heard by the hams using the repeater.

A more recent development is the use of Digital-Coded Squelch (DCS). This is a system that modulates a subaudible tone with a 23-bit digital code. Just as with the CTCSS system, the digital code of the transmitter must match the code of the repeater for the repeater to "open."

Communications Courtesy

Most repeaters are "open" repeaters, that is, they can be used by any ham within their operating area (there are some "closed" repeaters that can only be used by a limited group, but closed repeaters are not common). A consequence of this is that you can get a group of hams having a conversation on a repeater. This is called a *roundtable*. In a roundtable, each participant speaks, then passes the discussion to the next ham in the group. Such discussions can make it difficult for new stations to access the repeater. To allow a space for a new ham to join the group, most repeaters will transmit a short courtesy tone or beep a few seconds after the last station stopped transmitting. The time between the end of the last ham's transmission and the beep is a courtesy period when a new station can jump into the discussion.

The courtesy tone system does have a drawback. If a large group is having a discussion or a net is using the repeater then, even with each station waiting for the beep, it's possible for the repeater's transmitter to be active for an extended period. To prevent this, repeaters have a transmit timer. This timer is required by FCC regulations to be a 3-minute timer. It starts when the *repeater's transmitter* is first triggered. For this reason, whenever you participate in a roundtable or net on a repeater, it's a good idea to let the repeater's transmitter drop periodically to reset the transmit timer.

One final bit of courtesy that you will run into involves linked repeater systems. A linked system connects many different repeaters together to form a continuous system. When you "key up" one repeater in the system, an activation signal is passed to all the other repeaters, causing all the transmitters to be activated. The linked system I mentioned at the beginning of the article has a total of 15 repeaters on four bands connected into the system.

When using a linked system, remember that it takes a short time for all these links to be activated. When first keying your transmitter, wait a second or two before speaking to allow all the links to be activated. If you speak too quickly, all the links may not be established and the first word or two of your transmission (or your call) can be cut off.

I hope this discussion clarifies some of the finer points of analog FM repeaters for you. (Digital repeaters are quite a bit different and that's fodder for a future article.) So turn on that rig and check out your local repeaters. Join in a discussion or check into a net and enjoy another of the many aspects of ham radio.

Steve Sant Andrea, AG1YK, is an assistant editor at *QST*. He can be reached at **ag1yk@arrl.org**.