MOUNTAIN SPARK GAPS

NPARC—The Radio Club for the Watchung Mountain Area

Website: http://www.nparc.org
Club Calls: N2XJ, W2FMI
Facebook: New Providence Amateur Radio Club ((NPARC)

VOLUME 53 NO. 2 February 2018

UPCOMING EVENTS

Tri County RC
Fox Hunt
SundayJune 3

Regular Meetings

3/12 & 3/26
Monday 7:30
DeCorso Community Center

Meeting Schedule

Regular Meeting: 7:30—9:00 PM
2nd Monday of each month at the
NP Senior & Adult Center
15 East Forth Street
New Providence

Informal Meeting: 7:30—9:00 PM
4th Monday of each month
Same location
Everyone is Welcome
If a normal meeting night is a holiday, we usually meet the following night.
Call one of the contacts below
or check the web site

Club Officers for 2018

President: W2PTP Paul Wolfmeyer
201-406-6914
Vice President:K2GLS Bob Willis
973-543-2454
Secretary: K2AL: Al Hanzl
908-872-5021
Treasurer: K2YG Dave Barr
908-277-4283
Activities: KA2MPG Brian Lynch
973-738-7322

On the Air Activities

Club Operating Frequency
145.750 MHz FM Simplex

Sunday Night Phone Net
Murray Hill Repeater (W2LI) at 9:00 PM
Transmit on 147.855 MHz
With PL tone of 141.3 Hz
Receive on 147.255 MHz
Net Control K2AL

Digital Net
First & Third Mondays 9 PM
28,084 — 28,086
Will be using PSK and RTTY
Net control K2YG

Club Internet Address

Website: http://www.nparc.org
Webmaster KC2WUF David Bean
Reflector: nparc@mailman.qth.net
Contact K2UI, Jim

MOUNTAIN SPARK GAPS

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WB2QOQ Rick Anderson
W2PTP Paul Wolfmeyer
K2UI Jim Stekas

Climatological Data for New Providence for January 2018

The following information is provided by Rick, WB2QOQ, who has been recording daily weather events at his station for the past 36 years.

TEMPERATURE -
Maximum temperature this January, 62 deg. F (January 12)
Last January(2017) maximum was 62 deg. F.
Average Maximum temperature this January, 37.4 deg. F
Minimum temperature this January, -1 deg. F (January 7)
Last January(2017) minimum was 6 deg. F.
Average Minimum temperature this January, 20.1 deg. F
Minimum diurnal temperature range, 9 deg.(3 -12 deg.) 1/6
Maximum diurnal temperature range, 45 deg. (60-15 deg.)1/13

Average temperature this January, 28.8 deg. F
Average temperature last January, 35.2 deg. F

PRECIPITATION -
Total precipitation this January - 7.1" snow; 3.04" rain/melted snow
Total precipitation last January - 5.3" snow; 4.5" rain/melted snow

Maximum one day precip. event this January - January 4, 4.5" snow; January 12, 1.43" rain
Measurable rain fell on 5 days this January, 13 days last January.
Measurable snow fell on 4 days this January, 4 days last January.

YTD Precipitation - 3.04" (includes rain + melted snow, as of 1/31/18)

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Rick Anderson
2/1/18
243 Mountain Ave.
New Providence, NJ
(908)464-8912
rick243@comcast.net
Lat = 40 degrees, 41.7 minutes North
Long = 74 degrees, 23.4 minutes West
Elevation: 380 ft.
CoCoRaHS Network Station #NJ-UN-10

President's Column February 2018

End of February and the Auction is history…a great attendance with 100, donation sales over $500, and food sold out. Everyone seemed to enjoy themselves—I think the "social opportunity" of the auction is a big draw. As usual, club members stepped up to their assigned/ volunteered tasks, so things went efficiently. Joe's auctioneering as well as the support by handlers was very smooth. Thanks to all who participated. I think Saturday PM worked well, so we'll try to schedule it that way next year.

Kids Day, Sunday January 7 at the Berkeley Heights Rec Center was the source of some nice publicity in a publication that potentially hits 21 communities. Thanks, Barry.

The date of the Fox Hunt has been changed to Sunday, June 3. It is to be an afternoon event wrapped up by a picnic-type meal.

And we have the Memorial Day parade coming in May.

On a personal note, I've continued my pursuit of FT8—WAS is confirmed! The country count is up to 41 confirmed. Give it a try!! Our digital net has had a couple of new participants—James, KB2FCV and Scott, K5PBJ. Join us on "non-meeting" Mondays at 9PM.

73 for now

Wolf

W2PTP

201-404-6914 or W2PTP@arrl.net

SDR : Basic Digital Signals

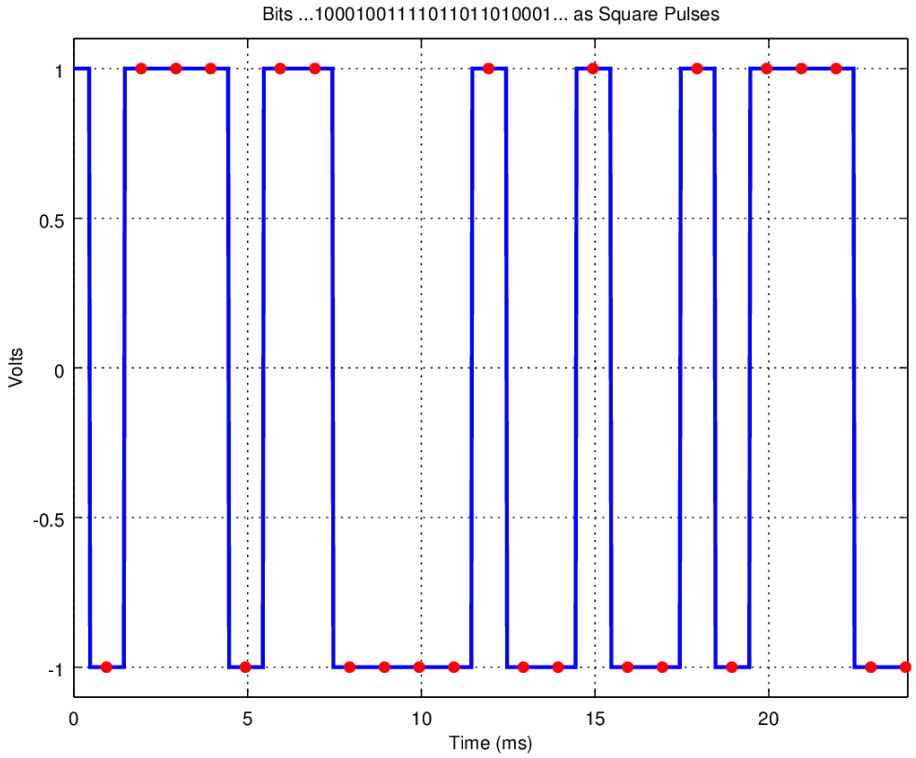
Jim Stekas - K2UI

In the previous two Spark Gaps we reviewed the architecture of a direct sampling SDR receiver using the ICOM IC-7300 as a model. The focus of the discussion was how digital signal processing (DSP) is used to provide the functionality of an analog receiver. There was no discussion of actual digital formats like RTTY, QPSK, JT8, etc. Whether you have an IC-7300 or a an IC-718, complex digital formats are processed they same way, in a PC.

This month we touch on some basic digital signal principles common to all the digital modes. A digital signal is one composed bits: zeros and ones. These may be raw bits like the 5 bits in a RTTY character or heavily encoded data where each bit of data is transmitted as 6 coded bits. (This is called a “rate 1/6” code, and is typical of the Turbo codes used in 4G/LTE.)

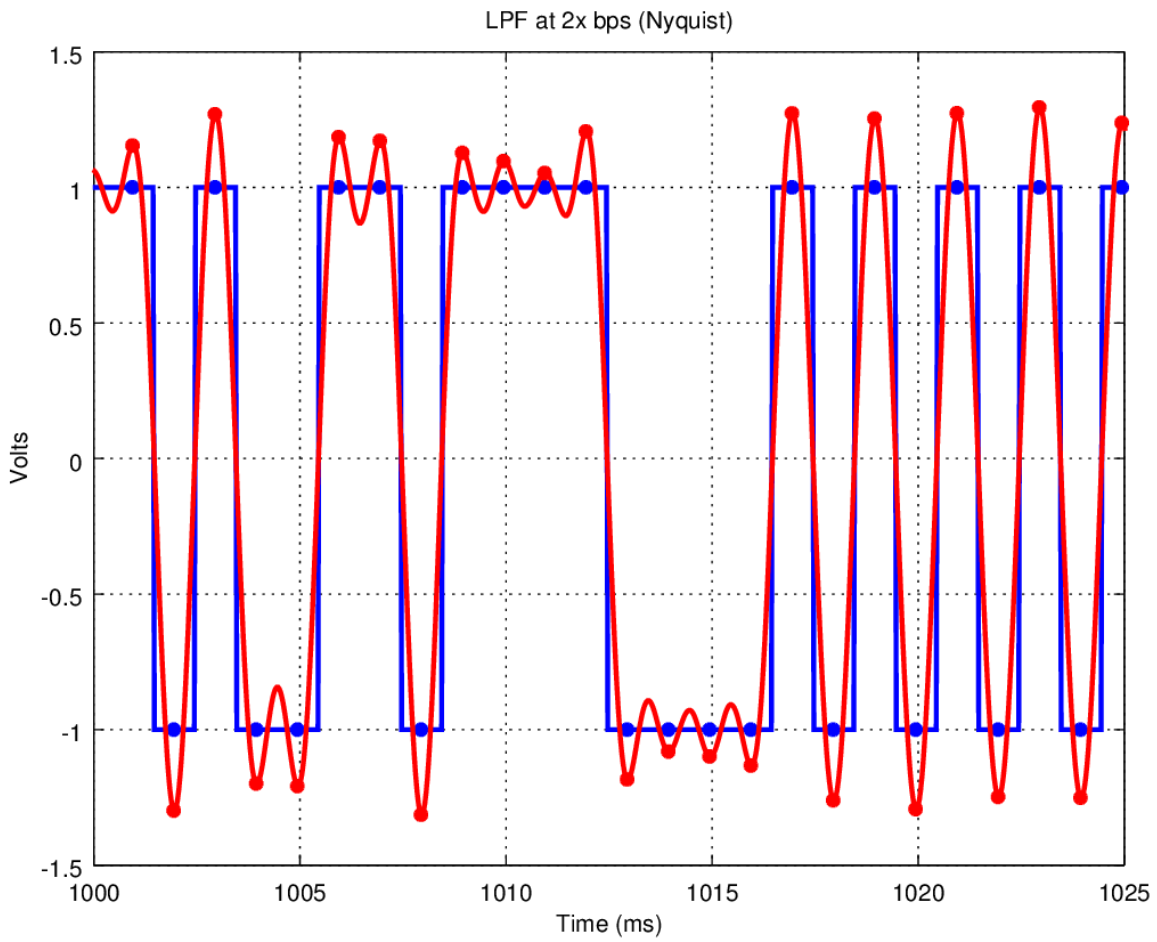
Let's start with a stream of bits to be transmitted: ...1000100111101101101001.... We start by ***mapping*** the bits to voltage levels: 0 → +1 and 1 → -1. The reason for this weird mapping is that multiplication of “symbols” gives they same result as the XOR (exclusive or) of the bits they represent.

Once symbols are generated by mapping we turn each symbol into a pulse of duration 1 / symbol rate. The figure below shows a sequence of symbols generated at a rate of 1ksps (sps=bps in this case). The blue lines show the voltage one would see looking at the signal on an oscilloscope. The red dots show the center of each symbol in time, where the receiver will sample them and convert them back to bits.



To get our symbol stream out over the air we will have to use it to modulate our carrier. Modulation could be FM, PM (phase modulation), AM, or whatever we want. We know that square waves are rich in harmonics so before we feed our signal into our modulator we had better do something to limit the bandwidth to minimum necessary for reliable communications.

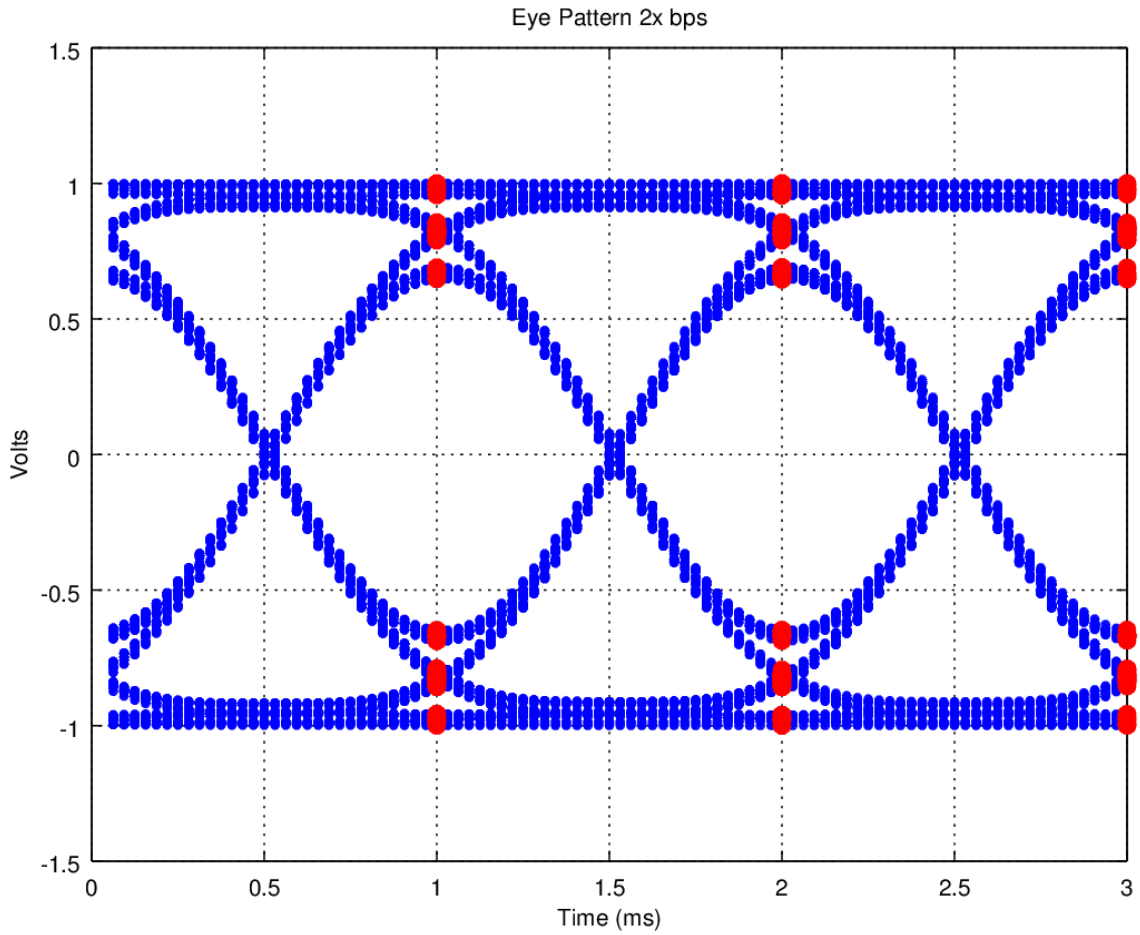
In theory, all the information needed to recover our 1kbps signal is contained in 0-2kHz, so we can run our signal through a 2kHz low pass filter (LPF) before we pass it to the modulator. The resulting signal is shown in red below. Note that all the red dots (bits) are widely separated and the ones and zeros are easily distinguished.



Note that we have limited the bandwidth of our signal but I haven't said anything about the sample rate. At the transmitter there is good reason for using sample rates much higher than Nyquist requires. The D/A output will also be a square wave and require an analog anti-aliasing LPF. Using an 8kHz sample rate puts the aliased junk at around 16kHz, which makes the 2kHz LPF design very simple. This output oversampling trick is used in all digital audio players: CDs, DVDs, iPods, etc.

Our transmit signal looks great, and it should because there is no noise at all, and I used a helluva good "brick-wall" LPF to filter it. (A 512 tap FIR.)

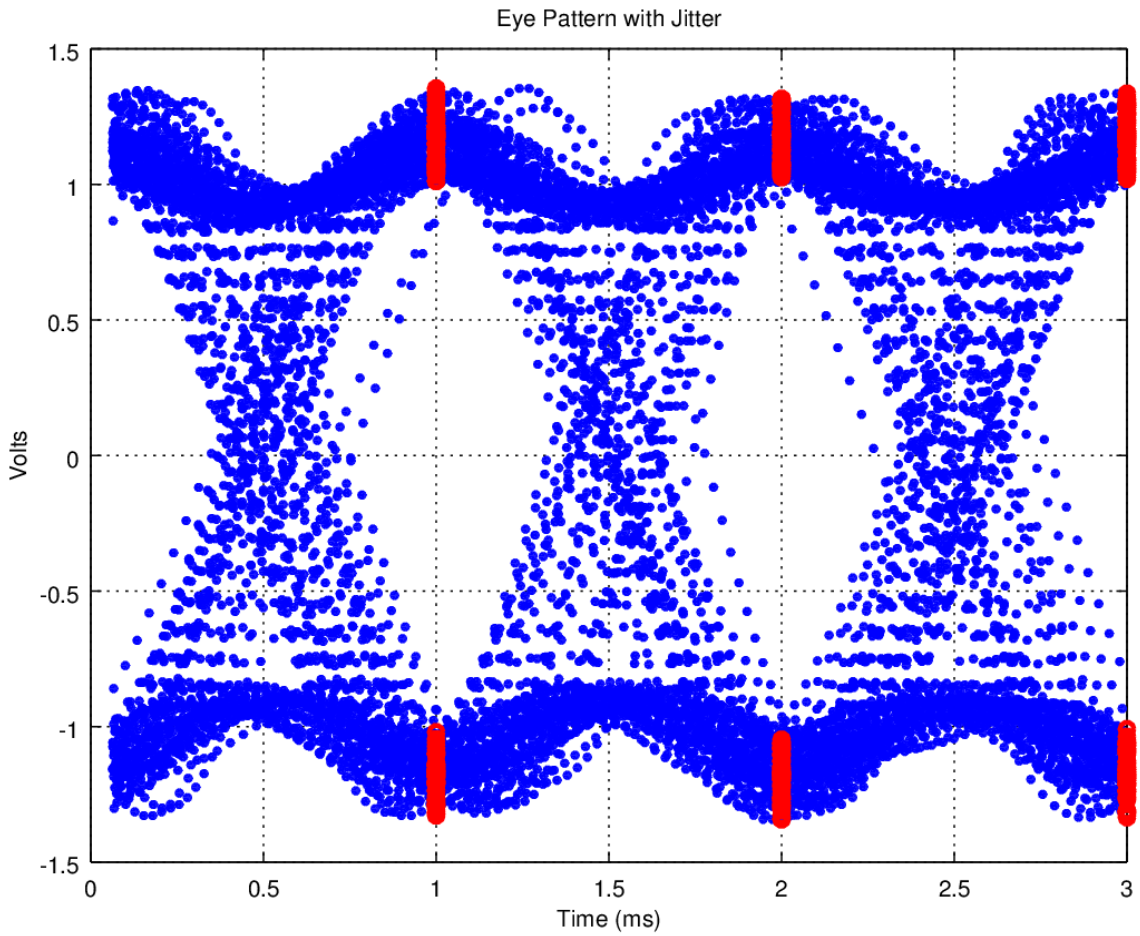
Now, let's imagine that we are at the receiver, and we use an oscilloscope to view the received signal. We do this by setting it up to trigger continuously when the signal crosses zero and we get something that looks like the figure below.



This is called an “eye-pattern”, and it shows two clear “eyes” at times 1 and 2ms, where the centers of the received symbols are located. There is a very nice separation between the ones (-1v) and zeros (+1v), and the “eyes are open”. But also note that the red dots don't lie perfectly on top of each other. The reason for this is ***inter-symbol interference (ISI)***. In theory, if a perfect 2kHz “brick-wall” filter is used, each symbol will be unaffected by the symbol before and after it. Looking at T=1ms and V= -1v we see a red dot, which corresponds to a bit value of 1. Note that the bits before and after it are also ones since the dot lies on a flat blue line. Just above that is a double dot corresponding to 011 and 110. The dot above that corresponds to 010.

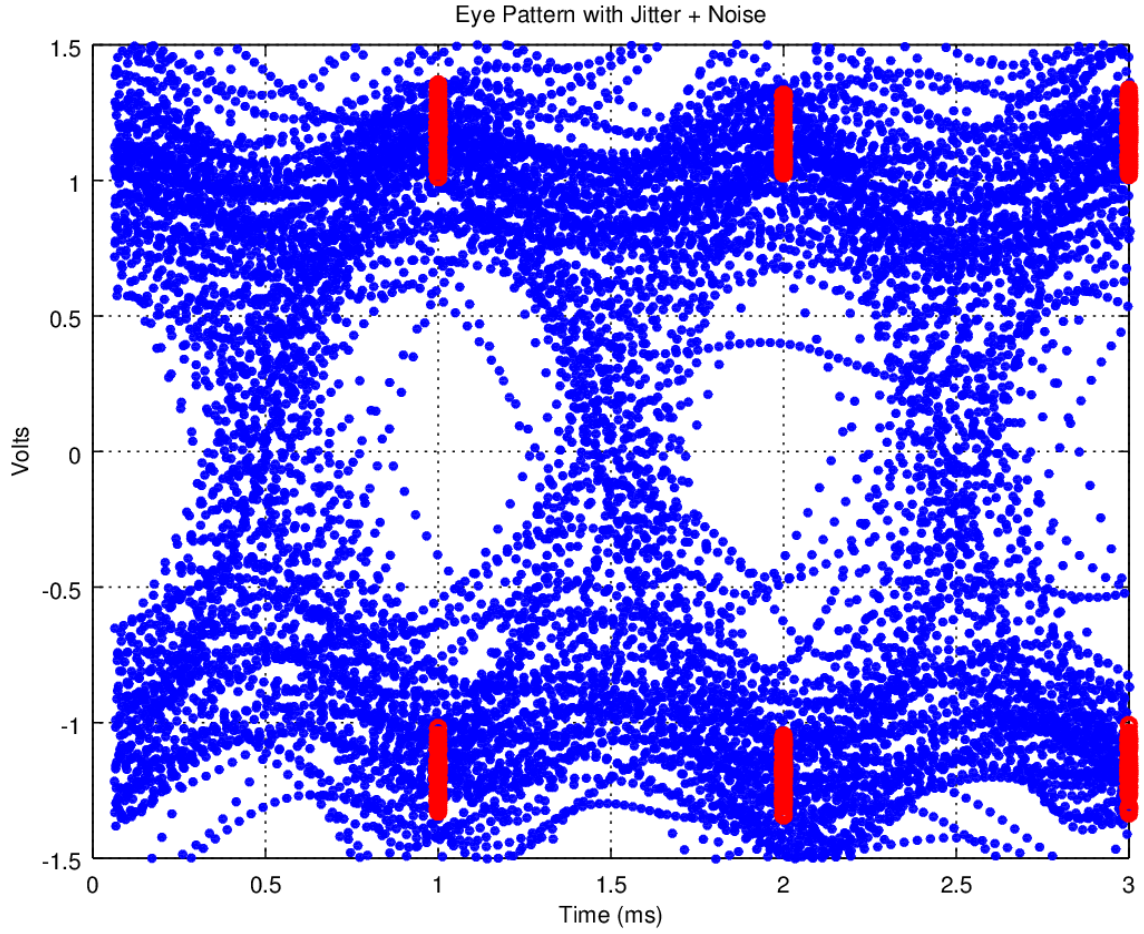
The ISI in this example is caused by a receive LPF with a slow roll off, attenuating some signal below 2kHz and passing signal above 2kHz. However, multi-path fading can distort the phase and spectrum of the signal contributing to ISI. Adaptive equalization algorithms are often used to estimate and compensate for the impairments from propagation to reduce ISI.

Another contributor to ISI is jitter due to phase noise in the local oscillator. This tends to cause timing shifts adding error due to sampling a bit at the wrong time. As can be seen below, jitter



distorts the eye pattern horizontally along the time axis.

If we add noise, the eye pattern is smeared along the vertical axis. The eye pattern below would probably produce near error free copy on a RTTY signal, probably below the rate of human typos.



For signals coded with FEC the bit error rate for this eye pattern would be near zero. For very strong FEC like Turbo Codes or LDPC it is often the case that perfect copy is possible even when the eye pattern looks like pure noise.