Squelch Tales

A Publication of The San Diego Repeater Association, Inc.

2018 Vol 2 March/April

Ahead in Squelch Tales

March membership meeting – SANDRA's March membership meeting featured Chuck Wood, WD6APP, explaining the use of service monitors for the maintenance of radio equipment. Chuck tested attendees radios and found all to be within specification.

Announcements: SANDRA's June 7, 2018 Membership Meeting will feature Gordon Shackelford, AE6QW, discussing receiver technologies. Come and learn how the new techniques compare to older designs. **Fry's Operating Day** will be on May 19, 2018.

YAGPS – Yet another GPS system. Brexit will cause England to lose access to high grade GPS signals for location and timing from the European system. They may build their own system.

SANDRA News – SANDRA is offering a free call sign badge for each **new** SANDRA membership.

Errata, mistakes, updates and shorts to previous issues of *Squelch Tales* are included as *SQ* receives input form the members and officers of SANDRA.

SANDRA's March 2018 Membership Meeting

Chuck Wood, AD6APP

The Use of Service Monitors to Diagnose Radio Problems

The March 2018 SANDRA General Membership Meeting featured Chuck Wood, WD6APP, demonstrating the use of a Service Monitor to check the performance of portable (handheld and mobile) radios for frequency accuracy, deviation and power output by testing the radios supplied by attendees. The meeting was attended by 26 people, the majority of which brought radios for testing.

Chuck Wood, AD6APP

SQ file photo.

A communications service monitor is an instrument for servicing AM and FM radios (a few service monitors can also service Single-Side-Band (SSB) radios) which consists of a highly accurate and precise receiver and a low power signal generator with FM and AM modulation capability all rolled into a single package with the ability to make sensitive measurements of both the transmitted and received signals. Service monitors are used to test transmitter frequency accuracy, power output, modulation deviation (FM) and spectrum analysis of the transmitted signal. A receivers sensitivity, frequency accuracy, signal rejection and demodulation product can be analyzed. The service monitor also has the ability to provide accurate audio frequency tones to the transmitter under test so that modulation and distortion may be tested.

To use a service monitor, the antenna of the radio is connected to the service monitor, and if tone testing is to be performed, an audio signal from the service monitor supplied to the audio input of the radio under test. The test functions of the service monitor are relatively automated and can be performed by internal programming.

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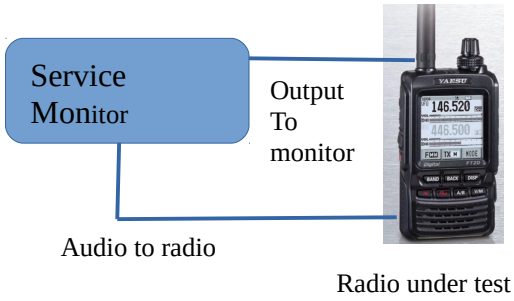

IFR 500A Courtesy of Ebay.

Chuck tested each radio for frequency accuracy, power output and he used mouth generated tones to test deviation. All of the radios supplied by attendees were vhf fm handhelds, none of the radios were tested on am. All of the radios passed the testing, which is a credit to modern radios. -*{SQ}*-

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ANNOUNCEMENT

SANDRA June 7, 2018 Membership Meetings

Gordon Shackelford, AE6QW

Lecturer SDSU Physics Department

Radio Receiver Designs

Gordon Shackelford

Meeting Location: County Office of Education
6401 Linda Vista Road, Room 306
7:00 P.M. Thursday June 7, 2018

Everyone is invited, come and hear Gordon Shackelford discuss the advantages and disadvantages of differing receiver designs.

Refreshments will be provided by SANDRA

ANNOUNCEMENT

Fry's Ham Operating Day

May 19, 2018

Fry's Parking Lot (North East Corner)

98256 Stonecrest Boulevard

San Diego 92123

Murphy Canyon Road and Stonecrest Blvd.

Just south of Aero Drive and Murphy Canyon Road

9:00 A.M. to 3:00 P.M.

Most local ham radio clubs will be operating Field Day Style

This is on opportunity for amateur radio operators to meet the public and explain what they do!

Free Hot Dogs Offered by *440 Hang out*

Come meet SANDRA at Fry's

El Cajon working the world

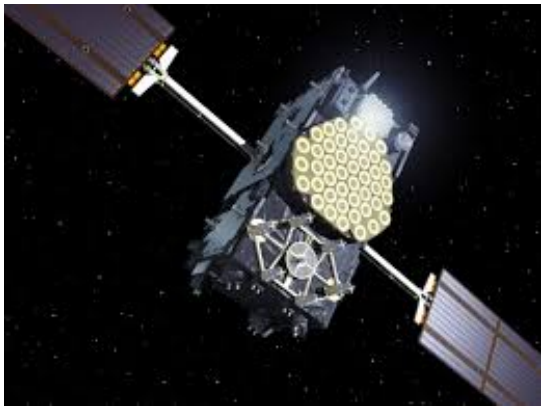
Antennas make a difference

Another GPS System?

Along with United Kingdom's (UK) decision to leave the European Union (EU) comes a separation from much of the joint infrastructure developed by the EU over the last couple of decades. One of those systems is the European global navigation satellite system (GNSS) called Galileo. Like the US GPS constellation and the Russian GLONASS constellation, the high precision navigation and timing information is encrypted and not available to all users; after BREXIT it will no longer be available to the UK. The UK has just published a review of how the loss of high precision GNSS information will effect their critical infrastructure. The review does not only deal with the loss of high precision GPS or GNSS information, but also the vulnerabilities of these systems that could adversely effect system utility in times of crises. The analysis is somewhat eye-opening.

GPS is considered the "invisible utility" because so many of the world's critical and non-critical systems rely on it. Because GPS/GNSS technology provides precise timing at very low cost, it is the technology of choice for computer networks, electrical transmission, broadcasting and all maner of telecommunication. A cell phone network can't function without a GPS timing source as was adequately demonstrated in Seoul, South Korea when GPS signals were jammed for a period of days. Hold over device lost sufficient accuracy in less than a day causing the cell phone network to fail. Many amateurs rely on GPS disciplined oscillators to improve the accuracy of frequency measuring equipment and the accuracy their rigs.

The UK government found that all of their critical infrastructure and much of their economy has dependance on GPS/GNSS, and that is also likely to be true throughout the developed world. Aside from BREXIT, which is high risk to super accurate position and timing, the system is at risk to a host of vulnerabilities due to its design and implementation. The biggest shortcoming is the low power signal used in GPS/GNSS satellites, which can easily be drowned out by signals in adjacent bands. On the market today are numerous GPS blocking transmitters that can be acquired and used to jam GPS signals. These device are used for a variety of applications (many illegal) from defeating employers wanting to track vehicles and drivers, car thieves defeating On-Star and other monitoring communications, to militaries defeating smart weapons. Examples of the latter can be seen weekly in the aviation notices to airman (NOTAMS) where advance notices of jammed or unreliable GPS signals in the vicinity of the BTY, HEC and TCS VOR's are announced. This is the training area around Nellis Air Force Base where both Top Gun and Red Flag are located. Another recent example is the Black Sea where ships were reporting GPS positions of more than 20 miles inland.



European GNSS Staelite

Unintentional interference is also a problem. The spectrum around the satellite navigations bands was originally designated for satellite communications which typically incorporate low power transmissions. However, this spectrum is now in demand for 5G wireless communications which are terrestrial systems at higher powers. The potential for interference from neighboring bands is exasperated by the wide filters employed in the front ends of GPS receivers. The front end filter allows signals from neighboring bands through, which is an artifact of the original design, and the belief that the spectrum would be protected from terrestrial transmissions. Current GPS signals are low power, spread spectrum and not much above the noise floor, another artifact of the legacy design which has been carried forward.

Timing accuracy is also effected by atmospheric propagation changes. However, there are augmentation systems for correcting atmospheric deviation such as the Wide Area Augmentation System (WAAS) which is a terrestrial station of known position that detects signal errors and sends a correction back to the satellite which is packaged with the GPS signal.

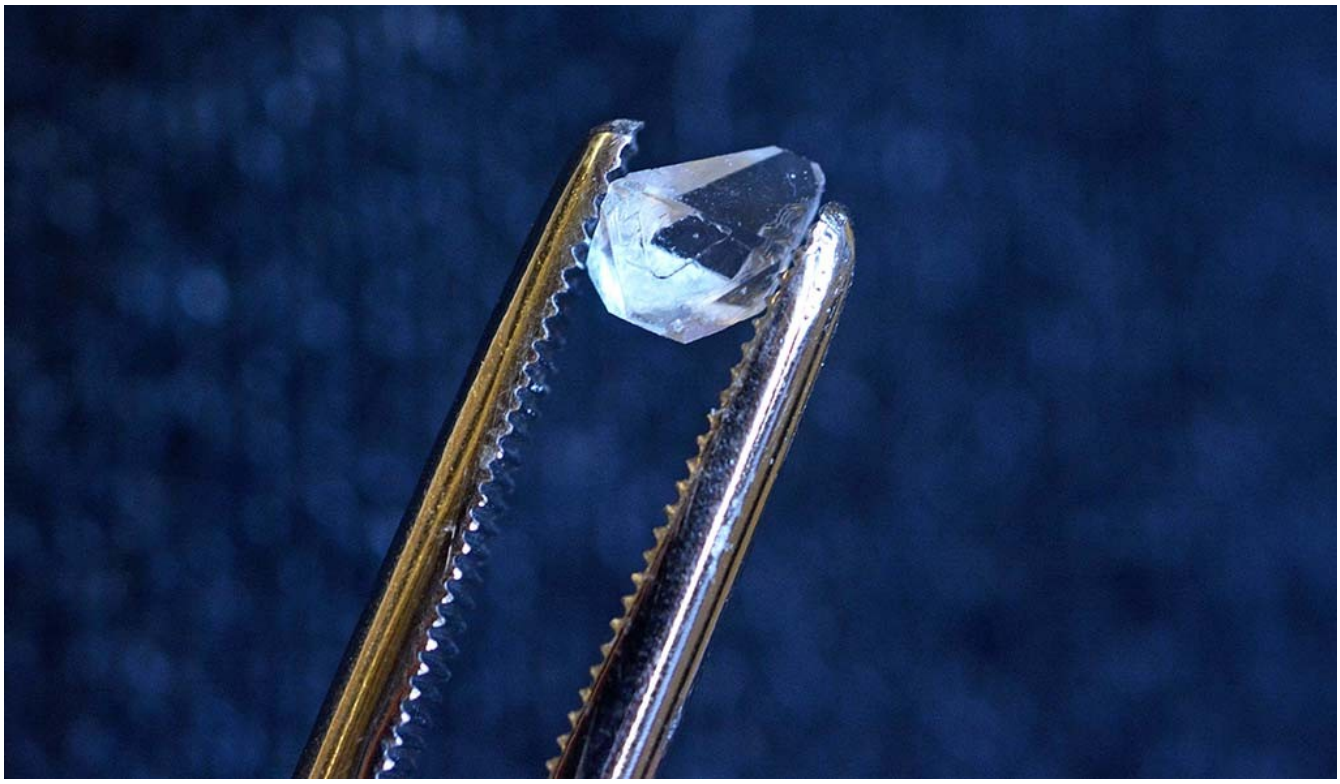
Constellation View.

GPS/GNSS systems are also affected by space weather. Particles in the solar wind, particularly during Coronal Mass Ejections, can take satellites off line for extended periods which certainly affects reliability of the signal. Fortunately for GPS/GNSS, the sun's output has been declining since the mid 1950's. The sun's output has been lower each successive cycle since 1956.

The UK analysis determined that there are other timing systems that are more accurate than GPS/GNSS; However, they don't have the ease of delivery over a wide (global) area that is available through GPS/GNSS satellites.

Taken in its entirety, the UK report reads like a risk analysis for developing a new GNSS constellation, which is apparently under discussion; However, without reusing current designs, this could be a decade long project. *-{SQ}-*

New Time Crystals



MAP time crystal.

Please see next page

All hams are familiar with quartz crystal as a very high Q resonant circuit for use in oscillators and other circuits. Quartz is a crystal of silicon oxide (SiO_2) where atoms are located in specific lattice location, creating a specific crystal structure. Quartz crystals deform as an electric field is applied and resonate as a result of that systematic elastic deformation; resonate frequency then is a function of the number of wave lengths that will exactly fit in its thickness (AT cut).

In 2016 a new type of oscillating crystal was discovered that does not rely on elastic deformation or size. Called *discrete time crystals* (DTC) these crystals do not require a regular structure or physical dimensions, that a quartz crystal requires, instead they work via atomic spin. When these crystals are perturbed with a magnetic pulse, a line of atoms spins in one directions, then reverses its direction going back and forth like a circular pendulum. Periodic magnetic perturbation keeps the cycle going. The time constants for this magnetic oscillation is independent of the initiating pulse. DTC's were first discovered at the Joint Quantum Institute at the University of Maryland, with collaborators from a who's who of American universities. Because these crystals oscillate based on a nuclear property, they are not effected by small changes in temperature or other environmental conditions that would normally have an effect on a mechanical crystal such as quartz. DTC's are also smaller and easier to operate than atomic clocks. The discovery is an example of spontaneous symmetry breaking in quantum physics.

Jared Rovny, Robert Blum and Sean Barrett.

More recently, Yale University researchers Jared Rovny, Robert Blum and Sean Barrett used nuclear magnetic resonance to to look for DTC signatures in a wide variety of common crystals. One of the most common and easiest to grow crystals is monoammonium phosphate (MAP). MAP crystals are included as a crystal growing experiment in children's chemistry sets, but it has the NMR signature of a DTC. MAP is inexpensive to manufacture and offers the promise of inexpensive and very accurate clocks for timing and frequency control. There may be a time when each of our rigs has a MAP reference oscillator to maintain an atomic clock level of accuracy. *-{SQ}-*

Errata, Corrections, Amplifications and Shorts: *This section acknowledges errors and omissions or allows additions to previous SQ articles. We rely on feedback from the readers – please write.*

Repeater Status: SANDRA is currently running three 440 MHz C4FM digital/analog repeaters, one at each of the Otay, Laguna and Kearney Mesa sites.

Otay: Everything is up and working. Project to connect both 220 MHz and 440 MHz to backup system

LYONS: Everything is up and working. Some outside interference which is being tracked down.

SHARP: Everything up and working.

LAGUNA: Exhibiting some noise when first linked for the Wednesday night net. Reports of low signal on 444.500.

HI-PASS: Up and working. Need additional weed removal.

Kearney Mesa: Up and working.

Note: Repeater information can be up to three weeks old due to the timing of committee reports and the preparation schedule of Squelch Tales – ED.

SANDRA repeaters are for all to use, all the time, and are not reserved for any single group of users. However, periodically they are used for public service, when this happens, we request that users give preference to the public service activities. This does not mean that public service has exclusive use, we just ask that users be polite and allow the public service groups to complete their mission.

The Lyons Peak Repeater 146.265 will be used in support of a 100 mile San Diego endurance run starting Friday June 8 at 12 noon through Saturday June 9 at 12 noon. -{SQ}-

SANDRA Calendar		
Event	**Date and Time**	**Location**
Fry's Operating Day	May 19, 2018 9:00A.M. to 3:00 P.M.	98255 Stonecrest Blvd., San Diego, 92123
SANDRA Membership Meeting	June 7, 2018 – Gordon Shackelford, AE6QW. Receiver Technology.	County Office of Education 6401 Linda Vista Road, San Diego, CA 92111 Room 306

Callsign	Location	Input	Output	Callsign	Location	Input	Output
WB6WLV	Mt. Otay	146.040	146.640	WB6WLV	Mt.Laguna	444.500	449.500
WB6WLV	Mt. Otay	222.460	224.060	K6GAO	Hi-Pass	144.680	145.280
WB6WLV	Mt. Otay	444.200	449.200	W6SS	Lyon's Peak	146.865	146.265
WB6WLV	Mt. Otay	1270.300	1282.300	WA6AIL	Sharp Hospital	147.285	147.885
WB6WLV	Mt. Laguna	147.750	147.150	WB6WLV	San Diego	442.320	447.320
WB6WLV	Mt. Laguna	222.600	224.200				

All SANDRA repeaters use PL 107.2

SANDRA NETS

Sunday 8:00 P.M. Mt. Otay Repeater

Wednesday 7:30 P.M. Mt. Laguna Repeater

GUIDELINES SUMMARY

SANDRA, Inc. operates their repeaters for service in the San Diego area. The policy of the organization is that the repeaters are available for all licensed amateur radio operators to use so long as applicable rules and regulation are observed, whether members of SANDRA or not.

SQUELCH TALES

SQUELCH TALES is published bi-monthly by the San Diego Repeater Association (SANDRA, Inc.), a corporation dedicated to the promotion of amateur radio. Distribution is free to members.

Newsletter exchanges are desire with regard to format, suitability and style is reserved. Ads are $50 per full page, $27 per half page and $15 per quarter page. Business cards are $8. Artwork is due by the first week of the month to the P.O. Box. Liability for errors in copy is limited to the printing of a correction in the subsequent issue. Permission is hereby granted to reprint items from S*QUELCH TALES* . Opinions or editorials are not necessarilly the position of the Board or the organization of SANDRA, Inc.

The SANDRA membership meets the first Thursday in the Months of March, June, September and December. Meetings start at 7:00 P.M. and are located at the San Diego County Education Center, 6401 Linda Vista Road, San Diego. Board meetings take place on the first Thursday of January, February, April, May, July, October and November. All SANDRA members are encouraged to attend.

SANDRA, Inc.
San Diego Repeater Association
P.O. Box 81103
San Diego, CA 92138