September 2015 VOL XCX, ISSUE 3

HARMONICS

1916 South Jersey Radio Association 2015

Antenna Analyzers You Can Hack

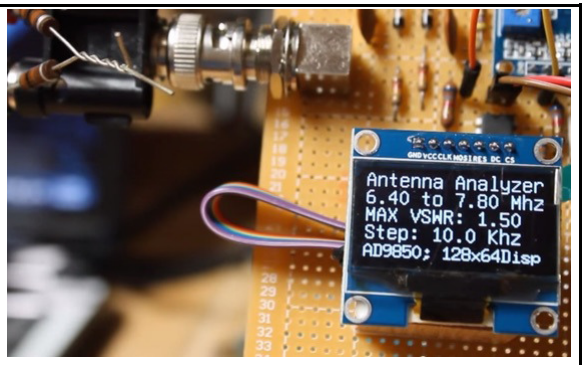
By Dan Romanchik, KB6NU

I'm a nut for antenna analyzers. I think that they are one of the most useful things a ham can own.

I've often wondered why there aren't more DIY antenna analyzer projects, though. Perhaps it's because designing measurement circuits isn't easy. An antenna analyzer has to have a signal source as well. Even so, an antenna analyzer doesn't need a whole lot of accuracy to be useful, so you would think that more builders/hackers would tackle a project like this.

I do know of one antenna analyzer kit on the market. The VK5JST Antenna Analyser Kit (http://www.ahars.com.au/about/kits/) costs about $110 USD. I actually purchased this kit a year or so ago, and it looks like a great unit. The unit seems well-designed, and it comes with a plastic case, unlike many projects theses days, but I haven't yet gotten around to building it.

I've also recently found out about an Arduino-based antenna analyzer project (http://hackaday.com/2015/08/06/40-antenna-analyzer-with-arduino-and-ad9850/). It uses an AD9850 module as the signal source. The approximate cost for all the parts is about $40, and you can experiment with the code, if you like. If you have the time and inclination, this project might



No Frills AD9850/Arduino Antenna Analyzer

be worth taking a hack at. Another antenna analyzer project from Australia is the VK3YY antenna analyzer (or "analyser" as they spell it there). It uses an Arduino Nano. The interesting thing about the blog post in which VK3YY describes the project (https://vk3yy.wordpress.com/2014/09/29/antenna-analyser-project/) is that you can follow his design and experimentation process.

Yet another analyzer

While I'm talking about antenna analzyers, let me mention another one that I've just found out about: the IW2NDH Antenna Analyzer (http://www.iw2ndh.com/). This antenna analyzer isn't a kit, but at $175 seems to be a good deal. This unit has a frequency coverage of 2 – 160 MHz, and can be used as an antenna analyzer, signal generator, and a scalar network analyzer.

(Continued on page 10)

SOUTH JERSEY RADIO ASSOCIATION

HARMONICS is published monthly and is the official news letter of the South Jersey Radio Association. The SJRA was established on June 16, 1916 and has been meeting continuously since it's inception. The club has been affiliated with the American Radio Relay League since 1920.

The SJRA meets each month on the fourth Wednesday, January through September; and usually the third Wednesday, October, November and December; in one of the Meeting Room of the Gibson House at 525 East Main Street, Marlton, NJ 08053. Visitors are always welcome at our general meetings. **"Our Meetings are Smoke Free"**

SJRA operates the K2AA Repeater (145.290 - PL 91.5) located in Medford, NJ and the K2UK Repeaters (146.865 and 442.350 - PL 131.8) located in Pine Hill, NJ. The repeaters are open for use without restriction to all licensed amateur operators.

There are currently over 100 SJRA members active in most all aspects of amateur radio. Membership is by application and is subject to the approval of the Board of Directors. Club dues are currently $30/yr. for memberships, $22.50/yr. for retired-person membership (62 plus 1 yr membership), and $15/yr. for additional family members and student membership. Membership information is available on the K2AA Repeater or from Mary Von Lintig, KV2M, 856-772-6475

EMAIL: sjra *at* sjra *dot* org SJRA's web page: www.sjra.org

SJRA VE Team: ve@sjra.org is the SJRA/ARRL VUCC card checker

Joe Fisher, KC2TN, is the SJRA/ARRL WAS card checker

Harmonics is now available on the WEB in pdf format at:
http://www.sjra.org
South Jersey ARRL Section News is available on the WEB at:
http://www.arrl.org/sections/?sect=SNJ

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Picnic: Vacant (Please Volunteer)
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Harmonics Staff:

Publisher/Editor: Ted Groke, W2TAG
Alternate Editor: Rick Stoneking, W2RDS
Circulation: Mary VonLintig, KV2M; Jim Vecchiola, KR2T

LOCAL WEEKLY NETS

Monday	K2AA, Medford	145.290 @ 8PM
Alternating Thursday	Various Locations	28.405 @ 8PM

Harmonics Deadline

Articles submitted for the next Harmonics will be accepted until Monday, October 12, 2015. Email:
ted.w2tag *at* gmail *dot* com

SWAP SHOP - For Sale/Wanted ads are free of charge and are accepted for Amateur Radio related items only. While ads are not restricted to SJRA members, there is only limited space available and members have priority for listings. No items will be accepted for inclusion in the Swap Shop from commercial vendors or traders. All ads must be submitted at least three weeks prior to the scheduled SJRA general meeting date.

GENERAL ADVERTISING - Limited commercial advertising is accepted on a space available basis. Annual advertising rates range from $25/yr (Min 1/8 page) to $200/yr (Full Page). Information is available from Ken Botterbrodt, K2WB.

Meeting Minutes

General Meeting of 26 August 2015

The meeting opened at 1930, with Ken, K2WB presiding, at the Gibson House, in Marlton (Evesham) NJ. A salute to the American flag, followed by the question " Will you be on the September VHF contest ?". The minutes were approved with a minor change- A new member was named John Hall in the minutes, corrected to John Hill. Motion N2HQL/ KV2R.

Health & Welfare- cards to go out, nothing else known- as reported by WB2EOD. Ken, K2WB noted that KA2MSM was listed as a silent Key in QST, no other information was available.

New member, John Hill, W2HUV, was announced.

Contests: John, W2FDJ- discussed certificate programs for participation, he pushed the NJ QSO party on 9/19-20/2015, noting that K2WB and W2MC operated from all but one county last year, and plan on getting all counties this year. Other contests: 9/12 Sept VHF contest; 9/19 NJ QSO party; 9/21 2M fall sprint. Future: 10/24 CQWW DX SSB: 11/7 ARRL CW Sweeps: 11/21 ARRL SSB Sweeps: 11/27 CQWW DX CW.

Webteam by NJ2IT – 100th Anniversary page updated. VE Team by Al, N3AVT- 144 people tested so far. Club Stuff by Joe, KC2TN- a boonie hat is available, w/logo for $15.

100th Anniversary committee- had a dinner meeting, came up with the following plans: 100th Anniv. QSO Party; A museum type display; a total of 9 centennial members, so far; the centennial banquet will be 30 July, 2016 at the Trump international Golf Course.

Tonight's program K2UT with a demo of Arduino: Sept will be the Storm Robotics Team: Oct will be "Gridless Power: November Tony, N2ATB, on Digital Modes.

Board of Directors Meeting of 2 September 2015

Due to lack of a quorum, no official meeting was held. The following items were discussed with no "official" action taken.

A sympathy card was sent to the Kernagas family.

A new Centennial member was accepted.

Ken noted that W2EA would be working the Sept VHF contest from High Knob.

We are moving forward to get a sked with ISS through the school system.

The Website is improving.

The repeaters still work.

Lou, N2HQL, Recording Sec.

HAM TECH

Vol 6 No. 9 by John - WY2J

wy2j *at* arrl *dot* net

Upgrading a Portable HF Vacation Station

Part 3 of 3: Modern Battery Power

Introduction – In this final part on Upgrading a Portable HF Station we look at modern battery technology to determine the feasibility of powering it in an off grid environment. A great deal of development work has been done on Li-Ion rechargeable batteries in the last 10 years driven by laptops, tablets, cell phones as well as hybrid and all electric vehicles. In the world of primary cells the 1.5 volt AA size Li-FeS_2 cell is a significant improvement over the old standby alkaline that can be used to power many HT's and QRP rigs such as the authors TenTec R4020 and Yaesu FT-817.

Primary Battery Technology – The primary cell is also known as the non-rechargeable, you buy it, use it and throw it away. As a result it is usually the most expensive battery to use but it has a few advantages including requiring no external power. The alkaline has been around for 30 years, is a mature technology with an energy capacity of about 2.5 A/Hr for the AA size and 10 A/Hr for the D size at 50 mA load. The Li-FeS_2 is a lithium metal cell manufactured by Eveready and available at Home Depot and Radio Shack in AA and AAA sizes. The AA is a 3 A/Hr cell with a much flatter voltage discharge curve than Alkaline. It has lower internal resistance than Alkaline that withstands higher pulsed loads like Morse keyed CW rigs. Discharge data for both cells is given in Table 1.

Both cells are well sealed against leakage and have long shelf life. Alkaline life is typically 10 and Li-FeS_2 is 15 years. The Alkaline cell has no restrictions on US air transport but the lithium cells have severe restrictions. The AA Li-FeS_2 is restricted to 12 cells maximum with non-short packaging in carry-on baggage only.

Hours	$V_{Alkaline}$ Volts	$R_{Alkaline}$ Ohms	$V_{Lithium}$ Volts	$R_{Lithium}$ Ohms
0	1.6	0,15	1.55	0.15
10	1.35	0.15	1.52	0.15
20	1.30	0.2	1.51	0.15
30	1.25	0.33	1.50	0.15
40	1.17	0.52	1.48	0.15
50	0.92	0.75	1.42	0.16
60	<0.8	-	1.33	0.17

Table 1, Cell Voltage and Internal Resistance for Alkaline and Li-FeS2 AA Cells at 50 ma Load

Secondary Battery Technology – Secondary or rechargeable batteries have been in use since the 1890's with the earliest being lead acid for automobiles and NiCd's for telephone central station power. Lead acid is still with us but NiCd has been replaced with NiMH due to the toxicity of cadmium. Most of the modern secondary cell development has been with Lithium Ion technology. Unlike the Li-FeS_2 primary cell there is no lithium metal in the Li-Ion cell, only oxides of lithium. The rechargeable lithium metal cell is highly desirable but has not been achieved due to metal migration causing self

(Continued on page 5)

*(**Ham Tech** from page 4)*

Parameter	Lead Acid	NiMH	Li-Ion Co-	Li-Ion Phos.
WH/Kg	50	120	250	120
R_{Int}	Very Low	Low	Med	Very Low
Charge Cycles	300	500	1000	2000
Charge Time-Hrs	16	4	2	2
Self Discharge/ Month.	5%	30%	<5%	<5%
V_{Cell} Volts	2	1.2	3.6	3.2
V_{Cutoff} Volts	1.75	1.0	3.0	2.5
I_{peak}-Amps	5 C	5 C	2 C	10 C
Cost	Low	Med	High	High
1st Use	1890	1990	1991	1999

Table 2, Secondary Battery Performance

shorting on charging that causes destructive thermal runaway.

A comparison of two Li-Ion chemistries along with lead acid and NiMH is given in Table 2. The Li-Ion Cobalt cell is used in modest peak current applications like cell phones, tablets and laptop computers because it has the highest energy density, 250 watt hours per kilogram of weight. The Li-Ion Iron Phosphate cell has less than half the energy density but 5 times the peak discharge current capability make it useful for electric vehicles and SSB and CW ham rigs. It is also a more stable chemistry than Cobalt.

One of the valuable characteristics of all Li-Ion batteries is the low self discharge rate, less than 5 percent per month. Compare this to the high 30 percent rate for NiMH.

Charging Considerations – Of the four chemistries listed in Table 2 only lead acid is easy to charge and tolerant of over charge. The other three require very specific charging algorithms and built in self resetting fuses to avoid damaging the battery or fire in event of a load or charging failure. Li-Ion batteries should not be totally discharged. The load should be removed below the cut-off voltage.

Transportation Issues - The FAA and similar regulatory agencies in other countries have issued severe restrictions on passenger and cargo air transport of lithium batteries. The threshold for requiring hazardous material shipping has been established as 100 watt hour for all Li-Ion batteries. This is equivalent to an 8 amp/hr 12 volt battery. Know the rules before taking any lithium batteries on an airplane.

Battery Life Examples – Three transceivers and one amplifier are modeled operating in CW mode and powered from $LiFeS_2$ primary cells and $LiFePO_4$ secondary battery using the latest lithium iron phosphate technology. The transceivers are the TenTec R4020, Yaesu FT-817ND and Elecraft KX-3. The amplifier is the HobbyPCB HR-50 described two months ago. The CW duty cycle of 44 percent key down and a 40 percent transmit 60 percent receive time was used.

(Continued on page 10)

100TH Anniversary Happenings

Ken – K2WB/100

So far the 100th anniversary committee has had 11 meetings (many more to come). Just to keep everyone up to date here is where we are.

Over 60 coffee cups have been sold. There are plenty more to go. Mugs may be acquired to SJRA members by a minimum donation of $10.00. There will be coffee mugs available at the General Membership Meeting on September 24th.

We now have 11 centennial members, there are centennial members in 6 states and now the Philippines. Our goal would be to have at least 2 members in each of the States. At least 1 member in each of the ARRL sections and at least 1 member in 100 countries. This will make some of radio sport events planned very exciting. Pass the word around.

Our 100th Anniversary banquet will be held at the Trump Country Club in Pine Hill, NJ on Saturday July 30th, 2016. So mark your calendar.

The SJRA website has been updated allowing easier access to 100th anniversary information.

Work has begun with the SJRA QSO Party, help is needed to administrate and operate. Also, discussions of the SJRA large area special event.

We still need a lot of money to achieve our goals and objectives. Our anniversary is only 278 days away.

With that said, Joe, KC2TN, is selling 100th Anniversary clothing and hats, in addition he has patches. Contact Joe should you want to have the "New" SJRA Look.

There is still a lot to do and we need your help. Please contact me if you are interested in helping with the 100th.

CX Contest Has Been Expanded!

In addition to the usual Sunday for CW and Sunday for phone, CX has now been expanded to add the following Tuesday for each mode. Now you can be part of working the "Great Ones" even if your weekend is taken. And even more fun if you can participate on Sunday and Tuesday.

The CW session will be Sunday September 20-21 and Tuesday September 22-23.

The Phone session will be Sunday September 27-28 and Tuesday September 29-30.

Plus there are now two categories:

Three and under receiver-transmitter pairs and four and over transmitter pairs. You can show how well you can do against hams with similar Boat Anchor stations.

Full details are on the CX website:

http://www.classicexchange.org/.

While you are there, be sure to read the January 2015 CX Newsletter for all the excitement, interesting signals (chirps), "Gee, I remember that rig" moments and unusual experiences, as well as marveling at the scores.

Come join in the fun again. And be sure to let your fellow hams, club members, and QSOs in on the coming fun.

73 and CU in CX,

Mac, WQ8U
CX Newsletter Editor

President's Message

Ken—K2WB

Fall will be here soon Autumnal Equinox is September 23rd. If you look carefully the signs are already showing, with a little yellow, or red is starting to appear from the green of summer. This is the best time to spruce up the antenna farm and get ready for the fall radio contest and DX season. Contact Rich, KV2R, if you would like to get an official SJRA hard hat to help protect you when overhead work is being done.

Get help with any big projects there are many members with knowledge and experience that will help make your project safe and successful.

If you participated in the ARRL September VHF contest, send your log to the league noting the SJRA as your affiliation. This is a club competition; VHF contesting is easy to do and does not require special equipment. Most of our members are located in grid squares FM29 or FN20, with the exception of our Centennial Members

It has been 1 year since 100th anniversary committee had its first meeting. There is still a lot to do.

Lastly, there are number of members of the club who can no longer make it to the meetings for various reasons. The Health and Welfare committee ca coordinate riders with drivers. If you can't make it the meeting because of transportation issues or would like to offer assistance, contact Roy, WB2EOD, or Dara, KC2THQ.

As always the SJRA is looking for more members, bring a friend to a meeting. With some luck and encouragement they may even join and become a SJRA member.

Monthly Puzzle

Don—WA2DUE, wa2due *at* arrl *dot* net

For August we presented the following:

The sum of the number of resistors and capacitors on a particular circuit board is 93. One eight of the number of resistors is equal to three sevenths of the number of capacitors. How many of each component are on this board?

Answer: Let R and C represent the Resistors and Capacitors respectively. Therefore we can write two equations, R + C = 93 and R/8 = 3C/7. We eliminate the denominators of this second equation by multiplying both sides by 56 and get a new equation thus, 7R = 24C. We can substitute for C in this equation by using C = 93 – R. Our final equation becomes 7R =24 (93 – R) and simplifying 7R = 2232 – 24R. Adding 24R to both sides we get 31R = 2232 and R = 72. So we find that there are 72 resistors and 21 capacitors on this circuit board.

An eighty year old heiress had four times the money her grandson had, but after she gave him a 33 million dollar trust fund he then was worth 3 times as much as she. How much money had she before establishing the trust for her grandson?

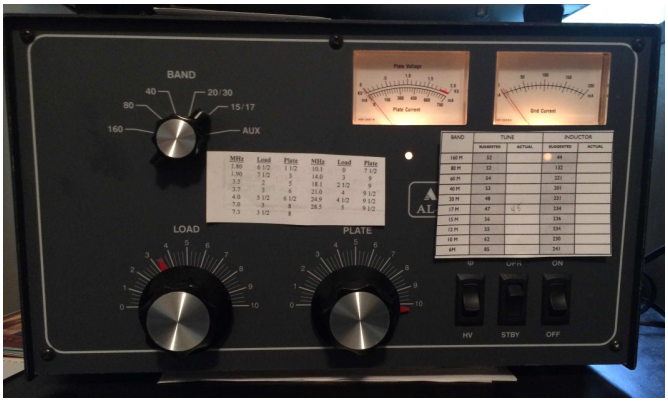
Answer: Let H and G represent the Heiress and Grandson respectively. Then we can write two equations thus, H = 4G and 3(H – 33) = G. The second of these equations can be rewritten 3H – 99 = G. Then multiplying this latter equation by 4 we get 12H – 396 = 4G. We then subtract the first equations from this and end up with 11H = 396. Dividing both side of this by 11 we find that the Heiress had 36 million

(Continued on page 10)

Items For Sale

LDG AT-1000 Auto Tuner
1.8-54 Mhz continuous
1000 W SSB
750 W CW
500 Digital modes
6 meters 100W
20-125 watts drive to tune
excellent condition with manual and power cord with power poles
asking $225.

Antennas.US UC-4364-328 Quadrifilar Helix antenna
http://www.antennas.us/store/p/229-UC-4364-328-UHF-Amateur-Satellite-Antenna.html
Rated at 50 watts CW
Lightly used and only outside briefly for satellite operation.
Very small!
Asking $75



Ameritron AL-811H Amplifier
SPECIFICATIONS:

- Output power: 800 Watts PEP, 600 Watts CW.
- All Band Operation: Covers 160-15 Meters including WARC bands. Can be user modified for12 and 10 Meters.

No problems with this amp and will come with 2 extra tubes. I usually drive it with about 50 watts and I work everything I hear. I'd be happy to demo this as it is in use in my shack in Cherry Hill.

Call Rick (W2JAZ) at 856-429-3539 or Email Rick at:rjlawn@gmail.com

Items For Sale

Mint Alinco DX-SR8T Transceiver with DM-330MVT Power Supply, USB Cable and 20m Dipole using a W2AU balun with coax and a W2FMI UNUN Transformer, $500. Contact John, W2HUV, at (856) 374-3696.

Test Session Report for: September 9, 2015

The SJRA would like to congratulate the following on their recent achievements:

Mitchell Aldrich, KD2GNQ
64 Burnt House Road
Indian Mills, NJ 08088
Earned his Extra

Daniel Robinson
520 Collings Ave., B-317
Collingswood, NJ 08107
Earned his Tech

	Tech	General	Extra	Total
To Date	88	38	20	146

North American QRP CW Club Information

Via Rick, W2JAZ

The North American QRP CW Club (NAQCC) will be celebrating its 11th anniversary the week of October 12-18 with some fun on-air activities. Special event stations N1A, N2A, N3A, … N0A will be on the air from all over the United States, and special certificates and QSL cards will be available for these contacts. The stations will be operating CW at QRP power levels and will be announced on our special spotting page (http://www.naqcc.info/spot_schedule.php<http://www.naqcc.info/spot_schedule.php>) in almost real-time. (You do not need to be QRP but we encourage you to give it a try.) On Tuesday evening of that week (0030-0230Z Oct 13) we will have our usual monthly sprint but with the bonus that all NAQCC members who participate will be automatically entered into a drawing for some great prizes.

More detailed information about our anniversary celebration can be found in our September newsletter at::

http://www.naqcc.info/newsletter_207.

Information about the NAQCC, including a membership application (it's free), can be found at:

http://www.naqcc.info/

*(**Antenna Analyzers** from page 1)*

Apparently, this started out as an Arduino project. As Maximo, EA1DDO, pointed out on the radioartisan Yahoo Group, there is source code for this project on GitHub (https://gist.github.com/jackdev23/7876502), and a schematic is available on the Union de Radioaficionados Espanoles (URE) website (http://www.ure.es/media/kunena/attachments/2420/Schematic.jpg).

• •

When not writing about antenna analyzers, Dan, KB6NU, actually builds an antenna now and then. You can often find him on the HF bands (mostly 40m and 30m), working CW. His #1-rated amateur radio blog can be found at KB6NU.Com, and you can e-mail questions, comments, or complaints to cwgeek@kb6nu.com.

*(**Monthly Puzzle** from page 7)*

dollars before establishing the trust fund for her grandson.

For September let us consider the following:

There is a tank circuit consisting of a coil, a fixed capacitor, and a variable capacitor all connected in parallel. The coil has an inductance of 30 microhenries, the fixed capacitor has a value of 200 picofarads and the variable capacitor maximum is 80 and its minimum is 10 picofarads. What is the minimum and maximum frequencies this circuit can tune?

What is the number when doubled is greater than its half by 66?

Please submit solutions and/or comments to wa2due *at* arrl *dot* net.

*(**Ham Tech** from page 5)*

Rig	P_{out}	$I_{Receive}$	I_{Xmit}	E_{DC}
R4020	4 W	0.055 A	0.9 A	12 V
FT-817	5	0.3	2.0	9.6
KX-3	5	0.21	1.23	12.8
HR-50	50	1.0	10	12.8

Table 3 above gives the power output, receive and key down current draw and the operating voltage of each transceiver and the amplifier.

Rig	P_{AVG} CW	$LiFeS_2$ 36 WH	$LiFePO_4$ 102 WH	$LiFePO_4$ 306 WH
R4020	2.3 W	15.6 Hr	44.3 Hr	133 Hr
FT-817	5.14	7.0	19.8	59.8
KX-3	4.68	7.7	21.8	65.6
HR-50	30.2	-	3.4	10.1
817+50	35.3	-	2.9	8.7

Table 4 above gives the average DC power draw in CW mode and the run time for each transceiver/amplifier for three different lithium batteries.

The only rig that can make practical use of the LiFeS2 primary cells is the Ten-Tec R4020, which is designed for two band back pack use. The 8 battery cells cost about $18 and with 15 hours life that's almost $1.20/hr to operate. The 100 WHr lithium phosphate battery with 1200 re-

(Continued on page 11)

(Ham Tech from page 10)

charges will give 2 or 3 days operating on a charge at QRP power. If you want a day of operating at 50 watts you need the 300 WHr unit, which weighs just 6.4 pounds and cost about $300.

Next Month - Ham Tech will start a new three part historical series titled "Putting the Voice into Ham Radio" Part one next month will focus on the early days of AM with technology like the Heising Modulator.

SJRA Jackets, Shirts, Hats

Order NOW – Next order going in soon!

Spring Jacket is $44 (S,M,L,XL), Fall Jacket is $55 (S,M,L,XL),
Shirts are $27 (S,M,L,XL), Hats are $20 (*New Lower Price*, one size fits all)
Name and Call Sign embroidery included….Larger sizes slightly more!
Email Joe, KC2TN, with orders or additional info: kc2tn *at* comcast *dot* net

Amateur Radio FCC License Testing

The SJRA sponsors *FREE* Amateur Radio FCC License testing on the second Wednesday of each month. The location is: 443 Commerce Lane, Suite 5, West Berlin, NJ 08091. Registration is at 7:00 PM and testing begins at 7:30PM. Walk-ins are accepted.

VE team members can be reached at VE ***at*** SJRA ***dot*** org. A calendar and more information can be found on the SJRA web site.

September Meeting:

Fourth Wednesday, September 23, 2015

The meeting commences promptly at **7:30PM** in the first floor Meeting Room of the Gibson House on Main Street, Marlton, NJ 08053. Guests are always welcome.

Program For September:

Storm Robotics Team

SJRA Member October Birthdays

Ken Botterbrodt, K2WB; Craig Hodsdon, WE2Q; Burton Sampley, NJ2IT; Robert D Turner, Jr, N2SCJ.; and Jim Vecchiola, KR2T

Health and Welfare Co-chairpersons: Roy, WB2EOD, and Dara, KC2THQ

List Your "For Sale" Ham Stuff in the SJRA Harmonics

Email Ted, W2TAG, with your listing, ted.w2tag *at* gmail *dot* com

First Class Mail

South Jersey Radio Association
PO Box 1026
Haddonfield, NJ 08033