Sierra Signals

P.O. Box 6421 Auburn, CA 95604 | July 2015 | http://w6ek.org info@w6ek.org

At The Key of SFARC:

PRESIDENT
Tyghe Richardson, KD6MLH
tyghe@tjrauctions.com

VICE PRESIDENT
Bob Brodovsky, K6UDA
k6uda@att.net

SECRETARY
Bruce Anderson, K6BAA
anderson51@wavecable.com

TREASURER
Richard Kuepper, WA6RWS
rkuepper@surewest.net

DIRECTORS
Birton Gilbert, N6UG
Robert Bell, W6RBL
Jim Jupin, WA8MPA

FIELD DAY CHAIRMAN
Mark Graybill, W8BIT

REPORTERS
Satellites: Greg, KO6TH
History: Gary, KQ6RT
Misc Radio: Fred, K6DGW
Sunshine: Richard, WA6RWS

WEBMASTER:
Birton Gilbert, N6UG

REPEATERS
145.430 (-0.6 MHz/PL 162.2)
440.575 (+5.0 MHz/PL 162.2)
223.860 (-1.6 MHz/PL 162.2)

CLUB NET
Thursdays, 7:30PM, W6EK/R
145.430

CLUB MEETINGS
Second Friday of the month,
7:30PM at the Auburn City Hall,
1215 Lincoln Way, Auburn CA

CLUB BREAKFAST
Last Sat of the month at Mel's Diner
1730 Grass Valley Hwy, Auburn 7:30AM

NET CONTROL OPS
Dave Jenkins, WB6RBE
Norm Medland, W6AFR
Bob Brodovsky, K6UDA
Al Martin, NI2U

NEWSLETTER EDITOR
Barbara Anderson, W6EVA
anderson51@wavecable.com

ARRL PIO:
Carl A Schultz, WF6J

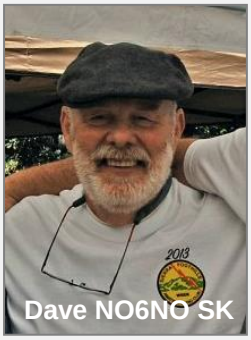
VOLUNTEER EXAMINER
Dave Albright, NO6NO

Calendar of Events

July 10th:
Club Meeting

July 25th:
Club Breakfast

Inside this issue:



Dave NO6NO SK

We encourage members to receive Sierra Signals via email to save the Club the cost of reproduction and mailing

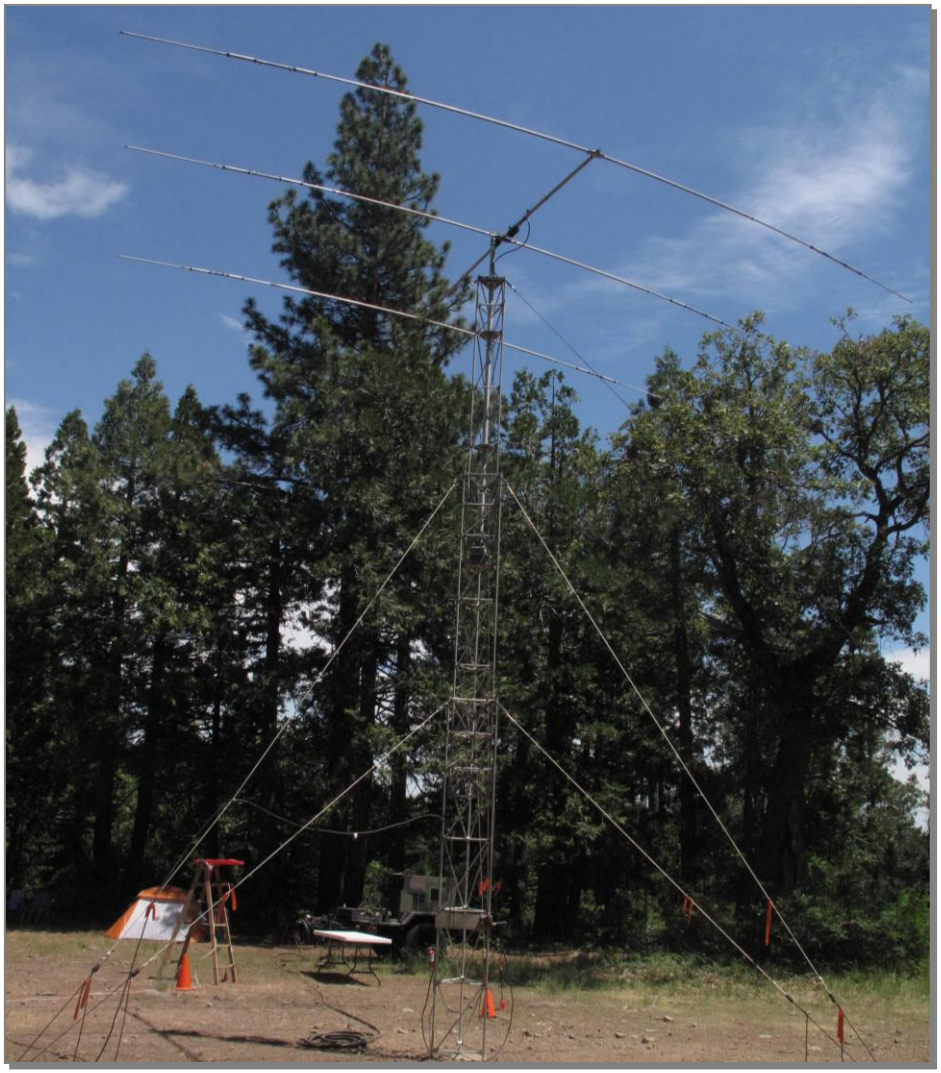
Field Day – June 2015 Nyack, CA

Here are the rough stats for Field Day 2015 from the "server log" only; this does not include the local logs from the other 5 computers where some logging occurred early in the event:

Total CW Contacts = 278
Total Phone Contacts = 620
Total Digital Contacts = 174

GOTA:
Total operators = 26
Total Contacts = 114
(3 operators logged 20+ contacts for extra points)

Dennis – WU6X



This is
our newest
antenna

Provided
by
Bob – N6EMS

MISCELLANEOUS RADIO

Radiotelephone

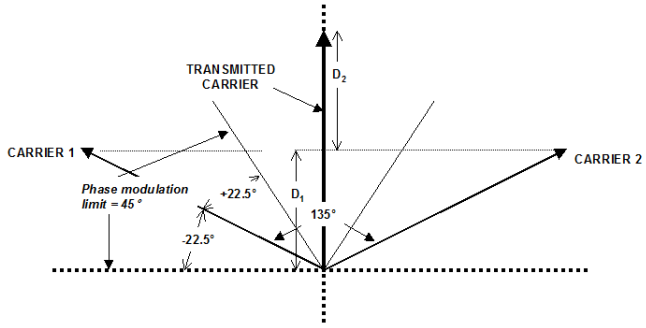
PART 2

An AM Technique Very Few Hams Have Heard Of

It originated in 1935, it was a common method of generating amplitude modulation in AM broadcast transmitters manufactured by RCA in the 50's and 60's, and there is a surprising local connection. It fell into disuse in the late 60's although a number of AM stations continued to use it for stand-by service since they already had the transmitter. If you'd like a short pop quiz, "Name the local connection … [Hint: four letters]."

The technique was invented in 1935 by Henry Chireix who called it "outphasing." AM transmitters of the day normally consisted of an RF chain that began with a crystal oscillator followed by subsequent amplification. The final amplifier stage typically ran Class C [highly non-linear] to achieve the highest efficiency … generally around 70-75% … and the audio was applied to the plate circuit through an audio transformer. While plate modulating a Class C amplifier produced the highest RF efficiency, recall that it has a downside … the audio amplifier has to produce half the DC input to the power amplifier, and the modulation transformer has to be big enough to handle that.

The largest AM broadcast stations ran 50 KW output meaning their final Class C power amplifiers ran around 75 KW DC input, requiring a modulation amplifier [and transformer] of about 37 KW. Big and expensive things. Higher quality signals could be obtained by applying the modulation to a low level RF stage and then using Class A linear amplifier stages to get to 50 KW output. Class A amplifiers are at best about 25% efficient, so the DC input power of the final PA would then be around 200 KW. The "outphasing" method would generate high quality AM but did not require the high power audio amplifier or transformer, and the RF amplifier chain could run Class C for highest efficiency. There being no "free lunch," the price paid is increased complexity in the transmitter and adjustment process.



Chireix's method was to generate a carrier with a crystal controlled oscillator on the station's assigned frequency. That carrier was then split into two, with the second being 135º out of phase with the first one. Both carriers are then separately amplified and finally summed in the transmitter's output circuit.

To visualize this we'll resort to what EE's call a "phasor[1] diagram" shown at the left and a small digression. The two angled arrows [phasors] at the left are rotating clockwise, one revolution for each cycle in the station's transmitted signal. We don't care about that however, all we care about is the phase relationship between the signals, which is independent of the rotation since they all rotate together.

This is particularly useful because we can treat the phasors as vectors on which we can perform all sorts of algebra, however, the only algebra we're going to do is to add two vectors [aka phasors].

CARRIER 1 represents the generated carrier in the transmitter. CARRIER 2 is exactly the same carrier with it's phase shifted by 135°. Again, while the diagram is rotating clockwise at the station's carrier frequency, that 135° phase difference is preserved, so we just ignore the rotation. In the output of the transmitter, the two carriers are summed. How do we add two vectors that point in different directions?

Well, all we do is project the two vectors onto each axis, and add the projections. Projecting them down to the horizontal axis, we get two equal distances with opposite signs which add to zero. Thus the vector sum will be a vertical vector along the vertical axis. I've labeled the projection for CARRIER 1 "D_1" and it extends from the origin up the vertical axis. That's also "D_2" from CARRIER 2, and when I add them together, I get the vector labeled TRANSMITTED CARRIER. With no modulation, it's just a steady carrier.

So, we've got a 50 KW carrier. Now, we phase modulate CARRIER 1 and CARRIER 2 with our audio program. Phase modulating CARRIER 1 in our diagram just means we increase or decrease the phasor's angle with respect to the horizontal axis. The audio has positive and negative half-cycles which just sweep the CARRIER 1 phasor up and down. For reasons

1 Not to be confused with "phaser," a weapon used by Capt. Kirk and his crew of the Star Ship Enterprise

that will become clear, we're going to restrict the phase modulation to ± 22.5°.

We'll do the same thing with CARRIER 2, except we'll use audio that is 180° out of phase with the audio modulating CARRIER 1. The effect is that the two phasors move up and down like a bird's wings flapping. Getting the 180° phase shift is easy, we just feed our audio program into the primary of a small audio transformer with a center-tapped secondary, and the audio from one end to center-tap will be 180° out of phase with that from the other end and the center-tap.

Now, flap the two phasors in your imagination, 22.5º down and 22.5º up and look at what happens to $D_1 + D_2$, the transmitted signal. That TRANSMITTED CARRIER phasor remains vertical because the two projections onto the horizontal axis are always equal with opposite signs and they cancel each other. The transmitted signal on the vertical axis however changes in amplitude with the audio program which is …??? If you said "amplitude modulation," you've been paying close attention.☺

When the two phasors are at their lowest point [-22.5°], D_1 and D_2 are zero, and so is the transmitted carrier. That's 100% modulation and that's why we picked a phase shift limit of 22.5°. When they are at their highest point, D1 and D2 sum to 1.85 times the no-modulation state. In pure AM, that should be exactly 2.0 times the no-modulation state, however that little bit of distortion is fixable by adjusting the audio dynamic range with sort of a reverse-AGC … the audio peak amplitudes are expanded, and in the outphasing world, it was called the "drive regulator."

Cherix's "outphasing" has several features for us, the AM broadcaster:

> **a.** Since everything up to and including the two power amplifiers are amplifying two constant envelope phase-modulated signals, they can all run Class C and we gain a great deal in efficiency.
>
> **b.** Phase modulating the two carriers takes essentially no power. No 37 KW audio amplifier [modulator], no huge 37 KW modulation transformer, and no electric bill for that 37 KW audio amplifier.
>
> **c.** The two power amplifiers [Class C] need to each produce 25 KW with no modulation and two 25 KW transmitters are a little cheaper than one 50 KW transmitter.[2]

The price we pay for this is two separate, identical RF chains up to and including the power amplifier stages, and adjustment and maintenance costs go up some. There is a net gain however, which brings us to the "local connection."

The "outphasing" method of generating high power AM pretty much languished in obscurity from 1935 to the latter part of the 40's, at which point engineers at KFBK[3] in Sacramento, which had just been authorized 50 KW, decided to home-brew an outphasing transmitter. They succeeded, it was used for a long time, and is, or was until recently, still their stand-by transmitter, I've seen it.

At that time, KFBK was owned by McClatchy Broadcasting. McClatchy has undergone a number of mergers, divestitures, and re-organizations since then, and it really isn't the same company as it was, and Clear Channel owns KFBK today.

RCA, then a major manufacturer of high power MF and HF transmitters for broadcast and communications became interested in KFBK's outphasing transmitter and McClatchy sold the rights to RCA who began manufacturing transmitters. They didn't like the name "Outphasing" and called their transmitters "Ampliphase" instead. They came in 5 KW, 10 KW, and 50 KW flavors[4] and sort of dominated the AM broadcast transmitter market in the 50's through the 60's. A couple were custom built at 200 KW for the short wave broadcasting industry.

KFBK is also the radio birthplace of "The Bloviator-in-Chief," Rush Limbaugh, a far more dubious claim to fame than the birthplace of Ampliphase transmitters ... but probably better known. I am unaware that the "Outphasing/Ampliphase" concept was ever used in a ham AM transmitter, but as noted below, the cost benefits decrease as power is lowered, and disappear around 5 KW, so that's not surprising.

As with the GE "Fizzatron," the RCA Ampliphase transmitters acquired the nickname "Amplifuzz," and broadcast engineers hated them. They were indeed touchy and difficult to adjust … and keep in adjustment. Obviously, the gain of the two RF chains had to be exactly equal [the two phasors always the same length] or the projections down to the horizontal axis wouldn't cancel and the phasor labeled TRANSMITTED CARRIER would deviate from the vertical axis, adding phase modulation to the intended AM-only carrier. It was also critical that the phase difference between the two unmodulated carriers at the output of the PA's be exactly 135 degrees. Getting two separate RF amplifier chains to exhibit exactly the same phase shift involved a number of internal trimmer capacitors and adjusting them changed the gain. One did not

---

2 Not much, however.

3 Answer to the pop quiz at the beginning

4 A handful of 1 KW units were built, mainly experimentally, however the savings decreases at lower powers, and the Ampliphase concept, requiring two RF chains in return for no Class B modulator and transformer becomes a detriment below about 5 KW.

want to undertake a Proof of Performance on an Ampliphase transmitter after midnight sign-off if you'd been awake all day.☺

They were also very sensitive to tube aging, and generally, if you replaced a tube in one RF chain with a new one, you also replaced the same tube in the other chain, even if it was working OK. There was a lot of interaction between gain adjustments and the "drive regulator" that linearized the transmitter. I have no idea what these adjustment/maintenance difficulties might have added to the cost of ownership, but I do know that a modulator and modulation transformer in a 50 KW plate modulated broadcast transmitter would take a big bite out of the bank account.

Ampliphase faded into obscurity with the invention of high-power solid state devices in the 70's but for perhaps 2 or maybe a bit more decades, go into any AM station's transmitter shack near the antenna and you'd find an RCA Amplifuzz TX.

73,

Fred K6DGW

BOARD OF DIRECTORS MEETING MINUTES

June 12, 2015

The SFARC Board meeting for June commenced at 1800 hours at the Sizzler restaurant in Auburn.

Roll Call: All officers and Directors were present with the exception of Secretary Bruce-K6BAA. Also present were guests Al-NI2U, Orion-KK6RGT, Scott-K6SVW, Laura-K6LVW, Dennis-WU6X, George-KG6LSB, Mark-W8BIT, and Toni-KK6JPJ.

REPORTS and DISCUSSIONS

President's Report: Tyghe-KD6MLH began discussion on the board's earlier request for member input on repeater operations. He floated several suggestions that were discussed. Tyghe also reviewed "T-shirt" options and this evenings program centered on "Field-Day 2015".

Vice President's Report: Bob-K6UDA made a motion to provide special "Green" field-day t-shirts to committee members to facilitate on-site communications. Richard-WA6RWS seconded. The motion passed unanimously. Bob also said, this year, the United States Army Reserve will provide a generator and 5 person crew to cover our Nyack stations. Birton-N6UG made a motion the Club provide field-day T-shirts to the AR team members. Richard-WA6RWS seconded the motion, it passed unanimously.

Treasurer's Report: Richard-WA6RWS reported net cash on hand at beginning of June of $TBD; deposits of $343.51, expenditures of $247.01 an ending balance of $TBD. Richard added Club memberships increased by one this month.

Sunshine Report: Richard-WA6RWS updated on the status of three club members

OTHER DISCUSSIONS

Bob-K6UDA outlined a challenge for this year's "field-day" participates. George-KG6LSB handed the "Drawing" baton over to Jason-???. Thank you George for your faithful service to the club.

Meeting adjourned at 1831. Submitted by Jim – WA8MPA, Director

GENERAL MEETING MINUTES
June 12, 2015

The SFARC General meeting for June commenced at 1930 hours at the Auburn City Hall Rose Room, President Tyghe-KD6MLH presiding. Officers and Directors were present with the exception of Secretary Bruce-K6BAA, Bob-K6UDA, and Birton-N6UG. Tyghe led approximately 38members and guests in a Pledge of Allegiance to the flag followed by an introduction of Officers, members and guests.

REPORTS:
Past minutes: Minutes were approved as posted in the Newsletter on motion.

President's Report: Tyghe briefly discussed the agenda. Tyghe reviewed this evening's board meeting to include a call for member input on repeater operations. He then called for Officers' reports.

Secretary's Report: Bruce-K6BAA on vacation - no report.

Treasurer's Report: Richard-WA6RWS reported net cash on hand at the beginning of June of $TBD; $343.51 in deposits, expenditures of $247.01 and a balance of $TBD.

VE's Report: Al-NI2U, VE reported elements were given to 11 candidates resulting in ? new techs and ? ? new generals and ? extras.

Sunshine Report: Richard-WA6RWS updated the membership on several club members with health concerns.

Refreshments/Drawing: Jason-???? our new Drawing volunteer reviewed items planned for the drawing. Scott-K6SVW reported on refreshments for the break.

OLD BUSINESS:
None

NEW BUSINESS:
None

General Announcements: The Club Net meets every Thursday at 7:30pm; Board and General Meetings occur on the 2nd Friday, Board meeting is held at **Sizzler Restaurant** in Auburn, and General meetings at 7:30pm at **Auburn City Hall**. The Club breakfast is held on the last Saturday at **Mel's Diner** in Auburn; an Elmer Net is held the first and third Wednesday night at 7:30pm on the 2m repeater. See **www.w6ek.org**for more information.

George-KG6LSB also briefed the membership on the Tour de Cure event in Rocklin, he read a letter from the event coordinator thanking the club for their help this year. George reported 23 club members participated in this event. Next year's event is on May 21, 2016.

Tech-10 & Presentation: None this month

Field Day 2015: Mark-W8BIT reviewed this year's plans and introduced team captains. A brief Q & A was held.

The meeting adjourned at 2046. Submitted by Jim – WA8MPA, Director

July 31, 2015, will mark the end of an era in Electronics in Sacramento. One of the last components stores, Metro Electronics, will close their doors.

We have seen this happen over the years with closing of many surplus places and other stores like Radio Place. With the advent of people not repairing things and television going mostly cable/fiber, those who need parts have to turn to the internet and have them shipped in.

~ Carl WF6J

SIERRA FOOTHILLS AMATEUR RADIO CLUB
P.O. Box 6421, Auburn, CA 95604

SIERRA FOOTHILLS AMATEUR RADIO CLUB
P.O. Box 6421, Auburn, CA 95604

2015 MEMBERSHIP APPLICATION

Name: _____ Call: _____ Class: ___ e-mail: _____

Address: _____ City: _____ State: _____ Zip: _____

Associate Name: _____ Call: _____ Class: ____ email: _____

Phone: _____ Cellphone: _____ Application is: (Circle) New Renewal

Dues / Donations:

Membership: yearly*	$22.00or 20x__	Name Badge:	$ 7.00	Yes	(special name)_____
Associate: yearly*	$ 7.00	Repeater Donation:	$_____		
Auto Patch Donation:	$_____	Newsletter Booster:	$_____		
Misc. Donation:	$_____	Christmas Donation:	$_____	ARRL member? (circle)	Yes No

TOTAL: **$**_____ **Please add $1 if paying via PayPal**

*Prorated dues for NEW Members/Associates Only

July	$ 20 /6	October	$ 14/3 + following year	**New---New---New---**
August	$ 18/5	November	$ 12/2+ following year	**Multi-year DISCOUNT Membership**
September	$ 16/4	December	$ 10/1 + following year	****$20 per year for 2 or more years (new or renewal)**

OFFICE USE ONLY: DO NOT WRITE BELOW THIS LINE

Date: _____ Treasurer: _____ Secretary: _____ Roster: _____

Payment: _____ Check Number: _____ Cash: _____ PayPal:_____

Rev. 5-15-2015