

The Shared Apex Array SAL-30 Antenna and other low band RX antennas

Ted Rappaport, N9NB

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CTDXCC

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LOW BAND RX ANTENNAS – Options and Constraints

- **Cost**
- **Performance (Receiving Directivity Factor: RDF)**
- **Physical Footprint**
- **Maintenance (active/passive and long-term upkeep)**

Some References for top-band RX antennas:

<http://www.topbandhams.com/tech-page/28-receiving-antennas>

<http://www.w8ji.com/receiving.htm>

<http://www.hizantennas.com>

<http://www.w5zn.org>

www.iv3prk.it/user/image/site2-rxant.prk_4-square_1.pdf

<https://www.youtube.com/watch?v=i46kR0pynFw>

PERFORMANCE – Receiving Directivity Factor (RDF)

- Typ. low-noise 160 m RX antennas have negative gain (~ -20 dB)
- RDF: Gain in desired direction vs. avg. gain in all directions
- RDF does NOT consider directional noise, crucial for top-band!
- RDF is degraded by structures, power lines (esp. large RDFs)
- Personal experience: Loops/low antennas less noisy than vertical

Typical RDF VALUES:

5 dB: A single vertical antenna (my experience: noise is bad)

4 - 6 dB: 250 - 400 foot Beverage or BOG (and I think less noise)

6 - 8 dB: Array of small loops (flag, pennant, K9AY)

8 - 10 dB: 500 - 600 foot Beverage

12 dB: 800-900 foot Beverage

13-14 dB: 4 phased verticals, 8-circle array (1 - 3 acres)

N9NB Goals: good RDF, small footprint, low maintenance

Shared Apex Loop Array (Array Solutions AS-SAL-30)

60x60', 8-dir. switch, uses 1 preamp, no radials, 8 dB RDF

BOG/Single Wire Beverage/2-el. Beverage/staggered pair

400 – 700' long, one direction, 4-10 dB RDF

800- 900' long, one direction, 10-12 dB RDF

Electrically Steerable 4-Square Vertical Array

80x80', 4-dir.switch, uses 4 preamps, no radials, 12 dB RDF

4 full-size phased verticals or 8-circle short vertical array

1-3 acres, needs radials and umbrellas, no amps, 13-14 dB RDF

THE SHARED APEX ARRAY

A new loop-style low band receiving antenna:

- **Invented by Mark A. Bauman, KB7GF in 2007-10**
- **US Patent: time delay between 2 to 4 loops**
- **Published in Sept./Oct. 2012 QEX/QST**
- **Presented at Dayton 2014 Antenna Forum**
- **More than 200 sold by Array Solutions since '13**

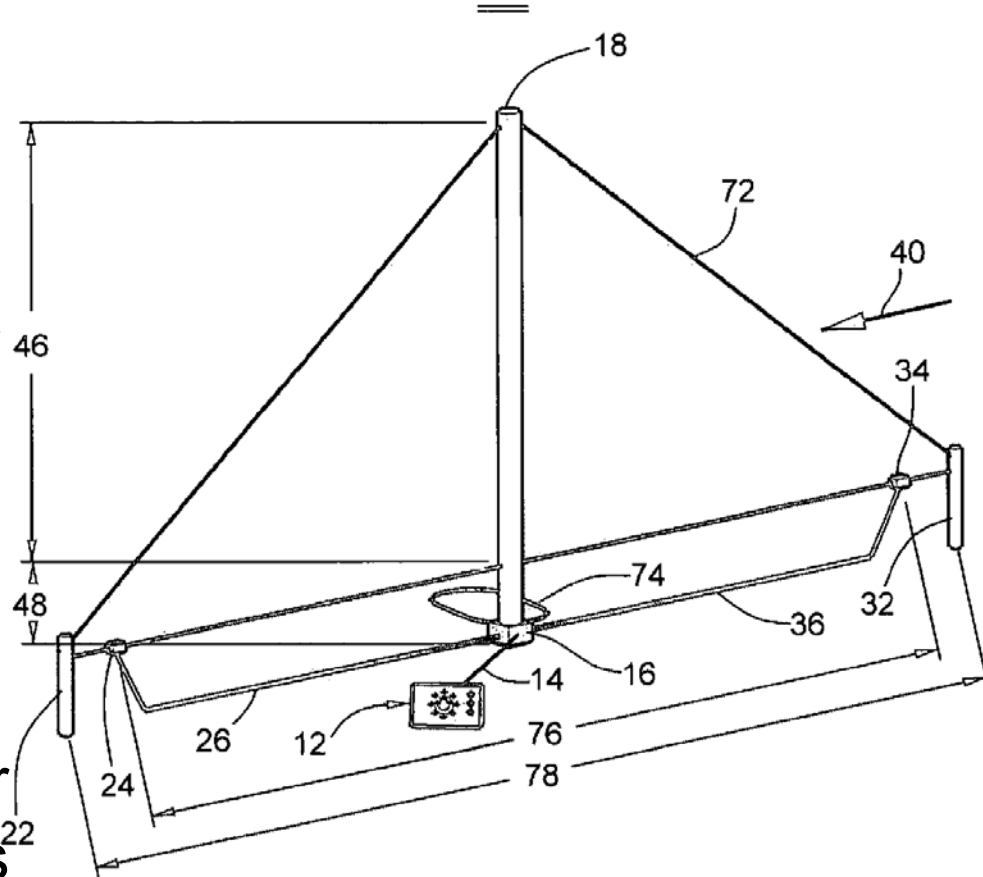
Great Resources by Mark Bauman on Yahoo, Web:
http://www.kkn.net/dayton2014/AntennaForum_SharedApexLoop_KB7GF.pdf

SAL-30 at N9NB



US Patent 8,350,776

Loops are aimed at NE, SE, SW, and NW directions and share a single non-conductive mast, delay line, and amp/combiner for the 4 loops



Shared Apex Loop Array

Only 60' X 60' of flat land required for directional low-noise:

-Sharing More than Just a single Apex:

- ❖ 4 LOOPS share the MAST
- ❖ Different directions take turns sharing the DELAY LINE
- ❖ LOOP SIGNALS share the COMBINER
- ❖ Combined SIGNALS share the AMPLIFIER and
(prewired but optional) AM-BAND HP FILTER
- ❖ POWER, SIGNALS and DATA share one FEEDLINE

SAL-30 at N9NB



Shared Apex Loop Array

The current sensors are ferrite beads on each loop:



SAL-30 Hardware



Super Support Team



Thanks to:
Sharon
N1SMM,
Bob
N4HY,
Joe
K2XX,
and
Jim
N3BB!

Site Selection

Didn't have level ground, but made a nice clearing 150' from TX

Site was conveniently in a trough, 30' elev. below TX antenna,
with 20 degree upward slope to EU and JA, amidst trees

Needed to install coaxial feedline down the hill to the antenna

Had to install feedline under the driveway

- fortunately, the lawn service was on-site the same day!

Site Selection



Small bright tree is due north, looking up hill

Site Selection



Looking SW from apex site, down the hill with forest all around

Site Selection



Deployment of SAL-30

The weather was ideal, even though rain was forecasted

Took about 5 hours including rag chewing and coffee/lunch

N3BB Jim had built a SAL-30 a month earlier at his location,
with great results using RG-6, so he led the deployment team

I ran the coax in 350' of PVC pipe while rest of team built ant.

I used RG8X coax (100' runs with connectors/barrels) instead of
recommended RG-6 (Mark and Jay told me it would work)

Deployment of SAL-30



Deployment of SAL-30



Deployment of SAL-30



Deployment of SAL-30



Deployment of SAL-30



Deployment of SAL-30



Deployment of SAL-30



Troubleshooting

Unfortunately, the antenna did not work upon completion:

- Had many difficulties with controller, combiner/amp, wiring
- Required several calls, several returned units, and several weeks working with Mark and Jay, but we prevailed!
- Mark Bauman and Jay Terleski WX0B never gave up trying to help, even when I was about ready to give up.
- Mark Bauman spent 1.5 hours with me on the phone, as I bench-tested two different amp/combiner units for proper relay operation

Troubleshooting

Faulty molded coax connector was intermittently shorting in cold/ice, this was independent of a bad sector in the controller or combiner box



Found PL-259/SO-238 junctions using stud-finder, and then replaced connectors with soldered Amphenol. Of course, the short was at the last junction!

Troubleshooting

Vertical wires were twisted by 90 deg. two sections below the top, so loops were not properly configured, while two different combiner boxes independently had relay switching problems during in-shack testing



Mark Bauman found our loop wiring error by enlarging this photo! He offered excellent support! We troubleshot the relays, finding more factory test steps and higher relay voltage was needed

Troubleshooting

Lessons Learned (on my end):

- Don't buy super cheap RG8X with molded connectors (I had to cut PVC pipes and replace all PL-259s w/ Amphenol)
- In hindsight, I should have used a single run of RG6 coax
- Must carefully and continually check all loops are aligned and not twisted during vertical mast construction

Lessons Learned (on Array Solutions end):

- SAL 30 factory testing was improved to test for relay closure
- Relay voltage in the combiner was increased from 3.3 V to 5 V based on my experiences (design change)

SAL-30 at N9NB

Behold: A thing of beauty – to hear on top band! 8 dB RDF and 8 RX directions in small area !



Only needs 8 ground stakes, and flags and chimes to keep out critters. Lowest part of loop is ~4' above ground. Has withstood 50 mph winds already.

Performance

Performance: This antenna works!

Even though ground is not level, **directionality and low noise** is incredibly good on 160 m and 80 m! Very slight fuzz on signal

As compared to Inv. L and 40' tall dipole on 80/160 m RX, the SAL-30 has (one S-unit = 3 dB):

- * **4 to 6 S-units less gain, but excellent directionality**
- * **5 to 8 S-units less noise than Dipole in all directions**
- * **6 to 9 S-units less noise than Vertical in all directions**
- * **Incredible directionality** – great once I find direction
- * Appears comparable to 8 switchable Beverage antennas!

Performance

Performance (cont'd.):

On 160 m, the SAL-30 has:

About 3 to 5 S Units F/B ratio

About 5 to 8 S Units F/S ratio (wow!)

W7: no copy -> S-7 when switching from NE -> NW

(Heard my first JA on 160 from my QTH with this antenna!)

Individual NE, SE, SW, NW directions better than N/E/S/W

Dipole, SAL-30 are sometimes comparable readability to EU on 160 even with some light noise present (Dipole has good ground slope)

The SAL-30 does slightly worse than 2 el. yagi on 40 m, unless I have a lot of horizontal noise (which is very rare).

EM90WA on 80m: Sal-30 v Dipole



Sal 30 vs dipole (1) IMG_3457.MOV

EM90WA on 80m: Sal-30 v Dipole



Sal 30 vs dipole (2) IMG_3461.MOV

Conclusion:

- **The SAL-30 is a terrific RX antenna**
- **Excellent solution for limited real estate or for staying out of the woods with a Beverage**
- **Directionality really helps on RX**
- **I may try to combine w/low dipole for omni RX**
- **Great support by the inventor and Array Soln.**
- **This should become a popular antenna**