



N.E.W.S. LETTER



The Publication of the North East Weak Signal Group

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V P: KA1OJ, Mark Foster

Current Officers
NewsLetter Editor: W1FKF, Don Twombly

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Next Meeting

September 27, 2008

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Don't Forget

**The North East Weak Signal Group
2 Meter VHF and Above Net
Every Thursday at 8:30 PM Local 144.250
W1COT, WZ1V or K1PXE Net Control**

MEMBERSHIP in the N.E.W.S Group is \$15 per year. Apply to Tom Williams, WA1MBA. Email tomw@wa1mba.org
You may download an application from our web page <http://www.newswhf.com>

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Preferably via email with "Newsletter" in the subject line to donw1kf-news@yahoo.com

The President's Corner

I hope everyone had a good time during the first Microwave Cumulative weekend. Personally my results were mixed. Saturday was a total bust. My plan was to try and work Henry, KT1J on 47, 78 and 122 GHz. I got to Henry's and found one of the x96 multipliers on the 122 GHz rigs had quit... Next, I went outside to work Paul, W1GHZ on a bounce off Whiteface on 10 GHz. The moment I plugged in my rig, it blew a fuse. Not a good sign. So, being the professional engineer that I am, I proceeded to keep feeding the rig fuses until I had blown all my spares. At that point, I was pretty well convinced that I had a problem. I drove back home and put the rig on the bench and found a shorted SMT electrolytic. It was pretty easy to spot as the top had a hole blown in it....

Sunday was spent on Mt. Mansfield with Paul, W1GHZ. We worked quite a few stations, but no real distance and only 10 GHz contacts. We did work Ray, VE3FN in FN14xw/15ik for two new grids for me from Mansfield. Ray had a great signal as usual. It was nice to talk with Dale, AF1T after his successful surgery! He said it was 'just what he needed' to be out working uWaves! Let's hope we see him at an upcoming meeting. We were pretty much in the clouds most of the day, so higher band contacts didn't happen. Pictured below are Paul and I set up to work Jimmy, VE2JWH in FN35. As you can probably tell from the way our dishes are situated, Jimmy's signal was really loud so aiming was not a problem.



Speaking of 122 GHz, Henry and I did finally make a 1km qso on 122.256 GHz. One of the multipliers is still a bit funky (low output) affecting transmit power. Pictured below is one of the systems. They are designed to be 'reflocked' but we ran them free running for the qso so as to be sure we weren't working our IF's.



At our upcoming meeting we will line up dates for the next several meetings. We will also vote on the proposed Constitution changes floated at the July Picnic. Also, thanks to Mark, K1MAP for signing up for another 2-year stint on the Board of Directors! Kudos to Don, W1FKF for taking over as our NEWSletter Editor. Finally, it looks like we won't be getting rid of Ron, WZ1V soon. Congrats to Ron on his 'permanent membership' status voted unanimously by the folks at the picnic. You don't think the vote had anything to do with the fact he was cooking our food?

Our presentation this month is by Ken, W1RIL. He has recently completed a 500 watt 2 meter amp using the Russian GI46B tube. I've seen some of the pictures. It's a beautiful amp. Knowing Ken, it sounds as good as it looks.

As always, we're looking for meeting topics. In fact, we have nothing for the next 3 meetings. If you have any suggestions, please pass them along!

73,
Mike, N1JEZ

From our Secretary

Minutes of NEWS meeting 12 July 2008 (Picnic)
at Knights of Columbus, Enfield, CT

President N1JEZ called meeting to order at 1335Z

Next meeting September 27 at the Storrs Library,
Longmeadow, MA

Treasurers Report:

- Picnic is membership renewal time
- there is 1 life member
- current balance \$2417 - spending for year typical

ANNOUNCEMENTS:

- Mt. Washington bike race 8/16 - conflict with 10 GHz contest
- KA1OJ - NEWS hats are available \$12
- N1JEZ has GPS parts - date TBD for building session
- Boxboro convention 8/23-24. W1GHZ organizing VHF Session Sunday Morning
- AF1T had a triple bypass
- W1TDS - Westover AFB Air Show
- K1MAP - MAD cross-border day - WA3ETD won DEMI gift certificate

NEW BUSINESS:

- N1JEZ proposed constitution change - to allow future changes and membership applications by email as well as mail

MOTION by WA1MBA - unanimous
vote next meeting

- K1MAP reelected to Board of Directors
- W1FKF elected NEWSletter editor
- WA1MBA motion - to elect WZ1V to permanent membership - unanimous
- N1JEZ suggests videotaping presentations for those who can't make a meeting, put on web

Meeting Adjourned <time not recorded>

Followed by MDS testing at 10 and 24 GHz

From our Treasurer

Our treasury is healthy. However, we depend on our members renewing dues promptly, and most who were at the annual meeting in July did so in person. An email was sent in June, and again in August to remind all those who needed to pay attention to this, and have email contact information. Only a few have no email address. If you are receiving this NEWS Letter via US Post, please check the address label. Your member-

ship is expired if the date is 07/08. If so, to keep your membership current please send a check for \$15 (per year) made out to NEWS Group. My address is on the back (address) page of this NEWS Letter as the return address. Thanks!
73's Tom WA1MBA

Constitution Change

There will be motions to make changes to the constitution at the next NEWS Meeting. At this point the known issues are as follows. Example motions are also presented.

- 1) The constitution requires mailing notice of a meeting where there will be constitution changes considered. In the electronic age we may want to allow for email notification of such a meeting.

Excerpt sentence from Article 6:

"Proposals for amendments shall be submitted in writing and shall be voted on at the next following regular meeting, provided all members have been notified by mail of the intent to amend the constitution and, or by-laws at said meeting."

Potential Motion for Constitution change:

- to change Article 6 the words "notified by mail of the intent" to "notified by postal mail, or email, or other suitable clear and effective means of the intent"

- 2) The constitution provides for membership when submitted in writing. We may want to clarify that this includes email as a method of writing.

Excerpt from Article 7, paragraph 2:

"Applications for membership shall be submitted in writing."

Potential Motion for Constitution change:

- to change Article 7, paragraph 2, the words "Applications for membership shall be submitted in writing", to "Applications for membership shall be submitted in writing, or via email, or by other clear and effective means."

- 3) Any other motion relevant to modernizing the constitution may be brought up during the meeting.

**North East Weak Signal Group
Annual Picnic - 12 July 2008**

Test results - 10 & 24 GHz

<u>CALL</u>	<u>RIG</u>	<u>10 GHz MDS (dBm)</u>		<u>10 GHz ERP</u>
		<u>lost</u>	<u>backup</u>	
WW1Z	23 dB horn	-85	-82	-25 dB
N1JFU	24" offset	-103	-99	-3 dB
N1LZK	24"	-101		-3 dB
KA1OJ	24" offset	-102	-98	0 dB
W1RIL	17 dB horn	(birdies)		
W1FKF	18" offset	-103	-102	-4 dB
W1GHZ	18" offset	-97	-95	-8 dB
N1EKV	24" offset	-96	-94	-14 dB
		<u>24 GHz MDS (dBm)</u>		<u>24 GHz ERP</u>
W1FKF	18" offset	-87		-16 dB
W1GHZ	18" offset	-87		0 dB
W1JHR	8"	-86		-13 dB
KA1OJ	24" offset	better		0 dB



N.E.W.S. Picnic and MDS
K of C - July 12, 2008



Just another quiet day on Mt. Wachusett,
first weekend 10 GHz and up Contest
Sept. 17, 2008
KA1OJ, W1FKF, WA1MBA

Everyone should check out
<http://www.heywhatsthat.com>

Here you can view many ham station tower views, the list is sorted alphabetically by callsign or place name. Default is magnetic bearings but you can click on true bearings to display true azimuth. Be sure to click on Show Profile and Visibility cloak too. You can enter your site in New Panorama by street address or lat/long. You can enter tower height above ground. It takes a few minutes to generate a new Panorama. There's a trick to saving your data: Once you're satisfied with how it looks, click Email this Panorama. Copy the URL shown in your email client to the clipboard.

Close your browser and restart it. Paste the copied URL into the browser. Go to All Panoramas, then View. Your new entry should be at the top of the list, click on it. You should then see the options View, and Make Public. Click Make Public once and only once. In a minute or 2 the option will change to Make Private, which means it is now public on the list. Clicking Make private will hide it from the list. I entered my tower site and it shows a visible path NNE to as far away as Shutesbury, MA at 61 miles (the home QTH of WA1MBA), which we have confirmed using other software and means. My take is heywhatsthat is fairly accurate. Thanks to N1JEZ for originally pointing this site out to us.

Beacon News

I placed a larger fan over the W1RJA/b beacon PA heatsink and the frequency stability has improved noticeably. It's pretty much been holding steady between 1296.285 and 1296.286 now. The URL for the beacon is:

<http://www.newsvhf.com/1296beac.html>
-73, Ron WZ1V



Ken W1RIL will give a presentation on a 2 meter 500 watt amplifier using a Russian GI46b Triode tube based on W6PO design.

The 222 Antenna Update
Dave Olean, K1WHS

The 222 MHz antenna here was replaced on the weekend of August 9 and 10th. The old system was a quad array of 16 element yagis at 100 ft. There were a few problems with that system. The rotator was a Tail Twister, and the main mast was a 2" aluminum mast with a schedule 40 type wall thickness. It did not give a warm and fuzzy feeling when the winds howled. So while the antennas themselves were OK, the support structure was a bit marginal. The plan was to enlarge the array and put it on a rugged mast and use an industrial strength rotor system in place of the T2X.

The added size would put the 222 MHz system on a par with 144 and 432 arrays. We had noted that 222 was taking a back seat to the other two bands in recent years. It was time that we updated 222 to keep up with improvements on those other bands.

I had a few volunteers show up for the antenna work party. Paul, W2PED and Warren, WB2ONA arrived from NJ, along with Warren's FB 115 volt electric winch. Our plan was to haul the whole system up the tower in one piece, utilizing the winch to do the heavy lifting. Al, WA1T showed up on Saturday along with WW1M and we proceeded with the project.

The new antennas are 28 ft long 22 element yagis in a quad yagi configuration. I spent a lot of time working with the first one, making sure we had the resonant point precisely located at a tad above 223 MHz for wet wx performance. When I was satisfied that the antenna was correct, we made three more. I cut some 21 ft long 1/2" LDF phasing lines and phase matched them together. The H frame was made from some 2" extruded

tubing with a 0.125" wall thickness. The mast for the whole affair is 2" high strength steel. The gain seems to be at almost 16 dBd with a half power beamwidth of under 24 degrees for a single antenna. The array gain is near 21.5 dBd.



The winch did a great job in raising the array, but just about when the antenna was half way up the 100 ft tower, the ham shack caught fire and smoke billowed out of the microwave shack!! We never found the source of the smoke. It must have been some piece of electrical equipment. I am sure it will show up when all the bands get turned on for the September Contest!! We bypassed the building and ran the winch directly off the generator with a long extension cable, and had no further problems.



The 222 MHz array is in its final location. It was late in the afternoon. You can see that we tied the 1/2" heliax cables to the braces and connected the power divider only after we had the H frame in place on top of the tower. The two workers shown are W2PED and K1WHS. The braces are quite rugged. I hope they are strong enough to hold things in place during the frequent ice storms that plague this part of the world.

I have enclosed a shot of the brace where it attaches to the boom. The brace material is 3/4" square tubing with 1/8" wall. It is very heavy, at a bit over 7 lbs., being about the same weight as the entire antenna minus the brace. I am hoping that the top yagis supported from the bottom will not buckle under a heavy ice load. I tried hanging some weights from the antenna, and it passed with flying colors, but I did not have any winds in the test!!

So far I have not been able to really try out the antenna as my 20 KW generator is not functioning and is actually removed for the time being. With 50-70 watts, I was able to contact KA2LIM in Western NY quite easily. I do note that I am hearing the 222 MHz W3CCX beacon regularly now on 222 MHz, just like 144 and 432. That is a good sign. Hopefully, when I get the amplifier running on 222 MHz I can give it a workout.

73, Dave, K1WHS - FN43mj



The 222 MHz Bracing system

A x4 Subharmonic Mixer for 24 GHz

Paul Drexler, W2PED

INTRODUCTION

It's often been said that the heart of any transverter is a good local oscillator (LO). If you're building your own transverter to get on one of the bands on 903 MHz or above, you know first hand that the LO is a big part of the trick to getting equipment to work reliably. This seems to be especially true at the higher microwave bands. If you've ever built a transverter from scratch or perhaps in kit form, then you probably realize that the construction of a suitable LO takes the most amount of time. I may have the best noise figure LNA, or gobs of transmit power capability, but if the LO is somehow marginal, or intermittent, then all bets are off in making the QSO! Most of the transverters we use on the lower microwave bands use fundamental mode mixers – that is, the LO signal is at the necessary frequency for the math to work. For the 24 GHz band it seems to be “many dB harder” to generate a fundamental mode LO. For example, if you're using a 144 MHz IF rig, then an LO is needed operating at 24,048 MHz (24192 MHz – 144 MHz). Another approach (as described here) is to use a subharmonic mixer – a mixer that uses a lower frequency LO and then “internally multiplies” within the mixer hardware to get to the desired higher frequency. This has the advantage of making for simpler LO hardware. This is especially helpful in getting on a higher frequency band like 24 GHz. Several local oscillator schemes are shown below.

IF Freq	Fundamental LO	LO / 2 Scheme
144 MHz	24,048 MHz	12,024 MHz
432 MHz	23,760 MHz	11,880 MHz
1296 MHz	22,896 MHz	11,448 MHz



Figure 2 – A Commercial Subharmonic Mixer for Spectrum Analyzer Use

TRADEOFFS

Like anything else in life, this involves tradeoffs. Using a subharmonic mixer means a simpler LO, but somewhat more involved mixer hardware. The biggest tradeoff to using this type of mixer is that they're less efficient – the mixer conversion loss is usually a lot higher. The HP mixer pictured above, for instance, has ~20 dB conversion loss! This is partly because of its broadband operation, but even over narrower bands for amateur use, subharmonic mixers still have more conversion loss than do standard fundamental mixers. Fortunately, most of our work involves narrow band operation, and over narrow operating bands the circuit efficiency can be greatly improved. Published narrowband x2-type subharmonic mixers for 24 GHz have typical conversion loss figures of 8-10 dB. In addition to higher conversion loss, a subharmonic mixer may have more undesired output frequencies and spurious signals due to the internal multiplication process. For commercial applications this can be a real challenge, but for amateur applications this is not usually a problem.

A HIGHER ORDER MIXER

Over the last year or so I set out to design a subharmonic mixer for 24 GHz, that instead of using a x2 scheme, uses a x4 LO scheme. My thought was that this would make a 24 GHz transverter easier to build by requiring only a 6012 MHz LO for the typical 144 MHz IF scheme. I feel it's easier to generate a 6 GHz signal than it is to generate 12 GHz. So a lower frequency LO is a good thing, but here again a x4 subharmonic mixer has several downsides: 1) the design is more complex, and 2) we expect the higher order mixer (x4) would have more conversion loss.

The mixer topology that I used for this design is based on work described in the IEEE literature by Madjar¹ shown below.

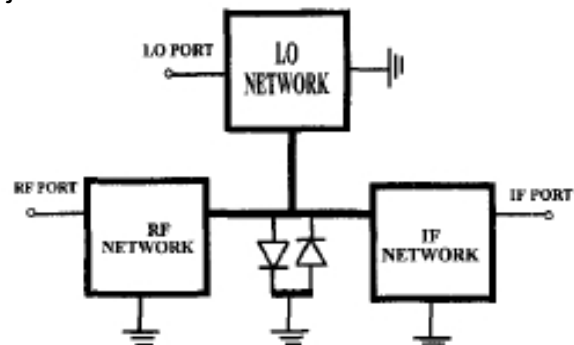


Figure 3 – Subharmonic Mixer Scheme

There are several keys to making the mixer work as a subharmonic mixer. The first is that two diodes are used, placed back-to-back to ground: the so-called “anti-parallel” diode. This allows the mixer diodes to give a frequency response that will work using a lower frequency LO input. The second key involves the filters that are used at the RF, IF, and LO ports of the mixer.

Like most high frequency circuits, the best performance is obtained by keeping all the parasitic inductance and capacitances as low as possible. This implies a very small component. It’s also beneficial to use diodes that are well matched in their DC characteristics. Fortunately, some of the commercial semiconductor manufacturers have recognized the above and have made low cost, high frequency schottky diodes available to the industry. One such anti-parallel diode is the M/A Com MA4E1318, shown below.

MA4E1317, MA4E1318, MA4E1319-1,
MA4E1319-2, MA4E2160

Tyco Electronics

GaAs Flip Chip Schottky Barrier Diodes M/A-COM Products
Rev. V3

Electrical Specifications @ + 25 °C

Parameters and Test Conditions	Symbol	Units	MA4E1317			MA4E1318		
			Min.	Typ.	Max.	Min.	Typ.	Max.
Junction Capacitance at 0V at 1 MHz	C _j	pF	300	300	300	300	300	300
Total Capacitance at 0V at 1 MHz ¹	C _T	pF	330	340	350	330	340	350
Junction Capacitance Difference	ΔC _j	pF				500	500	500
Series Resistance at 110MHz ¹	R _s	Ohms	4	4	4	4	4	4
Forward Voltage at 10mA	V _F	Volts	80	70	80	70	70	80
Forward Voltage Difference at 10mA	ΔV _F	Volts				300	300	300
Reverse Breakdown Voltage at 10µA	V _R	Volts	4.5	7				
VBE Test Point	VP	dB	0.5*			0.5*		

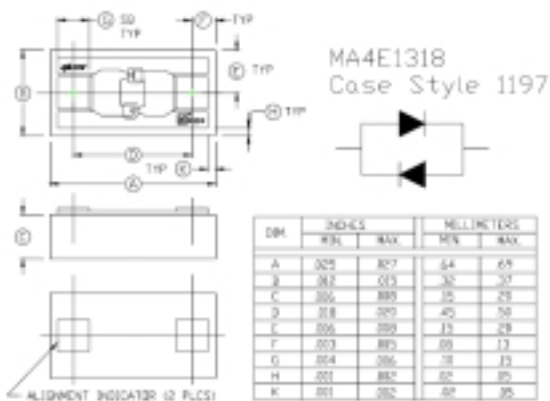


Figure 4-A/B – MA/COM Anti-Parallel Mixer Diode Specification and Package

The good news here is that these diodes are at least offered in tiny surface-mount type packages, so no fancy wire-bonding equipment is required. The bad news is that they’re only 0.026 inches in length... really small! You need a microscope or high-powered magnifier to work with these components. A

conductive epoxy is used to attach the diodes to a small printed circuit board.

MIXER THEORY OF OPERATION

The mixer consists of the anti-parallel diodes, the RF Filter, LO Filter, and IF Filter networks (see above block diagram). The mixer works as both a receiver mixer and a transmit mixer but we’ll refer to it as a receiver mixer to keep things straight. Perhaps the best way to understand the mixer operation is to start at the LO input. An external 6012 MHz LO is fed to the LO input connector. To make the numbers a little easier, we can just think of the LO as a 6 GHz signal.

The LO network is a narrowband filter centered at 6 GHz. It filters the incoming LO energy, but perhaps more importantly, it looks very reflective to all other frequencies. When the incoming LO energy hits the diode pair, LO harmonics are internally generated. The harmonic that is four times the LO input frequency (6 GHz x4) becomes our desired high frequency LO within the mixer. In addition, LO harmonics are generated at x2 and x3. All of these are reflected back towards the mixer to improve the efficiency. The LO network also includes a small microstrip transmission line matching section to match from 50 ohms into the low impedance of the diodes.

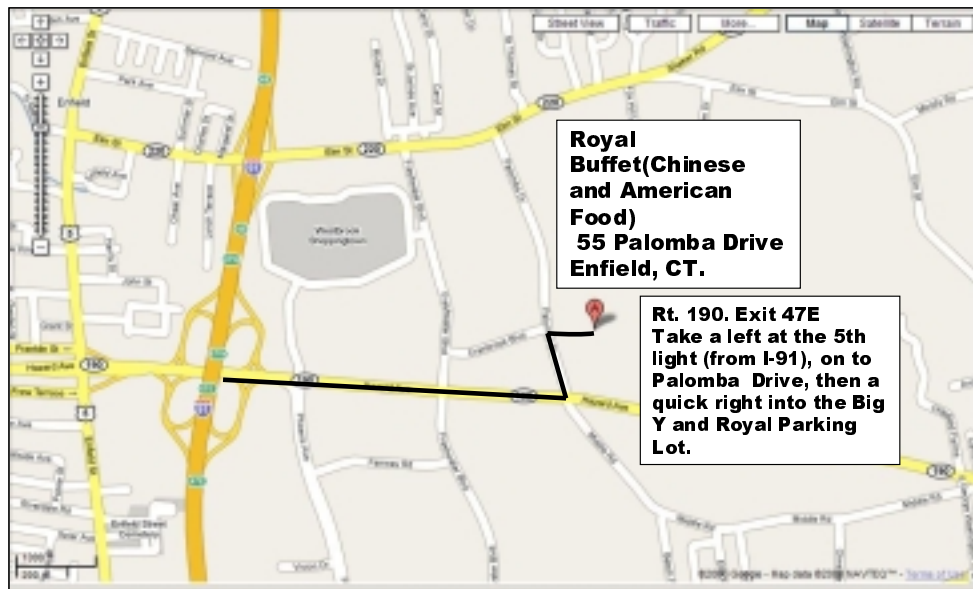
The purpose of the RF network is several-fold. In general, it looks like a low loss, wideband bandpass filter centered at 24 GHz. It provides some degree of out-of-band rejection, but more importantly it keeps the various LO signals from radiating out the RF input of the mixer. It looks reflective to the LO energy which is reflected back towards the diodes. The RF network includes an impedance matching section to improve the energy transfer into the diodes.

Lastly, the IF section of the mixer passes the mixer’s desired IF output energy, and just as in the other portions of the mixer, reflects the LO energy back toward the mixer diodes. This is done using high-Q *idler circuits* consisting of open circuited microstrip transmission lines. Each is resonant at the required frequency and reflects energy back towards the diodes with the correct *phase* signal for low mixer conversion loss.

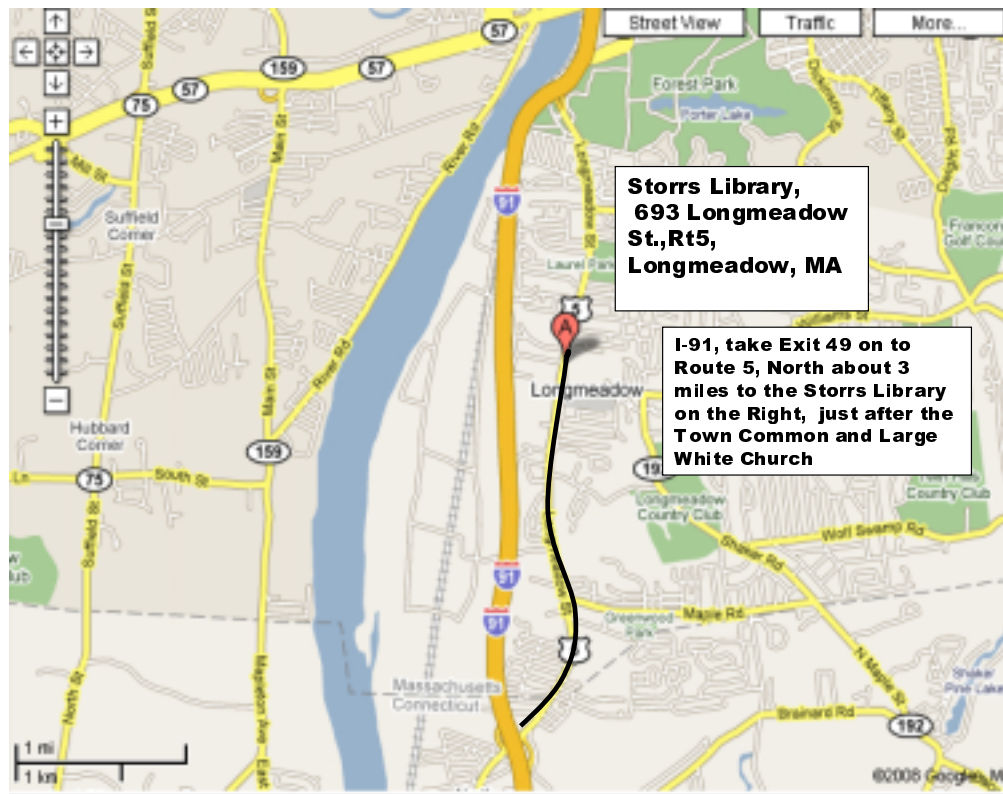
The next installments in this article will go over the design in more detail and present some results from a prototype mixer.

¹ A. Madjar, “A Novel General Approach for the Optimal Design of Microwave Subharmonic Mixers,” IEEE MTT Transactions, Nov 1996.

Directions



Board Meeting and Lunch



Meeting Location

**Second weekend 10 GHz and Above Contest
September 20 and 21, 2008**

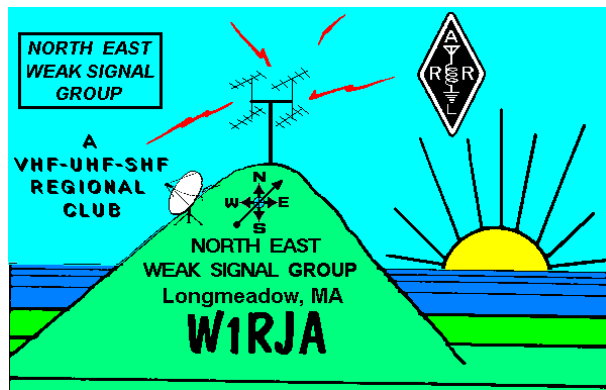
2008 Fall VHF/UHF Sprint

144 MHz Sprint	7 PM to 11 PM local time on Monday September 22, 2008
222 MHz Sprint	7 PM to 11 PM local time on Tuesday September 30, 2008
432 MHz Sprint	7 PM to 11 PM local time on Wednesday October 8, 2008
50 MHz Sprint	starts 2300 UTC Saturday, October 18, 2008 ends 0300 UTC Sunday, October 19, 2008
Microwave Sprint (902 MHz and above)	6 AM to 12 PM local time on Saturday October 25, 2008

**N.E.W.S Hats will be available at the next meeting !
\$12 each - cash (bring some singles please) or
check. See Mark, KA1OJ**

**Mid-Atlantic States VHF Conference 2008
Saturday September 27, 2008
Sponsored by Mt Airy VHF Radio Club
More information at www.packrat.com**

**HAMARAMA
37th Annual Pack Rat Flea Market
Sunday September 28, 2008
Rain or Shine
Gates Open: Buyers at 0700 Sellers at 0600
Middletown Grange Fair Grounds
Penns Park Road, Wrightstown, PA
Food, Beverages & Facilities on Site
No Overnight Parking**



N.E.W.S. Group Membership Application

Name: _____ Callsign: _____ Grid: _____

Street: _____

City: _____ State: _____ Zip: _____

Phone (home) _____ - _____ - _____ Optional (work) _____ - _____ - _____

Email _____

ARRL member? Y N

Electronic Newsletter Delivery? Y N

Operational Bands (circle) 50 MHz 144 MHz 222 MHz 432 MHz 903 MHz

1.2 GHz 2.3 GHz 3.4 GHz 5.6 GHz 10 GHz 24 GHz 47 GHz

76 GHz Light Other (list)

The North East Weak Signal [N.E.W.S.] Group is being established to form a comradery among fellow VHF-UHF-SHF enthusiasts, and support a convenient means to exchange technical information. We currently have 6 meetings per year, held at a centrally located facility, and provide a "NEWSLETTER" that is distributed 2 weeks prior to each meeting. Any contributions to this publication are appreciated and can be sent to: Don Twombly, W1FKF 23 Maura Dr. Woburn, MA 01801 Email: donw1fkf-news (at) yahoo (dot) com. Dues are \$15/year. Remember, this group is formed by VHF'ers for VHF'ers.

Mail to:

North East Weak Signal Group
 c/o WA1MBA
 Tom Williams
 PO Box 28
 Shutesbury, MA 01072



Email: tomw (at) wa1mba (dot) org

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Next Meeting
September 27, 2008
W1RIL - 500 Watt 2M Amp
1 PM at the Storrs Library
693 Longmeadow Street, RT 5
Longmeadow, MA

Don't Forget
The North East Weak Signal Group
2 Meter VHF and Above Net
Every Thursday at 8:30 PM Local 144.250
W1COT, WZ1V or K1PXE Net Control

North East Weak Signal Group

c/o WA1MBA
Tom Williams
PO Box 28
Shutesbury, MA 01072



Check your membership expiration
date on your mailing label!