



SAN BERNARDINO MICROWAVE SOCIETY, Incorporated

FOUNDED IN 1955

A NON-PROFIT AMATEUR TECHNICAL ORGANIZATION DEDICATED
TO THE ADVANCEMENT OF COMMUNICATIONS ABOVE 1000 MC.

W6IFE Newsletter December 2008 Edition

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At the **6 December 2008 SBMS** meeting the "Tech Talk" will be about IF Radios by Frank, WB6CWN. The SBMS meets at the American Legion Hall 1024 Main Street (south of the 91 freeway) in Corona, CA at 1900 hours local time on the first Thursday of each month. Check out the SBMS web site at <http://www.ham-radio.com/sbms/>.

REMINDER- NO PARKING IN THE CHURCH LOT

NOTE the January 2009 meeting will be on the second Thursday 8 January.

Fellow SBMS'ers, it's that time again! The **6th Annual SBMS Christmas Party** will be held again this year at the QTH of Dennis, W6DQ. So mark this date on your calendar: Saturday 13 December 2008, 12:00 Noon to whenever. As always, this will be a potluck affair, so get your favorite dish ready to go! We will have a gift exchange as always - you bring one, you get one - one set for the fellows and one set for the gals. Just the way to get rid of that thing-a-ma-jig you got at the swap meet two years ago, guys, and still can't figure out what to do with. Let me know what you plan on bringing for the potluck -- I will publish a list as it gets updated.

You can find Dennis' QTH at 1497 Marelen Drive, Fullerton, CA 92835 otherwise known as DM13av.

How about a swap meet, too? Bring your goodies and buy-sell-trade! We'll monitor 445.500 N6EX/R for talk-ins or you can always call me at 562-858-2883. Hope to see you all here! 73, -dennis W6DQ

Last meeting-Thanks to Robin, WA6CDR and Doug, K6JEY for providing a source of Rubidium Oscillators Standards and power supplies. Doug, K6JEY and Pat, N6mjn are looking at the Cerritos Hilton Hotel again for our MUD 2010, but are concerned over the new construction there deleting the antenna range. Dick brought up the question of needing a second person on the check book "just in case". Jeff Fort is to be added. Thanks to Miguel, W6YLZ for being the "US ambassador" to help get the Mexico "FCC" to reevaluate how it does business and improve the number of both Mexican hams and support foreign licenses/ permits. Miguel went to the tiawanna Mexico conventions and did a wonderful job. We need to get more loaner rigs, beacons, travelers (mentors) with the

San Diego Microwave Group, SBMS and Northern CAL groups working together to support the efforts. . 20 people present.

35 th EASTERN VHF UHF CONFERENCE APRIL 17, 18 & 19, 2009 ENFIELD, CT.
SPEAKERS AND PROCEEDINGS ARTICLES ARE NEEDED. FURTHER INFO TO FOLLOW.
BRUCE N2LIV CONFERENCE CHAIRMAN & PROCEEDINGS EDITOR

If you would like to move from USPS mailing of the newsletter to an email version, please let Bill WA6QYR know at bburns@ridgenet.net.

Activity reported at the November SBMS meeting: Dick, WB6DNX has a clean shop and working Rubidium Standard in box; Walter made some mandrels for making round to rectangular wave guide; Bill, WA6QYR went to MUD08, had a computer virus and got the BD program to work on his Palm Handheld for quick field directions and distance between grid squares; Ed, W6OYJ reported on San Diego efforts and meetings; Michelle, W5NYV went to MUD and had fun; Paul KB5MU also went to MUD; Charles K6PIP had a computer crash and experimented with lens reading compass, ephemeris and pointing to within a degree; Chris N3IW was our visitor; Gary W6KVC talked about 12v microwave ovens; Ed WF6DX has a new dish; Chris, N9RIN had a large number of LNB for sale along with conversion documentation, and has a new 3456 board in the works; Don, KF5QWC has new radio robots with TV cameras; Dick, K6HIJ gave a talk at MUD; Joonho, KG6MQS built a beacon with Qualcomm stuff, n LO brick on 10224 MHz and some 10 GHz amps with gold board parts; Larry, K6HLH went to MUD and the 10 GHz rig is working again; Jeff, KN6VR went to Utah; John KJ6HZ built a SDR Kit on Ebay \$20-40 soft66 SDR 40 meter receiver (<http://ZAO.JP/radio>) and worked 1296 EME with Doug 7 contacts. Several ATV reports KE6BXT, N6ESW, K6UQH, and K6ORG.

Wants and Gots for sale. Want drawings, plans, and dimensions for a 10 GHz Omni antenna Chris N9RIN 949-388-3121 cshoaff@yahoo.com

LNB-LNA Hello All, I brought a KU Band LNB to the last SBMS meeting. I went over to Doug's (K6JEY) place and put it on his noise figure meter. I had also made a second just to make a comparison. Well the LNB I brought to the meeting was fair. The gain is about 17dB with a noise figure of 1.15dB. Not bad since it had been hacked up to try to get it to work. The second one I did was much better. The gain is about 24dB and the noise figure is 0.73dB. I think I have found the new LNA for my rig. :-) Of course, not every LNB will be able to have this good of specs but it kind of gives a range to expect. Anywhere from $G=15\text{dB}$ and $NF=2\text{dB}$ at the worst (as a guess, it can be worse if you try) to $G=24\text{dB}$ and $NF=0.73\text{dB}$ at the best. Anyway, the LNB's are \$4 each and I have made a "this is how I did it manual". As of today, all of the LNB's have been sold. It did not take long for 110 units do go. Chris n9rin
Thank you all for your interest. There should be a lot rigs with a really good noise figure for the next contest.73's,



Circular to rectangular waveguide transitions

Hi Walt, I have been using an aluminum mandrel for several years and have made dozens of transitions. Make the transition about 5/8" long for best results. Chuck WA6EXV

On Fri, 24 Oct 2008 06:00:16 -0700 Walter Clark <walterClark@roadrunner.com> writes:

Gentlemen: I've been playing around with circular polarization and finding myself in need of many round to WR-90 transitions. Just butting a round next to a WR90 flange works but there's reflections and the experiments I want to play with might be confused by reflections. By the way I have an E-H tuner and it completely removes reflections from imperfect transitions, but I only have the one.

Would hard wood mandrel work? Would aluminum work? Which end do you pound into the copper tube? I've seen some of your transitions, at the Tune Up and they look really great. Walt

>So here's a little more information...

I'm using WR-22 waveguide components (tentatively) and a PCOM 1 foot 38GHz dish. I don't have the measurement at hand (will measure tonight after work) but I believe the diameter of the feed waveguide is somewhere around 0.250 inches maybe just smaller. I (and others) have used this antenna in the past on 47 GHz with good results. The feed is kind of a Cassegrain style in that it has a round waveguide feeding a shaped sub-reflector. According to this site: http://www.quinstar.com/appendices_a_thru_n.pdf 0.181 inches is correct for 47 GHz. So I may end up using pieces of tubing to reduce the diameter of the feed. I really do need to get decent return loss on this as I don't want to burn out what will be driving it during transmit.

Yet another option is to start out with round waveguide and not worry about the transition. It does simplify the waveguide switch construction, though I wonder how difficult it would be to get a really nice curved section machined into the rotor... The main problem though is testability, as I don't have access to any known good round waveguide transitions.

So for now, lets say I'm using 0.181 diameter round waveguide and WR-22rectangular.

-Tony

Tony-

was there a specific circular diameter that you were aiming for? The reason I'm asking is there is a simple way to go: just taper by squeezing a section of round copper hobby tubing down until it is the same size as WR-22 and then just butt that up against the rectangular guide. I have even gone so far as to butt the raw circular section (without taper) up to the rectangular guide so long as the circular guide is no larger than the wide dimension of the rectangular guide. I did this for 241GHz and HFSS showed little upset in the SWR of the transition.

The ideal would be to make a slow taper over many wavelengths (say 5cm @ 47GHz). But for single frequency amateur operations, you can get by with far less than that. Remember that if the circular guide is very long, you can get polarity twist and not get the same "sense" out of one end that you put in. But a short section (say a few cm) shouldn't be too much of an issue. It's really only an issue if you run say >10m of copper water pipe up your tower for 10GHz! :-) -Brian, WA1ZMS/4

Does anyone have any references or design hints on how to build a rectangular to round waveguide transition? (This is for 47 GHz) -Tony KC6QHP <tony@wavelen.com>:

On Tue, 2008-11-04 at 07:25 +1000, D&R Friend wrote:

Giddy Tony. If it's any help, I have two nice commercially made (Hughes) ones that I purchased on the surplus market several years ago. I have them ready to use with my (two) recently completed 47 GHz transverters.

With a local friend who is also interested in amateur engineering, I have been closely examining them in order to imagine how they were made. It is a puzzle to both of us because the long dimension of the WR22 'hole' is greater than the diameter of the circular waveguide hole whilst, in the E-plane, the circular 'hole' is wider than the narrow dimension of WR22.

There are no apparent outer seams indicating that they were made in two pieces, but looking at the ends there is an annular line of demarcation around each waveguide 'hole', indicating two 'qualities' of brass. It seems from this that there is an inserted inner section in which all the clever machining has been done. It is not possible to say whether the inserted section comes in one or two pieces, but our guess is that this evidence is the 'key' to the way it was made. An alternative possibility is some sort of high quality investment casting process for the inserted section, but that's only conjecture. As with all Hughes stuff, they are immaculately finished, covering much of the

manufacturing trail. This looks to my friend and me like a machining impossibility so I guess that is why you are posing the question to us all.... if I can be of any further help from a distance (pics, etc.) please feel free to get back to me. 73, Doug Friend, VK4OE, Brisbane, Australia.

Just start with a round tube. Squeeze the end in a vice with parallel jaws until its 0.112" high inside. The sides will be rounded, but squeeze at right angles to the first squeeze (preferably holding that 0.112 dimension) until the inside width is 0.224 or thereabouts. The tubing will take the shape of the needed taper. 73, Jerry, K0CQ

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-Brian, WA1ZMS/4

Thanks especially to Chuck Smallhouse for his advice on making round to WR-90 transitions. Here's a trick that might be new to him. Heat the copper with a torch, then when it is as hot as it can get plunge it into water. I don't know if it is the heating or the fast cooling, but afterward it is so soft I'm sure a wood mandrel will work. In fact you have to be careful when you trim the WR-90 end down that you don't distort it. Before learning that trick from one of the guys at work, it was so hard, the mandrel would get stuck and I had to invent a tool to pound it out the other way. It now comes out with one hand and a slam against the bench.

Here's some more tips...

- Heat the copper over a distance of two inches. If you heat-process just the end, only the end will deform.
- My mandrel was from a .4" thick piece of aluminum and only the .9" wide dimension was narrowed.
- The small end goes into the WR-90 end.
- Alternate between pounding the mandrel in, and using a vice to flatten the oval on the sides.
- Use tapered metal inserts in the jaws of the vice for a perfect transition.

Walter

Frequency stability

Subject: [Mw] uW Hill Topping with the "Brick Osc"???

Hello to All,

I keep getting questions about taking the brick oscillators that are used in most uW systems out to the hilltops to make portable contacts with.... My (1) first question is to "ONLY" the ops that have done this - is the brick osc. Really that stable out in the open elements vs. lets say just a self contained DB6NT transverter? (2) Is there any simple way to come up with a DC to DC converter that takes 12 v DC in for -20 v DC at 1 ampere output?

I personally wouldn't want to do this myself but with all the questions that I have been asked and after just attending the uW Update last month I really didn't get much answers on this problem. I have been trying to keep as much of my equipment at 12 v DC that I can just for the reason of going Rover in> (the spelling of the last word was done just for ND2X sake) myself. My very first uW Rover in was on the way up to MUD and put several grids (7) on the map on 5.7 Gig's and (1) grid on 10 Gig's. Of course all the really good sma relays and amplifiers that we scrounge are in the 24 to 28 v DC range.

Thanks for the bandwidth and hope to hear from those who are actually using the brick osc's out there on the hilltops. 73, Dave - KB0PE

>>

First, a couple of my stations are set up with microwave bricks. 12V is nice when you can. I tend to KISS. Simple, and least complexity. Less stuff to break and go wrong. So, DC-to-DC converters are out. 2 x 12V batteries and a zener or regulator, dropping resistor. OK, it is only good for so many minutes. There are some nice small ones out

there. Lighter weight. Less stuff to go wrong. Easy to find batteries. Better, is the LiPo batteries used for RC. Beware, very expensive, but nice. For environmental stabilization, some Styrofoam, something. 28V relays. Again the 3-x 9V battery solution works. Simple, easy, quick. Dead batteries, fairly easy to find more. Not some hen's teeth. Second, weight and convenience. Third, ease of use. Reliability and gasp, cost. 73, Lloyd NE8I

Hello to All, I keep getting questions about taking the brick oscillators that are used in most uW systems out to the hilltops to make portable contacts with.... My (1) first question is to "ONLY" the ops that have done this - is the brick osc. Really that stable out in the open elements vs. lets say just a self contained DB6NT transverter? (2) Is there any simple way to come up with a DC to Dc converter that takes 12 v DC in for -20 v DC at 1-ampere output? I personally wouldn't want to do this myself but with all the questions that I have been asked and after just attending the uW Update last month I really didn't get much answers on this problem. I have been trying to keep as much of my equipment at 12 v DC that I can just for the reason of going Rover in (the spelling of the last word was done just for ND2X sake) myself. My very first uW Rover in was on the way up to MUD and put several grids (7) on the map on 5.7 Gig's and (1) grid on 10 Gig's. Of course all the really good sma relays and amplifiers that we scrounge are in the 24 to 28-v DC range. Thanks for the bandwidth and hope to hear from those who are actually using the brick osc's out there on the hilltops. 73, Dave - KB0PE

Donn, I have to disagree with you on your requirements for 10 GHZ stability. Here in Arizona most of our contacts are over long distances (150++ miles) and using unreliable or inaccurate azimuth pointing. No beacons or other close stations are available. Also, at this time, a big gun is a 5W station with a 2' to 3' dish. Most are 100 mw to 1W, before the line loss, to an 18" dish.

The frequency stability and accuracy of both the (older) DB6NT and DEMI transverters is not acceptable for these random and even scheduled QSOs. I have resorted to augmenting both brands by using JWM phase lock systems that use either GPSDOs, or very stable and accurate OCXOs (10MHz). Previously I had to repeat ably verify my TX frequency with a very accurate Systron Donner portable counter, running off an DC to AC converter.

I think that now both of the manufactures have phase lock options available for their 10 GHz transverters. There may be some question or confusion about the potential phase noise, resulting from their implementation techniques, but in practical terrestrial ham communications, it doesn't appear to be a problem.

During this last 10 GHz & Up Test, I worked another AZ station who was using a DB6NT transverter with the new phase lock circuitry, and I was using one of my described 10GHz phase locked transverters. Both of us were using FT-817s as 2 M IF's. Because of the lack of other activity at the time, we were able to carry on a SSB QSO for well over a half hour. He was exactly on the frequency that we scheduled and I never had to touch the 817's tuning dial during the entire duration of the QSO!

This type of frequency accuracy and stability now eliminates one of the unknowns in microwave weak signal acquisition. Now you can really concentrate on your antenna pointing and this also allows you to utilize a larger one with a narrower beam width and more gain. This also is an advantage during potential rain scatter or 'Boeing Bounce' type of contacts. You don't have to be continuously tuning around, while awaiting for an event to happen. Chuck, W7CS

At 09:33 AM 11/7/2008, Donn Baker - WA2VOI/0 wrote:

Hi Dave, Your first question is really two.... "Bricks," and DB6NT and/or DEMI transverters.

Transverters first. The answer to the general question is, yes. Otherwise there wouldn't be a lot of 10GHz activity as no one would every find the other station.

First thing you have to realize is that you will NOT see 40m frequency accuracy or stability. You can't turn the system on and expect to have the dial read the frequency correctly to 1 Hz! It will NOT happen. You WILL have to tune to find the other station. Once you get over the ideas that the "dial is right," and that "the other guy is on frequency" it's allot easier. Well, realistic, anyway.

In the MN, most of our activity is portable... I think we have only 3 fixed stations on 10GHz in the area, so even when operation from k "home," it's with portable equipment on the back porch or in the driveway. With both DB6NT and DEM I transverters, there is no problem with the stability of the LOs. They DO drift, but it's manageable. None of us are phase-locked (up to now... that's changing).

The drift is controlled by 1) leaving the transverter ON the entire time we're operating. I mention this 'cause many of us do the high-speed Rover thing... moving every 30minutes or so. We don't turn thing off between operating and the Los are usually within 5 KHz or so from stop to stop. In

some cases, the drift DURING OPERATION is more than the drift between stops. (Operation drift seems to be due to the unit heating up during transmit periods. The 2 watt amplifier is close to the LO in the DEMI transverters. If there isn't a XTAL heater in the unit, they will drift with the added heat.)

You should have a marker of some sort that you can take with you. An easy one is a 64MHz computer oscillator driving a MMIC, which drives an Schottkey diode multiplier. The one I have is mounted in a tight Styrofoam enclosure. Battery operated. Runs for the duration of the operating session. Once it warms up (about 15 minutes) its stable, and it returns to the same frequency time after time. 10.368.345 +/- 3 to 5 KHz. This is more than adequate to allow me to determine where I am. (My system currently has an offset of about +245KHz. That is, 10.368.100 reads 144.345 on the FT817 i.f. radio. Using the marker, I tune to 144.590 +/- 3 to 5 KHz, and it tells me things are working OK.) Get in the habit of tuning 30 to 50 KHz from where you THINK you are and where you THINK the other station is. You'll find'em unless you're working with S0 signals.

Many of the bricks I've seen (and have) have a failed XTAL heater in them, in that the heater NEVER turns off. This means the XTAL isn't stabilized as you think it would be. The result is that they drift all the time. (There was areas on they were taken out of service and dumped on the junk market!) As was mentioned, disabling the heater circuit will "fix" some of them. Repairing the circuit works, too.

In either case, leaving the brick in the open air is not a good idea. You need to protect it from both wind and sunlight. (This is true of transverters, too.) The heat gain from being in direct sunlight for a while will cause the unit (brick or transverter) to drift a bit. Likewise, a sudden gust of wind will cool the stuff down and cause a drift. We found that even a simple plastic bag over things solves the wind problem (usually) and a piece of cardboard to provide shade solves the sun issue. Generally, you don't have both at the same time.

Good luck. Hope to work you and the other guys in ST. Louis next summer on rain scatter.73 DonnWA2VOI/0 scrounge are in the 24 to 28 v DC range.

Circuit analysis software

Can anyone recommend a good piece of software for designing microwave amplifiers?? There seem to be quite a few different types of EM simulation software out there, and was hoping for some recommendations from those who have used the different packages. I am looking for something similar to "microwave office", but that a poor college student can afford. I've done some searching and it seems for most software as though you have the option of a student version (which is usually free), but severely limits the number of nodes, etc. Or else you get a full version of the software, but only for a month or so, which is barely enough time to learn how to use it to it's fullest. So here are some of the criteria I'm looking for:

- 1.) Cheap (less than \$100) or free
- 2.) Not severely limited by the number of nodes, etc.
- 3.) Not limited by a short trial period
- 4.) User friendly
- 5.) No steep learning curve
- 6.) Good documentation on how to use it

I will be using this software for a microwave amplifier design class I'm taking in the spring and would like to get familiar with it before then. Thanks for your time, Vince - N9VN

Vince,

I suggest that you look at: <http://www.ansoft.com/ansoftdesignersv/>

Capabilities

Analysis

- a. Linear Circuit Simulation including S, Y and Z parameters and VSWR, insertion/return loss, gain, stability, noise figure and group delay
- b. Filter Synthesis
- c. Transmission Line Synthesis
- d. Planar Electromagnetics including Near and Far Field Radiation

Features

- a. Easy-to-use Graphical User Interface (GUI)
- b. Fully integrated schematic and layout editors
- c.. Component library developer and manager
- d. Vendor component models

- e. 3D post-processing and results viewer
- f. S-parameter import
- g. Smith tool
- h. Upward compatibility with Ansoft Designer

I have used it in the past. It looks like they have crippled it even more though. It has no active component libraries. It will only do linear simulation. You can simulate a linear amp if you load in the S-parameter taken at the correct bias point no DC Bias analysis. It is free.

Another choice is PUFF 2.1: <http://www.its.caltech.edu/~mmic/puff.html>. It runs under DOS (will run in Windows under DOS box PC emulator) is super simple to use. A very simple linear simulator the will output a layout to a PCL printer (may be hard to find now). I used it in the mid-1990. A copy with manual is very cheap.

Another possibility is QUCS: <http://qucs.sourceforge.net/road.html>. It looks promising and I think it is exactly what you are looking for if the developers ever. Finish it claims to have several simulation options including S-parameters but not harmonic balance. I have no experience using it. It is free and open source.

LT Spice is another idea: <http://www.linear.com/designtools/software/>. It is very powerful simulator with no specific limitations that I know of. There is an active Yahoo group that supports it. It is basically an enhanced Spice3simulator but no specific RF capabilities. No harmonic balance. No S-parameter linear simulator. Although I think there are tricks to extracts-parameters for a Spice simulation. I have used this tool several times in the past few years and it is really good for what it does.

I don't know of any free or cheap harmonic-balance non-linear RF simulator currently available. Good Luck. Eric Haskell KC4YOE

2009 Southeastern VHF Society Annual Award for Design Achievement

The SVHFS is pleased to announce the continuance of its "Design competition for the advancement in circuit design of VHF through Microwave and related circuitry". This competition commonly know as the SVHFS Design Contest will take place again culminating with final judging at this years conference in Charlotte, NC on April 25th.

In the past, this competition has brought about many great designs for the VHF/UHF/Microwave amateur community. This year we hope to keep the tradition by again attempting to attract designers from outside of the Southeast region of the United States. Rules for the contest are simple and can be reviewed in the Design Contest Pages on the www.svhfs.org or the www.downeastmicrowave.comweb sites.

In general, the designs should be "Hardware Oriented" and pertain to VHF, UHF, and Microwave operation. The designs will be exclusive to the SVHFS conference. You will be required to meet deadline dates to the committee, publish a technical paper in the conference proceedings and make a presentation of your technical paper at the conference. But most important, your design will be critiqued and judged by the Design Contest panel before and during the conference.

We anticipate this years awards will be in line with the 2008 contest. First place being \$2500 in value, second place being \$1000 in value. Third place and forth place are \$300 and \$200 in value. A list of last years winners and designs can be found on the web sites but for detailed reading you will need to pick up a copy of the 2008 proceedings to examine all six designs that were entered.

After reviewing the rules and judging criteria, if you decide this is something you wish to participate in, please drop me an e-mail atdesign@downeastmicrowave.com. I can answer your questions, provide advice, and receive your official notice of entry now or later in the year. So for now, get your designs drawn on your brown paper bags and your breadboards built! (My! That is old school isn't it!) Do whatever it takes to get that circuit working and enter the contest!

Thanks for reading!

Steve, N2CEI

THE BIG DISH (1 meter Prodelin)

by Jeff KN6VR

THIS THING IS BIG AND RATHER HEAVY. IT SEEMS TO WORK OK BUT IT IS NOT A GOOD BEGINNER OR ROVER DISH. IT IS HARDER TO POINT BUT IT ISN'T TOO BAD. THE REAL PROBLEM IS THE HEIGHT AND BALANCE. The first version of my mount had the dish out front and much lower but the unbalance was extreme. Probably would have needed a car battery along with the IF radio to balance it. The almost final version here tonight has a bit of adjustability built in. The rows of holes allow mounting near the center of balance. The next changes are a waveguide t/r switch and remounting everything further back except the LNA and pwr amp. Then I can just select another set of holes to balance everything.

W1GHZ SOFTWARE

Ver hd1_3b4

MEASURE / CHARACTERIZE DISH

INPUT HEIGHT, WIDTH, DEPTH AND MANY POINTS ETC

OUTPUT is f/d, LOCATION OF FOCUS, GAIN

DESIGN W2IMU FEED – INPUT f/d and FREQUENCY

OUTPUT is ANGLE OF TAPERED
SECTION, LENGTH AND DIAMETER OF
OUTPUT SECTION

This design assumes a circular waveguide input section, .811 ID for the HOME DEPOT waveguide with a tapered transition. A step .350 long also works – another subject.

TOOLS -- safety glasses

BRAIN – PLAN AHEAD TO USE WHAT YOU HAVE

FOR LAYOUT - TAPE MEASURE / RULER

SQUARE / PROTRACTOR
I USE IT THE MOST

CALIPERS - PLASTIC ARE OK FOR
LOTS OF THINGS

VERNIER CALIPERS - ALMOST AS
GOOD AS A MICROMETER +
LONGER

SCRIBE

CENTER PUNCH

FOR BUILDING - CENTER DRILL, SINGLE FLUTE
COUNTERSINK

POWER TOOLS - I HAVE SEVERAL DRILL MOTORS,
BATTERY AND 115V

ALL THIS CAN BE DONE WITH HAND
TOOLS EXCEPT BAND SAW

DRILL PRESS
TABLE SAW
CHOP SAW
BAND SAW
BELT/DISC SANDER



Joonho and Chris talk about the LNAs that Chris was selling for \$4 each. The San Bernardino Microwave Society is a technical amateur radio club affiliated with the ARRL having a membership of over 90 amateurs from Hawaii and Alaska to the east coast and beyond. Dues are \$15 per year, which includes a badge and monthly newsletter. Your mail label indicates your call followed by when your dues are due. Dues can be sent to the treasurer as listed under the banner on the front page. If you have material you would like in the newsletter please send it to Bill WA6QYR at 247 Rebel Road Ridgecrest, CA 93555, bburns@ridgecrest.ca.us, or phone 760-375-8566. The newsletter is generated about the 15th of the month and put into the mail at least the week prior to the meeting. This is your

newsletter. SBMS Newsletter material can be copied as long as SBMS is identified as source.

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93555
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