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

June 2006 Edition

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At the **1 June 2006** meeting, - 24 GHz rig progress. Members share their 24 GHz rigs and I've a tech talk on details of construction and challenges. 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 UNTIL CLAIRIFICATION IS MADE.

Last meeting-Dick, K6HIJ gave a great talk on noise figure some theory and practical sides of the topic. Thanks Dick. Welcome to new member Lawrence Leslie WB6NPF of San Bernardino. The membership voted to purchase liability insurance for a year at $495. Send your 2 GHz and up logs to Larry KG6EG at KG6EG@arrl.net. Several members went to OVRO for a 1296 MHz EME event- KI6DVR, KH6HZ, WA6NIA, K6JEY, WA6EXV, and WA6JBD. There was talk of building an 8 GHz receiver to monitor spacecraft at OVRO. The Society voted to send copies of the 2005 MUD to Central States convention as prizes. Chris, N9RIN thanked past officers for good work. Frank, WB6CWN was awarded a Senior Member plaque and Dave, WA6CGR was awarded an "All time service merit award".Dave, WA6CGR did Noise Figure Measurements at the end of the meeting. 25 people present.

President Dennis presenting Dave, WA6CGR his award.


Dave, WA6CGR doing NF measurements.

"**Wants and Gots for sale.**
Want- YO Yagi Optimization I would like to check a 3 element design. Dick Kolbly K6HIJ 760-253-2977
Want Kenwood 1296 xcvr like TM 531 Fred Bongard W6JLL 310-971-0815.
For Sale Astron 70 amp power supply with meters. Great shape. Good to power your whole shack of radios and amps. $175. Very heavy, 48 lbs. Prefer pick up. Whistler 1000watt 1200-watt peak mobile power inverter. New old stuff, still in the box, Great for Rovers who need AC power for rotors, laptops etc. $100. Ameritron's AL-811 Amplifier, 600 watts on HF. Little use. $425.00 Kenwood TM 631A 2-meter 222Mhz mobile radio. With duplexer. $350. Dave, N6TEB 562 644 3943

Scheduling.
July- Directional coupler design and use.
How about a field trip to Cal Tech to their receiver lab? We have been invited. Tune up party
Aug. Get ready session for 10GHz and up contest

Activity reported at the 4 May meeting- Chuck, WA6EXV via phone, Working on the OVRO 1296 amp that is marginally stable; Mel, WA6JBD working on Cactus radios; John, KJ6HZ looking for tech talks; Dick, WB6DNX working on 10 MHz oscillator; Bill, WA6QYR worked WA6EXV in the contest backyard to backyard; Doug, K6JEY worked on his 2.3 GHz rig, had 20 QSLs on 10 GHz, digital JD65 EME work; Howard WA6YGB did some 902 MHz work; Fred, W6JLL was busy at the lab; Larry, KG6EG had 16 calls and 42 QSL on 10 GHz and reworking his rig; Ken, W6DTAworked the 2 GHz contest and will be on Potosi in June; Jerry, K6DYD bought a new/old rover rig; ReinPA0ZN working on digital modes and amateur GPS projects; Pat, N6RMJ has his 24 GHz PLL working; Chip, N6CA working on Frazier beacon again, ready to work Paul in Hawaii; Bob, WA6VHS experimenting with mounting 47 GHz diodes, says digital mode needs better GPS than pyrojoe model, has a 3 solution GPS indicator on his web site; Jerry N7EME lots of work on 10 MHz stability testing; Jeff KN6VR 1296 MHz power divider work; Rich, KG6JKJhad 25 QSOs on 10 GHz; Don, KF6QWC working on a robot board RF; Chris, N9RIN, has a transverter board for 1.2 to 5 GHz work; Dick, K6HIJ made a drawing of a DSN filter, worked on N6RMJ waveguide switch, has some new old dishes, did the noise figure talk; Mike, W6YLZ had 16 calls and 21 QSOs, was portable in Spain with a EA call; Larry, K6HLH worked on a 4 way power divider for 1296 MHz and had a MEMSI inclinometer that worked neat; Dave, WA6CGR had 18 QSO at the lab on 2/5/10 GHz, has a Wind Generator company Superior Wind Gen Company; via ATV Art KC6UQH had one contact in the contest, KA6DPS showed his 2 GHz rig; KE6JUV had an HT to show.

Email stuff
Chip has posted K6SE's DBG--Distance, Bearing and Grid program on the SBMS website for downloading.
Go to: http://www.ham-radio.com/sbms/ You can also download W9IP and N1BWT's venerable BD bearing and distance program from the same location. See you on the air, Frank WB6CWN

NW1B wrote: Gentlemen, Just to remind the group that I have one and two ft parabolic antennas.
I can supply any Ham band from 2 ~ 24 GHz. Antennas come with reflector, feed and interface. Radome also available. Other items such as Flex WG in WR42 and WR90 Contact me off list at nw1b@comcast.net <mailto:nw1b@comcast.net> 73 Troy NW1B
Troy's are very nice! I recently saw his 2' dishes at the Southeastern VHF Conference. One with 10 GHz feed, the

other with 24 GHz. My crude 24 GHz system uses two of Troy's 1' dishes. One for TX, the other for RX. This setup made an initial 112-mile contact while running less than 10 mw. Dex, W4DEX

In response to this thread, we created a calculator-worksheet, which addresses the coax cutoff frequency issue. Check http://www.vhfsouth.org/tutorials/coax-CO.htm Note that the dimensions of the coaxial cable can be found on the internet if one searches hard enough; I don't have any URLs for you, but if someone can come up with a good list of sites which show requisite coax parameters, it would be worth posting to this reflector! Meanwhile, hope the worksheet helps. Best regards, ND2X/5

Jupiter GPS emails off MW site.
Just out of curiosity does anyone else besides me have a construction project going to put a Jupiter GPS Receiver board into service to lock their 10 MHz oscillator? Loren Moline WA7SKT

Yes, I do. I have to get a GPS unit working first, and then I'll try the phase locking. I haven't had much time to work on it since I posted my problems with the GPS units a while back.
I do have a question - there have been attempts to phase-lock 10 MHz oscillators with the 1 pps output of the GPS engine. The engines I have are supposed to put out 10 kHz as well. Wouldn't it be better to try to phase-lock the 10 MHz oscillator to the 10 kHz signal?
73, Zack W9SZ

FYI, there are interface boards available from N1iJEZ (locks onto 10khz output from the Jupiter GPS engine) and lock indicator designs/parts from W1AUV. The latter provides a data stream from the NMEA info output from the GPS engine, which can either be decoded on a PC or by a PIC.
I have these assembled & working, and a 2-page note on the project, which I will gladly forward, off-list.
Thanks are due to members of the San Diego Microwave Group who have sponsored this project.
Rod Adkins WI6M

I've bread boarded a Jupiter-T (TU60-D120-041 new from a Navman dealer in 2004) using the 10 KHz output to lock an Oscillatek 10 MHz TCXO modified to allow a separate external voltage control to the vari-cap without disturbing the TC aspects of the oscillator. I made a synchronous TTL divide by 1000 counter (to minimize phase noise) into a type II phase lock (also TTL to minimize phase noise and 10 KHz noise). The antenna is an Ebay purchased NAIS (Matsushita) VIC-100 for timing application (the specs say) mounted on the peak of the house with a 360-degree sky view.
Its phase noise performance is better than I can tell with a spectrum analyzer, i.e., it doesn't degrade enough for me to measure when I lock it up, and that's where I've let the project lapse. I need to package it and take it to someone with a rubidium standard or some such to see just where I am. Regards, Charles Patton K6PIP

I have a Reflock II disciplining a HP 10811 OCXO using a Motorola M12 GPS. The M12 is set up using the TAC32 program, and it monitors the M12. I've been monitoring the output of the OCXO on a HP counter that is referenced by Z3801A, and the display only flickers by 1/10 of a hertz.
Luis programmed the latest CPLD code (r2_enhpps_30_1) to output a status value on the serial interface. I have a PICmicro MCU (the PIC18F4550, the full speed USB device) interfaced to the Reflock II serial port. At the moment, I am using the RS-232 serial port and the terminal program on the PC to display the status value. It is rock on. It only moves between 2-3values, another indicator of the heath of the system.
Since Motorola sold off the Oncore GPS line, I think either iLotus or SiRF will be selling the M12M later this year.
I also have a Crystek Crystals 10 MHz OCXO (Part number CO27VH15DE-02-10.000 and available from Mouser) to test.
All these setups we'll do stability and phase noise testing at N8UR's lab. I am trying to find some spare time to write all this up. But I am happy to answer questions on the list.
I'll be demo'ing and displaying the Reflock II at the Hamvention. Come on by the TAPR booth.
73, - Steve, N7HPR (n7hpr@tapr.org)

The spec of the timing version of the Jupiter-T is plus/minus 25ns. Plots on their specs show a random jitter of that level. One comment to this list was that the resolution of the Jupiter-T clock is its xtal x 4. That certainly makes sense as the xtal on the bd is 10.949 MHz, therefore the 25 ns spec. I don't have full schematics/app notes to know if that xtal is phase-locked to the GPS or the uncertainly is due to clock edge uncertainty in the DSP engine. Earlier (1999,2000 vintage?) Navman GPS chip engines had VCO control outputs, but as I said, I don't know if they still exist and/or are used. But in any case, yes, the absolute frequency is very good – I'd have to dig out references right

now to get the numbers, but the question I'd like to answer is how bad it affects the short term jitter/phase noise if one uses multi-second lock loop filters. Regards, Charles Patton K6PIP

Chuck, I have tested the Isotemp OCXO into an 1150 MHz PLO without GPS yet and the stability of the oscillator alone is great. Monitored the signal with my IC-R7000 receiver and after 2 days the cw tone was still the same. My frequency counter is not much so I listened on receiver to detect drift. Keep in mind that that was equivalent to multiplying the 10 MHz oscillator 115 times, which would really show if there was drift. I will feed an 8 GHz PLO soon with it so that will show more if it were to drift.
I believe the GPS lock will do as much to just confirm the 10 MHz as anything. Drift control will be secondary on such a stable oscillator. Loren Moline WA7SKT CN86cx

Hi Chuck, I copied the board from that site and built it. For some reason neither of the two Jupiter boards part # TU30-D140-061 seem to want to come up when I power them up.
I've been over and over my circuit and can't find anything wrong with the construction. I've tested everything including the MAX232 I used and everything else seems to work. All the voltages on the pins of the GPS board seem correct. All the jumpers are correct.
I have two other GPS engines I have yet to try - one has the RS-232 interface chips built into the board and the other runs on 3.3 volts. I just need more time! I've been too busy lately doing other things. The microwave sprint this past weekend was great fun but sure a lot of driving.
If all else fails I might get one of those Pyrojoe units. But I'll bet at least one of these other boards works OK.
When I get one working I plan on trying the Reflock circuit for the 10 kHz phase-lock (since I already have it built). If I can't get THAT to work I'll go with the N1JEZ circuit.
I have three Isotemp 118 OCXO's. I set them to a rubidium standard after they'd warmed up and stabilized, using Lissajous figures. I then connected two of them to my scope and watched the Lissajous figure for over an hour. It didn't budge. So these things are stable even when "free-running". Either that or they drifted in exactly the same directions in unison. :)73, Zack W9SZ

Also I would like to be able to find a plug for the 20-pin connector or plug and ribbon cable so I wouldn't have to solder to the pins. Loren Moline WA7SKT

The connectors used on the GPS engines are 2 mm connectors. Digi-Key has these. For example, for the plug you can use part number ASA20L-ND. The ribbon cable number (1 mm spacing) is WM12-X-ND. The straight headers are, for example, part number 3M1120-ND.I hope this helps! 73, Zack W9SZ

Hello Have a look there : http://www.qslnet.de/member/on4iy/ 73 F1VL

Hi Zack, The main serial port should come up with an ASCII ILOG message showing firmware version etc at 4800 baud N81, inverted TTL levels if it's alive, regardless of whether it's hearing any RF. If you don't want to bother converting that to RS232, a scope should show that activity about 1 sec after powering up. 73 de Mike W5VSI

Zack et el: Here is a site with some worthwhile information http://www.gpskit.nl/index-en.htm. I have the Jupiter GPS receiver, Interface board and Isotemp OCXO from Pyrojoseph, which utilizes the 10kHz signal in the Phase-lock function. KE2N and I are assembling frequency standards using this system. Neither one of us has it "up and running" yet. Mike Manes manes@attglobal.net Tel: 303-979-4899

Zack, Did you try my suggestions in my email of April 9, 2006? Your description is exactly what happened to me when I first fired up my unit. It will not output anything except an initial binary test message, and the 10 KHz and 1 pps signals, regardless of satellite lock. I have to send my unit inquiry messages to get the ASCII string of model, S/N,. etc. and another message to start a continuous reporting process of binary messages that contain the numbers of satellites in view, signal quality, etc. My unit will not work in ASCII (which seems to be in accordance with the tech references I have for this series of units.) So I can only surmise that early units would come up in ASCII that have the NEMA pin on the header, but the units designed for timing do not seem to have ASCII (NEMA) capability. It may get removed in order to put in the timing code. The tech reference specifically states that the timing units have code to stabilize their outputs and that those type of units should not be used on moving platforms. Regards, Charles Patton K6PIP

I just bought an Isotemp OCXO and a GPS conditioning kit from pyrojoe. I have a box with four microwave bands in it mounted at 185 feet on my tower and I run it remotely from the shack. The unit runs on 2304, 3456, 5760, and

10368 MHz. If you are interested in more detail, I gave a paper at the SVHFS conference last week in Greenville, SC. The paper will be posted shortly, if not already, on the SVHFS.org website. I will repeat the presentation at the VHF/UHF/Microwave forum at Dayton on Saturday afternoon. I am first on the list, if you are interested.
Having been considering a more stable LO system for these bands for a while, I finally decided to get the OCXO/conditioning combo. My first thought is to mount this in the box at 185 with external GPS antenna and then use four separate reflock boards to generate the crystal frequencies required for each LO chain or to generate each LO frequency and not use the LO chains in the various transverter (all of which are DEMI transverter).
Since I am relatively inexperienced in microwave design, I would appreciate the input from this reflector as to the relative merits of these two alternatives. Perhaps neither approach is what I want, so if there are better ideas, please let us know.
My ultimate goal is to attain adequate frequency stability and accuracy to enable me to operate some of the new digital modes that might result in more grids. JT 65 is one I know of. I am sure that there are others. Let the discussion begin...and thanks 73, Dave, K4TO

If my memory serves me correctly, in the past you had some on-air frequency standard you calibrated to immediately before really weak microwave QSOs. While that's no doubt a nuisance, is it an adequate solution? You can be off a couple hundred Hertz and be slowly drifting and WSJT can compensate. Adding all that hardware to the top of the tower is also that many more points of failure.
I also have tower-mounted transverter and getting them down when they break is not fun. Expensive, complicated tower-mounted electronics seems to attract lightning. I'm going the OCXO/GPS to DEM Weak Signal Source in the shack route unless someone can convince me otherwise.
Of course, if you want to do it for the technical challenge, more power to you! -Russell Dwarshuis KB8U

Russ, Your memory is correct and your comments are right on. I am not sure that the stability of any of my bands is adequate for the newer digital modes. I know the 10G drifts pretty briskly under transmit conditions. I am interested in the technical aspects of the project and that may be one major reason that I'm heading in that direction. Your approach with GPS conditioned DEM WSS setup is a much more practical approach and, as you point out, leaves less on the tower to be damaged by lightning. Thanks for your comments. Dave Sublette

Actually it might be an idea to mount your reference oscillator in the shack even if you put the rest of the transverter on the tower. Not much loss at 10 MHz or even 100 to worry about sending it up some coax. If you have more that adequate LO level the coax would make a good small level attenuator. Loren Moline WA7SKT CN86cx

The ww2r/g4fre web site has moved to: - www.g4fre.com Dave ww2r, g4fre

From Dick, K6HIJ tech talk of May meeting, here is the text-

"Noisemanship"

The Art of Measuring Noise Figures
Nearly Independent of Device Performance

Almost everyone who has measured the noise performance of a sensitive amplifier or converter has found it possible to read noise-figure values considerably lower or higher than expected. The more exacting experimenters among us have refined their measurement techniques to eliminate such ambiguities and can even obtain accurate noise-figure values for the new, exotic, negative-resistance devices such as parametric amplifiers, masers, and tunnel diode amplifiers and converters. However, as yet, only a few astute practitioners have recognized the tremendous practical value of being able to read noise-figure values much lower or higher than actual. For example, when evaluating their own devices, they can manage to read unusually low noise figures by following certain experimental procedures. (Do not be anxious about their results being much better than theoretical, since they can usually postulate some plausible explanation such as space charge smoothing.) Conversely, when evaluating their competitors' devices, they can just as readily manage to read exceptionally high noise figures. (Here, however, they usually do the gentlemanly thing and make the magnitude of the noise figures inversely proportional to their competitors' abilities.) To encourage the practice of noisemanship, and thereby bring these very effective practical advantages to all those interested in advancing the state of the art of low-noise devices, we have compiled a partial list of the correct experimental procedures to follow in these two cases.

CASE: I PROCEDURES TO BE FOLLOWED FOR HIGH-NOISE-FIGURE READINGS

1) Use a post-receiver that is very nearly saturated this makes the output indication almost completely independent of the device under test. By varying the degree of saturation, this one technique alone can lead to almost any desired high noise-figure value.

2) Place a grid-dip meter or sweep generator near the receiver IF amplifier, this is not as effective as procedure 1), but less readily detected by unfriendly observers.
3) Use an argon-discharge noise tube, but use a calibration chart for a neon tube. Since the argon tube has about 3 db less effective output-noise power, an error of 3 db in your favor is easily obtainable. This technique is especially useful if skilled unfriendly observers are present, since the discharge is not visible in any commercial noise generator (because the noise lamp is always located inside a waveguide or coaxial structure) and, therefore, they cannot tell the type of discharge present from its characteristic color.
4) Use a noise generator having the biggest possible difference in source impedance at the two reference noise levels (assuming that a Y-factor measurement is made, which is generally true above a few hundred megacycles where noise diodes are no longer useful). This causes a difference in the gain of the device for the two reference conditions. Here, however, one must be careful that the gain decreases when the higher reference temperature is connected. One should also allow sufficient time between the two reference readings so that the output indicator drifts well down scale before the high temperature reference is connected. The use of a badly mismatched noise generator may also cause an unstable device to break into oscillation, if so, an immediate victory is scored.
5) Orient the noise generator for maximum TV, FM and police radio pick-up.
6) Assume that the device has at least three equal spurious responses and therefore, add 5 db to the measured-noise-figure value. This gives you knowledgeable air and usually impresses those present.

There are an unusually large number of these procedures, which are too numerous to list here. However, by the use of the few techniques listed above, one can readily pin the noise-figure indicator on the infinite end of the scale. For those pessimists who have only lately entered the low-noise arena, these techniques are guaranteed to lead to immediate positive results.

CASE II -- PROCEDURES TO BE FOLLOWED FOR LOW-NOISE-FIGURE READINGS

1) Undo procedures 1), 2) and 5) above.
2) Reverse procedures 3) and 4) above.
3) Neglect any spurious responses and quote only the radio astronomy noise figure.
4) If the observers are aware of the above procedures, place a carefully measured 100 dB pad between the noise generator and the device under test. This will eliminate the gain variations caused by noise-generator mismatch but when 100 db is subtracted from the over-all reading, a low-noise figure is sure to result. An alternate procedure is to use a post-receiver with a 100-db-noise figure and then carefully subtract its noise contribution.

Again there are too many of these procedures to list here, but if only the few above are followed, noise figures below 0 db can easily be obtained. This may be a little embarrassing in the presence of theoretically inclined antagonists, but again one can postulate some elaborate thermodynamic mechanism as the probable cause. (If you are anxious about such a procedure, use only one or two of the above procedures, and the noise figure indicator will rest just slightly above the 0 db mark, which is much more readily explained.) For those adventurers who have only lately entered the low-noise arena, these techniques guarantee an immediate entrance into the innermost ring.

In conclusion, techniques have been listed to encourage the rapid growth of noisemanship. Here, however, we think it appropriate to paraphrase Oscar Wilde, who noted that people only like to give advice they will not follow themselves, and with his characteristic wit denoted such advice as the depth of generosity.

J. C. GREENE
Airborne Instruments Lab.
Division of Cutler-Hammer, Inc.
Melville, N. Y.

* Received by the IRE, March 27, 1961.

WHAT IS NOISE?

I. ANY UNWANTED SIGNAL

A. EXTERNAL
1. ATMOSPHERIC
2. COSMIC

B. INTERNAL
1. SPURIOUS SIGNALS (BIRDIES,ETC.)
2. THERMAL AND QUANTUM NOISE

THIS PRESENTATION WILL ONLY ADDRESS THE LAST ITEM!

THERMAL NOISE

TRADITIONAL CALCULATION: $P_n = kTBG$

WHERE:

P_n = Total Noise Power Out

k = Boltzmann's Constant

T = Temperature in degrees Kelvin

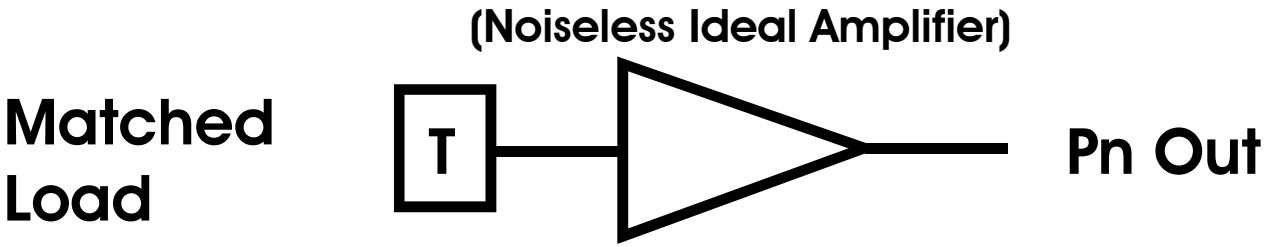
B = Noise Bandwith

G = Amplifier gain

Boltzmann's Constant = 1.38 x 10-23 watts/ °K-Hz

or:

-198 dBm/Hz-°K (Much easier to remember!)



ACTUALLY!

$$P_n = kTBG\left[\frac{\frac{hf}{kT}}{e^{\frac{hf}{kT}}-1}\right]$$

WHERE:

P_n = Total Noise Power Out

k = Boltzmann's Constant

T = Temperature in degrees Kelvin

B = Noise Bandwith

f = Frequency in Hz

h = Planck's Constant

Boltzmann's Constant = 1.38×10^{-23} watts/ °K-Hz

Planck's Constant = 6.6262×10^{-34} Joule-Seconds

Dick, K6HIJ giving his Noise figure talk at the May SBMS meeting.

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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