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

August 2005 Edition

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At **the 4 August meeting**. Contest preparation and places. Find out where people are going during the 10ghz and up contest, get information on locations and maybe form a team.
The auction-
Folks are to bring something to the auction off during the meeting for the benefit of the Auxiliary Fund, which is to provide extra monies to the treasury for MUD05 expenses. Here are three categories of sales:
1. Whatever it brings, give it to the club.
2. Starting bid needs to be met or it goes back to the owner. If it goes over that, it all goes to the club.
3. Starting bid needs to be met, the club gets a percentage of the final bid.
Put a tag on the items so that it is known which category they fit in.
There will be no more bidding for some one else to take something home.
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/.

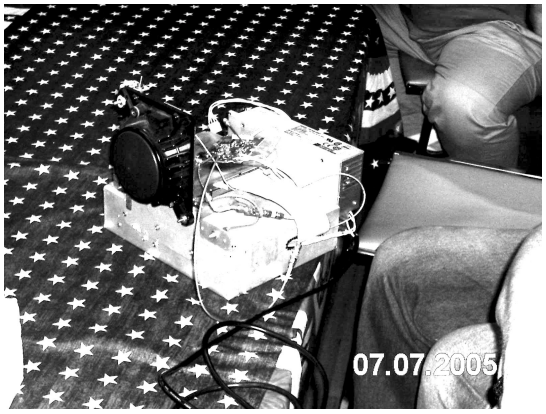
It was voted by the membership to change the SBMS Newsletter over to pdf format that can be delivered by internet. So everyone that wants to receive it that way needs to provide a current email address to Bill WA6QYR the newsletter editor. Those who wish to continue receiving the newsletter via USPS will need to indicate such to Bill at bburns@ridgenet.net.

Last meeting- Kerry, N6IZW presented his 76 GHz Mercedes automotive radar and his laser pen optical communicator. From Kerry-Here are the links to the Power Point presentations I had planned to give at the SBMS meeting last evening before we found the projector didn't make it. This only covers the optical communications projects and not the 76 GHz Mercedes radar unit which was a separate presentation and

not yet posted. As a reminder, the optical receiver info is on the K3PGP web site. The first presentation listed below does include the schematics for both the wide-band laser link as well as the receiver used for the NLOS experiments. - Kerry N6IZW -

http://www.earthsignals.com/add_CGC/hr/Wb_Laser.doc (2.6 mb)
http://www.earthsignals.com/add_CGC/hr/Wb_Laser.ppt (6.6 mb)
Here is the link to the NLOS 45km grass bounce experiment performed in France I also was going to present last evening.- Kerry N6IZW -
http://pageperso.aol.fr/F1AVYopto/NLOS+LASER+EXPERIMENTS2.htm

There were a number of San Diego folks present; Ed W6OYJ, Chuck, WB6IGPKerry N6IZW and Lee KD0IF. Welcome. 25 people present.



Kerry, N6IZW's Mercedes 76 GHz automobile radar was shown at the July SBMS meeting.

Scheduling.
6-7 August ARRL UHF Contest
20-21 August ARRL 10 GHz and Up contest
1 September Contest prep, Owens Valley project update and prep, and Microwave Update rep.
10-12 September ARRL September VHF QSO Party
17-18 September ARRL 10 GHz and Up contest
6 October- Microwave Update preparations.
3 November- Microwave Company rep on latest microwave developments we will have someone in from industry to talk about the latest developments. Door prizes!
1 December- History of Radio Astronomy- We hope to have a guest speaker.
YY December- Christmas Party at The Lab and Gift Exchange
5 January 2006- OVRO-SBMS Update and Report. Details of the Owens Valley Radio Observatory project with pictures and sound.
2 February 2006 - 1296Mhz High Power Amplifiers. Members will share their projects and results. Want to build an amp? Join us for a presentation by those who have had experience building them. Both solid state and Tubes

Pat, N6RMJ SBMS 2 GHz and Up Contest coordinator (right) presents Ed, W6OYJ of the San Diego Microwave Group their plaque for 5th place in the contest. Other plaques will be sent to the other participating clubs.

Pat, N6RMJ SBMS 2 GHz and Up Contest coordinator (right) presents Chris, N9RIN President of the San Bernardino Microwave Society their plaque for 1st place in the contest.

"Wants and Gots for sale"
Wanted- 10w 10 GHz amplifier Dennis Kidder WA6NIA 714-446-4876
Want manual for HP 8621B sweeper 100 MHz to 6 GHz Chuck WA6EXV 760-377-4972

MICROWAVE UP DATE 2005

Chairman:	Pat Coker, N6RMJ of SBMS
Planning Committee:	Pat Coker, N6RMJ of SBMS
	David Peters, KI6FF of WSWSS
	Dennis Kidder, WA6NIA of SBMS
Presentations:	Chip Angle, N6CA
Publicity:	Wayne, KH6WZ
PRIZES:	Dave Glawson, WA6CGR
Registration & Finance:	Dick Kolbly, K6HIJ
Family Program:	Mel's wife—need name
Surplus Tour:	Mel, WA6JBD
Location:	Sheraton Cerritos Town Center

The SBMS web site has a MUD 2005 sub site. Dave WA6CGR has five companies donating prizes. Three or 4 vendors are on line to be in the flea market. More help will be needed at the registration table. Dick, K6HIJ working on a display for MUD.

Microwave Up Date 2005 Call for Papers

MUD 2005 will be held this year in the Los Angeles area on October 27 thru the 31st. As the Technical Program Chairman this year, I would like to invite interested authors to present a paper(s) for the 2005 conference.

Microwave Update is the premiere microwave amateur radio conference on the planet. Many people around the world collect the proceedings from this conference since it represents the current state of the art in microwave amateur radio. This is a great opportunity to get your ideas and papers published! You don't have to give a talk to get your paper included in the proceedings.

Electronic submissions in Word, WordPerfect or text format accepted by email or CD. Usual drawing formats also accepted with your paper(s).

Cutoff date for inclusion in the proceedings is September 5th, 2005. If you are interested in writing and/or presenting a paper for the 2005Conference, please send me an email or write to:

N6CA PO Box 35 Lomita CA 90717-0035 email: n6ca@ham-radio.com

Please contact me as soon as possible with an abstract or even a general idea. This will help the conference team with its planning activities. For more information about the Microwave Update 2005 see:

http://www.microwaveupdate.org

73 Chip N6CA

Registration Desk helpers- looking for volunteers, wives or anyone to help man the registration booth from Wednesday October 26 afternoon or Thursday October 27 thru Saturday October 29, please contact Dick Kolbly K6HIJ 26335 Community Barstow, CA 92311 760-253-2477 dick@eventhorizons.com

Kerry, N6IZW spoke about his laser communicator at the 7 July SBMS meeting. Kerry is interested in the non-line of sight modes of communication with his laser transceiver. Cloud and moisture scatter contacts have been made out to 15 miles. The smaller tube on the left side of the rig is the laser pen transmitter. The larger white tube on the right is the receiver. Kerry was able to demonstrate the transmission of video over his set up using bounce off the wall or a mirror. He has some micro-drives to run a search pattern in both azimuth and elevation while trying to locate a distant station.

A closer view of the communicator built by Kerry, N6IZW.

Owens Valley Radio Observatory Project

Chuck, WA6EXV has been building up the 1296 MHz and the 10 GHz transverters for the receiver box that goes at the feed of the 130 ft OVRO dish. Circular polarized antennas go on the out side of the box. A 30 amp 24 volt power supply was found to cover the transmit requirements.

Activity Reported at the July SBMS meeting- Gary, K6KVC put SBMS meeting on the local ATV microwave net again. Dick, WB6DNX is reprogramming a 900 MHz radio; Chuck, WA6EXVis building the two transverters for the OVRO project and hopes to have them complete by August; Charles, K6PIP did some antenna range software and experiments in using an optical mouse for an optical encoder; Bill WA6QYR did some 40 meter SSB 5 Communications for local ham club field Day and is working on another 10 GHz rig; Lee KD6IF made a microwave noise source with Qualcomm parts; Kerry, N6IZW did tech talk presentation; Ken W6DTA went into DM02 for the contest but the ocean was too rough; Ed, W6OYJ did some work on the high side lo Pcom; Chuck, WB6IGP ran the optical system for Field Day; Dennis, WA6NIA ran 1296 and 2.4 GHz for field day and heard at 17.2 KHz Swedish signal; Jeff, KN6VR changing out a TR relay; Bob, WA6VHS did some tuning on 24 GHz parts; Wayne, KH6Wzhas a new 10 GHz rig; Larry, KG6EG was on during June contest with 10 GHz; Mike, W6YLZ worked 900 MHz during contest, and has a new dish mount; Chip, N6CA showed his new 10 GHz transverter with 1.1 dB NF and 10 w output and indicated that Paul KH6HME has beacons on air; Peter, K6PTL worked on Cactus equipment; Gary WA6MEM had some 3 GHz contacts; Greg, K6QPV hopes to be on San Clemente in August; Doug, K6JEY reworked his 10 GHz rig; Chris, N9RIN reworked his PLL hardware.

OFF the internet-

Hi Bill, Here is the info from N9JIM/6 about 802.11b wireless card procedures. I asked Jim Moss, N9JIM, how he did the 37 mile 2.4 GHz QSO with KK6MK during the 2 GHz and Up Contest, using 802.11b broadband wireless gear. I was hoping for step-by-step details. Here is his excellent response. His earlier email also indicated they were using 18 inch dish antennas. Ed Munn, W6OYJ

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1) We've been using the SMC HIGH POWER cards... 802.11b they are 200mW and have removable antenna with 2 ports. 1 port is RX only, the other is RX/TX. These go for about $59-79.
2) We set them up to a particular channel (2 or 3 seem best) <6 to stay in band
3) set bit rate to 1 or 2Mbps. (narrower signal)
4) run HORIZ polarization to minimize QRM to our stations...
5) Set the SSID to be the same at all stations playing. THIS IS CRUCIAL. We kept forgetting to do this! ARRL recommends using HSMM. We used 50UP during our last contest. be sure to use ADHOC mode.
6) set up static TCPIP addresses and agree on them in advance. for example 10.1.1.1 for kerry, and 10.1.1.2 for Robert.
7) open a dos window by going to RUN and type in "cmd"
8) use the ping program to ping the other station "ping -t 10.1.1.2" The –t means continuously.
9) point antennas for best pings
10) when u get fairly consistant pings... you are ready to try net meeting. Note that signal strength does not work on the cards in "adhoc" mode.
11) run net meeting... use setup to set your name to callsign + Grid. (insures minimum info qso) In newer operating systems... they no longer show net meeting in the communications menu. there should still be a folder in "program files" called "net meeting". The file to run is called "conf.exe" first time you run it will help setup the audio settings.
12) connect to the other station by typing his TCPIP address into the top box.
13) A "ring" sound should ring on the other guys computer, and he accepts
14) you can then use the chat window to type, audio to talk, video to see (if you have USB camera), and whiteboard, and share screens/control.
15) to end... use hangup.
Note: only the first 2 stations connecting can use audio (we don't know why) But all connecting can see chat mode an other stuff.
We also did this all together in one room to start and get familiar with it all, otherwise... you have no chance when you go out!
Let me know how you make out.
Jim
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de K2RIW 6/4/05
Dear John, Doug, et al.,
MAXIMUM DISH EFFICIENCY AND THE BEST ANTENNA SIDELOBE LEVELS
by Dick Knadle, K2RIW 6/04/05
INTRODUCTION -- What follows is long winded, but it is intended as a mini-tutorial that I hope will give some microwavers a better understanding about the highly misunderstood area of Maximizing Gain, Aperture Efficiency, Properly Feeding Parabolas, and the Proper Sidelobe Levels that Must be present in a properly operating high efficiency aperture-type antenna.
THE FORMULA -- This is the formula that answers John's direct question (repeated below). The most important factor that determines the achievable Gain of a microwave antenna is it's area. The formula that is the beadrock of the antenna measuring/designing industry and science is:
Gain = (4*Pi*Ae) / (Lambda^2)
Where: Ae = Effective Area, often 55% of the Physical Area
Pi = 3.1416
Lambda = Wavelength in the same units as Ae
GAIN EQUALS AREA -- When you study that formula you can come to an interesting conclusion; at a fixed frequency everything is a constant except the Ae. Therefore Gain equals a Constant x Area. If you want to double the Gain of your antenna (that's a +3.01 dB Gain increase) you have to double it's effective area.
ILLUMINATION -- All of the above assumes that you are properly illuminating that new area you added. In most Parabolic Dish situations (offset and center fed) that Gain is maximized when you choose a feed horn that has the -10 dB pattern fall at the edge of the illuminated surface (including the extra path length to the edge). That will usually give you a Dish with a Aperture Efficiency of about 55 to 60%.

100% EFFICIENCY? -- You can almost achieve a 100% Aperture Efficiency. All you have to do is design a feed horn that illuminates every square inch of the dish with the same power, and have that power abruptly fall off to zero at the edge of the dish (no spill over). To have that much control of the feeds Primary Pattern will require a properly-fed, Cluster Feed, Phased Array of about 1,000 elements, and that feed assembly will be about 30 wavelengths in diameter. If you are working with a Dish that is 120 wavelengths in diameter, this is almost doable.

A REAL DISH -- Since many of our antennas are only 20 wavelengths in diameter, that approach is not practical. You would end up with more gain in the feed horn assembly, than in the whole Dish antenna system. You would be better off just aiming the feed at the target and eliminating the Dish reflector.

APERTURE EFFICIENCY -- The subject of Dish aperture efficiency is highly misunderstood. Most amateurs (and engineers) believe that the lack of 100% Aperture Efficiency, or 100% Main Lobe Efficiency, represents a true Power Loss (it does not), and that the "lost power" is in the sidelobes (it is not).

THERE IS NO LOSS -- In a reasonably-constructed 55% aperture efficiency Parabolic Dish antenna system, if you apply 100 watts to that antenna, 99.9 watts will be radiated into space. Aperture Efficiency (surface efficiency) is a measure of the True Gain of your antenna versus the theoretically achievable Gain of an antenna of equal area. The desirable 100% aperture efficiency will only be achieved when:

1. The complete surface is illuminated with the exact same number of watts per square inch.
2. There is no phase error on any of those square inches -- this means no bumps in the reflector and no feed horn phase errors in the Primary Pattern.
3. And there is no spill-over energy being wasted.

WHAT'S PRACTICAL -- We can either loose a lot of sleep fretting over how you are going to make your aperture efficiency go from 55% up to 65%, or you can simply add another foot to the diameter to the Parabolic Reflector (and properly illuminate it) -- both may yield the same gain increase. The second approach is much faster, cheaper, and practical.

MANY ANTENNAS HAVE 100% ? -- The world is filled up with Parabolic Antennas that have an aperture efficiency of about 98% -- they are called "Diffraction Limited" Telescopes. My 8 inch diameter telescope has about that aperture efficiency. It achieves this because the Parabolic Reflector is 370,000 wavelengths in diameter, and the Feed Horn (the Eye Piece) does create the desirable Primary Pattern; it is 9,000 wavelengths in diameter, that allows it to do that.

SIDELOBES vs EFFICIENCY -- Here is the real kicker concerning sidelobes and sidelobe "wasted" energy. A Diffraction Limited telescope could be described as one where the Parabolic Reflector has about 1/20 wavelength accuracy, and the rest of the optical system is working properly. That telescope could easily have an Aperture Efficiency of 98%. That's the highest Gain you are ever going to get out of that available area. But now, lets see what it is really doing.

THE AIRY DISC -- As all astronomers know, every Diffraction Limited telescope creates a "picture" (the antenna pattern) that contains an Airy Disc. That means that around every star in the image you will see some dim rings (the sidelobes). The Airy Disk is present in all diffraction limited optics systems (and in all antenna patterns). A proper Airy Disk does not represent a system error. However, if a system error is present, the Airy Disk will change in a characteristic way that's beautifully pictured in Suiter's book, "Star Testing Astronomical Telescopes: A Manual for Optical Evaluation and Adjustment" by Harold Richard Suiter, $29.95 at Amazon.com.

HOW MUCH POWER IN THOSE SIDELOBES? -- From my Melles Griot "Optics Guide 5" catalogue, in the section entitled Fundamental Optics, they say that the Diffraction Limited Airy disc will have a Central Maximum region relative intensity of 1.0 (that's the antenna's main lobe at boresight), and 83.8% of the energy is located there. The first ring (I call this the 1st sidelobe), will have a relative intensity of 0.0175 (I call this -17.57 dB), and will contain 7.2% of the energy. The second ring relative intensity will be 0.0042 (I call this -23.77 dB), and will contain 2.8% of the energy. The 3rd ring intensity is 0.0016 (I call this -27.96 dB), containing 1.5% energy. The 4th ring is 0.0008 (I call this -30.97 dB), containing 1.0% energy, and a bunch more dimmer rings with less and less energy (the remaining 3.7%).

100% APERTURE EFFICIENCY CHARACTERISTICS -- Now let's review those last statements. A Diffraction Limited 100% aperture efficient telescope has 83.8 % of the received energy located in the main lobe, 7.2% of the received energy located in the first sidelobe, 2.8% of the received energy is located in the second sidelobe, and 1.5% of the received energy is located in the 3rd sidelobe, etc. These are the best numbers you are ever going to get from a perfect, round aperture, that is not an infinite number of wavelengths in diameter.

REMOVE THE SIDELOBES, NO WAY! -- There is an amazing number of amateurs and engineers out there who are dreaming about getting rid of ALL of those side lobes and their "wasted" energy. This is a VERY FUTILE EFFORT. When a circular aperture HAS 100% aperture efficiency, it WILL HAVE sidelobes that are exactly that strong (-17.57 dB [1st sidelobe], -23.77 dB [2nd sidelobe], -27.96 dB [3rd sidelobe], etc.) and the amount of energy in each of those sidelobes WILL BE exactly the numbers indicated (7.2%, 2.8%, 1.5%, etc.).

REAL DESIGNS -- You can definitely design an antenna with weaker sidelobes; but it WILL HAVE less Gain. You can design an antenna with stronger sidelobes; and it also WILL HAVE less Gain. You can then design a low loss (no pads) circular aperture antenna with exactly those magic sidelobe levels; and it will have the MAXIMUM GAIN for that size aperture.

IS THIS REASONABLE? -- Of coarse this doesn't seem to make sense, but that's the way "Mother Nature" and Diffraction Limiter 100% aperture efficiency antennas (and telescopes) behave. Those sidelobes are the result of the abrupt change in the illumination taper at the edge of the aperture -- Mother Nature reacts to them by creating sidelobes. You could slowly taper the energy as you approach the edge of the aperture; that will decrease the abruptness of the illumination taper and it will lower the sidelobes, but the available Gain will decrease when you do this. You can't have it both ways (maximum Gain and no sidelobes).

SO LET'S STOP THE INSANITY -- It's time we microwavers, amateurs, engineers, and interested scientists stop seeking Maximum Gain antennas that have miniscule sidelobes; it ain't going to happen. At least I can say, it's not going to happen in THIS universe, that operates with THIS SET of the Laws of Physics that determine our antenna patterns by using what the mathematicians call Window Functions -- that's the way you feed an aperture.

THE YAGI CONNECTION -- A well tuned long Yagi antenna has a nearly circular aperture with a nearly uniform aperture distribution. It is interesting to note that such a Yagi usually has a set of sidelobes that are very nearly -17.5, -23.8, -27.9, and -30.9 dB. I think we have been looking at the Yagi antenna's "Airy disc" for a long time, we just didn't give that name.

DISH COMPARISON -- A well tuned Parabolic Dish antenna has weaker sidelobes than these, simply because the best available feed horns need to use an Amplitude Taper of -10 dB at the Dish perimeter.

GOOD OPTICS BOOKS -- For those microwavers who wish to dig deeper and try to understand this material I recommend reading some of the better optics books. I soon recognized that the guys who have gotten the subject of High Aperture Efficiency down to a science are the optics people. They can easily do this because their "parabolic antennas" frequently are more than 100,000 wavelengths in diameter. Their "feed horn" is called the eyepiece. Their books can give us a lot of insight into what is really achievable with our microwave antennas.

THE REFERENCE -- Here is what I believe is one of the best books on optics. It's modern, well illustrated with computer-generated graphics and photos, and it's in it's 3rd edition: Eugene Hecht, "Optics", Addison-Wesley, 3rd edition, 1998. It's much nicer than the classic, Born and Wolfe, "Principles of Optics", Cambridge University Press, seventh edition, 1999.

AIRY DISC DEFINITION -- Chapter 5, page 228 of Hecht says: "Because an instrument can only collect a portion of the incident wave front to be reformed into an image, there will always be diffraction: the light will deviate from straight-line propagation and spread out somewhat in the image plane. When an optical system with a circular aperture receives plane waves, rather than there being an image "point", the light actually spreads out into a tiny circular spot (called the Airy disc, containing about 84% of the energy), surrounded by very faint rings. The radius of the Airy disc determines the overlapping of neighboring images and therefore the resolution. That's why an imaging system that is as perfect as possible is referred to as Diffraction Limited. For a perfect instrument, the ideal theoretical angular resolution is given by the radius of the Airy disc, which is [1.22 x Lambda / D] radians (this is the Rayleigh criteria). Another way to present the angular resolution is [2.52 x 10^5 x Lambda / D] arc-seconds. "I added the parenthesis.

73 es Good VHF/UHF/SHF/EHF DX,
Dick, K2RIW