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

July 2012 Edition

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At the **July 5, 2012 SBMS meeting** will have a program by Doug Millar, K6JEY will be presenting on EME.. 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.

Last meeting-Mel, WA6JBD gave a talk on Com Study computer software. It shows the propagation for various sites you put in by lat and long coordinates. It shows graphically what distance you can reach given the input parameters. Mel had a number of our normal sites plugged in and showed us what we could expect for range. Com Study is on the order of $1000 licensed to one computer. Our visitor was Dave, K6VML from San Bernardino. The "Tune Up Party is set for 4 August in Fair View Park in Coasta Mesa around 0900 start and running until around noon. The extra 2010 MUD Proceedings are going to MUD 2012 for door prizes. 19 people present.

2 GHz and Up Club Contest- **Don't forget to send your entries to Bill Burns 247 Rebel Road Ridgecrest, CA 93555 before 1 June.**

Scheduling:
August 4-5 ARRL August UHF Contest
August 18-19 ARRL 10 GHz and Up contest part 1
August 16-19, 2012 The 15th International EME Conference in Cambridge, England.
September 8-10 ARRL September VHF QSO Party
September 15-16 ARRL 10 GHz and Up Contest part 2
October 18-21 Microwave Update 2012 in Santa Clara Biltmore Hotel

Wants and Gots for sale.
For Sale: 30w 1296 MHz PA kit $50 + $5 for US shipping Chris Shoaff, N9RIN cshoaff@yahoo.com
For Sale: 10 GHz slotted waveguide antennas $55 kit, $80 assembled plus shipping Dan W6DFW W6DFW@apex-scientific.com
For Sale: table mounted wood router $15; 8 ft solid aluminum dish, $50 (can transport to your site for mileage.); 6 ft fiberglass dish free; 7.5 ft TVRO dish free; 6ft motorized Az/El RV TVRO dish with control box $10; 10 ft TVRO mesh dish free; Roll-a-round Sampson camera mount with quickset head $25, various lengths of 0.5 inch helix up to 70 feet free. Bill WA6QYR bburns@ridgenet.net 760-375-8566.
For Sale- lots of microwave stuff. Let me know what you need. John KJ6HZ 951-288-1207.
Wanted- HP854 and or 8555 plug-ins for a HP141T main frame. Jason W6IEE W6IEE.73@gmail.com.
For Sale – new SMA attenuators DC-18 GHz 6dB and 20 dB $5 each Dick 714-529-2800 rabremer@juno.com.
Wanted- Macom 2 foot dish with feed or Prod line dish with feed Chuck N6EQ N6eq@juno.com.
Want wr75 to SMA adapter, need 2, Dick, WB6DNX 714-529-2800 rabremer@juno.com.
Want-1 section of Rohn 25G tower Pat N6RMJ 661-755-1773
Free-I have a collection of the Qualcomm synthesizer boards etc. available for 10 GHz use, for free (pickup in Tucson -no shipping). Also FREE-- some 6 GHz Alcatel MDR6000 cell site pieces including power converters, OCXO's and linear amplifiers which will put out at least 1 watt in the ham band (no shipping either). This Class-A amps are broadband, and will need significant heat sinks. . Steve Bell Tucson 520 297 1282
Wanted- WR42 to SMA transition Chris. cshoaff@yahoo.com
Wanted-I guess my prospect in Alaska to buy a HP141T with tracking gen has evaporated. Repeated calls and e-mail were put-off even though the
equipment was listed on a local swap list. So.....
I can obtain the HP141T with IF and probably a lower freq RF deck from another source up here but he has no 8555's or tracking generators.
I do not want to buy a complete 141T due size/weight shipping cost but if anyone has the 8555 or a lead to one, it would be appreciated. I need the SA for my new business fabricating kits on contract.
73, Ed - KL7UW@acalaska.net.

Activity reports from 7 June SBMS meeting- Mel, WA6JBD did some Cactus radio work; Pat, N6RMJ did some tower work; Dan, W6DFW has slot antennas available; John, KJ6HZ did some EME with Doug K6JEY; Dave, K6VML did some HF work; Dennis, W6DQ went to Maker Fair with Tony KC6QHP, Wayne KH6WZ and Brian, W6BY-lots of demo item there; Walt had a electro-static field meter with HIGH impedance unity gain voltmeter box and has been making gig-ohm resistors; Bill, WA6QYRworked on wind broken 2 meter antenna; Chuck, WA6EXV the Heaps beacon is ready to go up; Dick, WB6DNX is rebuilding 10 GHz rig; Chris, N9RIN did some work on oscillators for the beacon and did some dish focusing work; Dave, WA6CGR had some gig ohm resistors for Walt.

Sadly, I inform you that Gene Zimmerman, W3ZZ, passed away on Sunday
morning, 3 June, 2012 due to complications related to his surgery. Many of us have heard/worked him at the "Grid Pirates" station, K8GP. I met him way back in 1972, shortly after returning to the D.C.
area from my ARMY duty.--He will be missed, 73's, Bob Curry, KC3VO

On 19 June, Rex VK7MO and Dave VK3HZ completed a 24 GHz aircraft scatter JT65c QSO over a distance of 462 km. The advantage of aircraft scatter is that the majority of the path is at high altitude where atmospheric losses are much lower.
A detailed report is at:
http://www.vk3hz.net/microwave/462km-24GHz-Aircraft-Scatter-QSO.pdf
73 Rex VK7MO

Hello MW DXers
I have uploaded a write-up to http://www.ntms.org/ describing QSOs on 5760 and 10368 between K0VXM and myself. These were 1609 km QSOs between EM13qc and EL98pj.
Our California friend N6CA still holds the overall North American 5760 DX record between the mainland and Hawaii. I am sure Chip is working away at claiming the BIG 10 GHz record with Hawaii as we speak.
GL to you guys.

Btw, if you would like to see the DX records on the ARRL web site (I have not updated them yet), they seem to have them conveniently hidden so here is how you find them in this mouse clicking order.
ON THE AIR
Operating Specialties
VHF/UHF Microwave/Weak Signal
The World Above 50 MHz
Distance Records
If you have updates for me, I will be making the changes soon.
73 & DX Al W5LUA EM13qc

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60 degrees North East Company. I am starting up a kit making service for assembling certain kits made by Down east Microwave. For those that do not want to make their own kits or maybe it's gotten too difficult, or just don't have the time or want assembled kit faster than DEMI can supply it. This one-man business so I will only be able to build a limited number per month. My price is the same as offered by DEMI assembled, plus shipping which should be medium-size flat-rate priority mail in the US. I am expecting to be able to deliver within 30 days of receipt of paid order. I am not carrying any inventory so this allows shipping time to obtain kits and any other materials, and time to test the finished product plus ship to the customer. At this time I am limiting this to the VHF/UHF 25w Transceiver kits. In a couple months I hope to add three amplifier kits from Communications Concepts, Inc. If there is a something special you want assembled contact me. My professional credentials are at:
http://www.kl7uw.com/60NE.htm Ed Cole

There has been some interest in connecting to the SBMS meetings that appear on the internet. Try this:
http://www.batc.tv/ch_live.php?ch=2&id=139

OOPS... the correct email address for papers is mud2012papers@gmail.com.

This year's Microwave Update conference will be in Santa Clara, CA (San Francisco Bay Area), October 18-21.
Please consider writing a paper for the Proceedings and/or giving a talk at the conference.
You will find a suggested topics and detailed authors guidelines under the "Call For Papers" tab at www.microwaveupdate.org .
The deadline for paper submissions is August 18, which is in 10 weeks.
It's time to start writing up your latest microwave projects, ideas and experiences!
Please contact me at mud 2012 papers@gmail.com to submit papers or to let me know you are planning to submit a paper. Thanks,
Mike Lavelle, K6ML
MUD 2012 Technical Program
Mud 2012 papers@gmail.com
Please check www.microwaveupdate.org for more information on the conference.

Gentlemen,
I'm playing with very high input impedance voltmeter. Very interesting.
LF356 op amps have ten to the twelfth type input impedance and cost mere pennies. Unfortunately 100 G and 1 T resistors are needed to do anything interesting with them that can use that kind of impedance. But those are like $12 to $20. I have one. But some circuits need two. And I'd like to make more of these. Do any of you know how to make ultra high value resistors? Precision and temp tolerance is not important. I suspect that precision and temp tolerance is what makes them expensive. Walt

Hi Walter: Back in my college physics days we were working with some

ion experiments and needed a resistor in that value range.
My physics prof took about a 4 inch square piece of cardboard,
a pencil, and drew a dark line from one side to the other, and then
put a clip lead to the line on both sides. That wasn't enough, so
he drew the line darker and darker. So a couple of inches of
pencil lead/carbon. Lots of scribbling and the eraser make it
a variable resistor! Good luck with your experiments. Kent WA5VJB

Thanks you guys for your ideas,
Kent's idea worked the best. The best line was a heavy (6-8 strokes of a number 2 pencil) the long way on a business card. My high Z VM could discharge a .001 µ in about half the time the $12 100 G ohm resistor did. I tried a number of thinner lines and they all were about twice the 100 G resistance. And then I discovered that the card by itself was about twice the 100 G. So at last I have something to do with my business cards.
Do you think I could sell them for $12 each? I think Kent might be on to something. The value in ohms can even be written in the very material that is the resistor. Walt

If your business card shows any resistance, it's probably damp. Do you want a hygrometer or a resistor? Humidity is going to affect almost anything you build, unless you can encase it in something like varnish or clear nail polish. That goes for the circuit board you build the circuit on also, of course. I would think you would put everything together, and then bake it in an oven for an hour or so, and then spray it with varnish.
Don't bake it too hot--read the data sheets for your components. Try this ahead of time with your home-brewed resistors to see what happens.
--Doug, WA2SAY
Pencil lines on mica capacitors and capacitor mountings were used in the early vacuum tube days, called grid leaks.

I think you will find the business card to be a reliable, though slow to respond, indicator of the past several hours relative humidity. It may need encasing in lacquer or epoxy to hold the resistivity more constant with environmental changes. Check by breathing on the card.73, Jerry, K0CQ

How about just a pencil lead from a thick mechanical pencil with alligator clips on the end? Tyler

Jerry, it may need encasing in lacquer or epoxy to hold the resistivity more constant with environmental changes. Check by breathing on the card.
I did. And I tried a hot air blaster on it too.
The change was not very much. The change was less than the affect of the investigators arms or even unknown changes of the electric field. In other words we can't turn a lemon into lemonade and use it as a sensor of humidity or temperature. The response to unknown changes in the normal operation of this ultra high impedance voltmeter is very large.
This amplifier/sensor was originally intended to support one slide in a talk on EM waves. I had no idea it would be so much fun. With the use of a super cheap gig ohm resistor and the very affordable LF356, electrostatics could be a fun hobby for the next generation of young engineers coming out of government schools.

- flying saucer detection
- ghost busting
- alien invasion

If they can use this effect to show how industry is destroying the environment they might be able to get a government grant or at least the love and respect of the enlightened scientific community.

Walt
The silver epoxy Zack brought our attention too and this point about connecting to strange coatings. . .

It's probably one of those cases where soldering to it would be impossible without the conductive aspect deteriorating due to the tiny molecular thickness of gold.

Is also appropriate to my problem of a cheap source of gig ohm resistors. This is how I can connect to the pencil mark. I did an experiment this morning to see if I can make my own silver epoxy. I'm sure you are all aware that using silver allows the seller to charge far more than what silver actually goes for. Most people don't look up the dollars per gram; they just expect to pay a lot. So I will not even bother looking at their price. Instead, I looked around for something I own made of silver. Nope. Poorer than I though. So I pushed a section of copper pipe against an 80 grit sander and made as thick a paste as I could. You can just about double the load of metal by heating the epoxy with an air gun. The results are not much of a surprise. It is either zero ohms or open. You really have to have a lot of metal in the mix. My samples were 1/2" long with wire embedded into each end. I believe one sample went from zero to open when I bent it. Not sure. Pushing an ohmmeter probe into the hardened epoxy-copper was always non-conducting until you push really hard and twist to get through the layer of epoxy that finds its way to the surface. It then jumps from infinity to zero; to the resistance of the probe leads. My powder was rather course and I'll bet you can get a higher copper to epoxy ratio with finer powder, or a mix of fine and course. Walt

It would be interesting to have some scraps of the gold flashed Kapton used on spacecraft to experiment with. It's probably one of those cases where soldering to it would be impossible without the conductive aspect deteriorating due to the tiny molecular thickness of gold. One of those space blankets is probably a poor man's choice for the test I suppose. But really for a Faraday quality shield the edges must bond. I.e. it's practically got to be water tight at RF frequencies.
The conductive plastic boxes are all about keeping static from building up and zapping circuits. But there are some sprays that use nickel to coat the inside of plastic PC keyboards for EMI/RFI reasons. The best commercial versions work a little like a plasma torch and spray hot nickel dust to adhere to the plastic. That gets rid of the lacquer, probably improving the efficiency of the coating. But again this is all being done to meet some of the FCC Part 15 Class A/B requirements or MIL-461 over a limited frequency range. And generally it's just to get a 10 ~20 dB improvement in shielding.
We usually need all the dB's of shielding we can get (>100 dB) doing weak signal receive and high power transmit in close proximity to one another.
Plastic boxes might work for VHF/UHF shielding after a fashion. The main times plastic is useful is in saving weight, cost, and merging lots of complex shapes into a single assembly. Sealing up much circuitry inside though might lead to overheating as the thermal resistivity is generally pretty high.
Give me a good Hammond die cast box any day. The seal is practically DC to daylight as is. They have good heat transfer / dissipation capability as well. For the money they're hard to beat.73, Charles K4CSO

HI Charles, Just add that I second that about Hammond boxes. DEMI long used them for their kits and I used one with my Elecraft signal source XG3 to improve isolation for very weak signal testing. Without the box I am only able to get down to about -125 dBm before leakage defeats using more attenuators. With the box I am able to test down to -145 to -150 dBm (If using double-shielded coax test cables).
WA2ODO has successfully used PCB board as enclosures though I am going to enhance that more with installing them inside a small Hammond box. His preamps withstand +65 dBm near-field environments if some extra precautions are used (dbl-shield coax from relay to input and shielded dc wiring).
I use some of the plastic enclosures where wx is factor but not RF shielding.
Recent purchase was plastic cake container from Wal-Mart to house my relay-preamp matrix for 222&432 at tower-top. Much cheaper than a 4x Hoffman box.73, Ed - KL7UW

Years ago I build a weak signal 1296 source. For convenient level prediction I made the buffer output 1 mw, 0 dBm. To allow using 145 dB attenuation to get down to about MDS for a 500 Hz filter, I had to mount the shielded oscillator in a second shield. I mounted the battery inside the oscillator shield and set it up with a power switch operated by a fiberglass rod. I used Scotch copper tape to finish the inner shield, and then I connected the two shields only with the coax connectors. Then I could cut the output level well below the good receiver MDS. But it took double shielding and that care with the grounding and the internal battery. Wire leads for power supply would have complicated the isolation a great deal.
I've soldered custom boxes from bits of PC board, and made custom boxes from bent aluminum. I like starting with two Ls for sides and end that I can bend with my brake and include flanged ends for bolting together.
Then I have a collection of long 4-40 screws and can bolt on flat plates front and rear with those long screws running through both plates and put those screws close enough to rub the corners. More recently (and I've not test

the shielding) I've used octagonal or square electrical boxes with an overlapping cover plate. Can't beat a buck for the basic enclosure and some now have a raised portion of the back for a ground screw that makes a decent PC board mounting post.
While the kitchen box is much cheaper than the Hoffman box, it doesn't stand full sun well and will be on the ground in a year or two in flakes and powder. And then the relay will be out in the open.
73, Jerry, K0CQ

Thanks Jerry for the tips on cheap boxes.
My favorite is the UHF splitters at the 99¢ Stores. The size of a Pomona Box at 1/30th the price.
Bottom is easy to remove with a heat gun and after sawing off the F-Connectors the remaining hole is just right for feed through caps or BNCs. Walt

And the splitter contents might be handy for splitters/combiners, or for broad band transformers at low power.

One can make fairly elegant custom boxes with 1/4" thick aluminum bar stock for the sides. Cutting the ends square is critical to a nice result, but that's not hard with a milling machine or a metal cutoff saw at hand. Or some patience cutting a bit long and filing square by hand or disk or belt sander. The corners can be assembled with inside angles or by drilling and tapping holes. Then the cover plates can be drilled or punched and the edges of the bar stock drilled and tapped for pan head or counter sunk for flat heat screws. Not as cheap as a splitter box, but more adjustable for sizes and nicer looking than the typical die cast box.

In Europe the standard box is tin plated steel. It forms easily, comes in a wide assortment of sizes, and it solders easily. All of DB6NT transverters products 10 GHz and below I think come that way.
One can make boxes from hobby shop brass using 1/32 or 1/16" by 3/4 or 1" for the sides, and flat sheets soldered together for the bottom.
Sometimes you can solder nuts (threaded brass spacers work better than brass nuts, more solder surface) to take the cover bolts. You can buy similar brass stock from McMasters-Carr. Look for miniature brass shapes.
For other sizes a squaring shear and box brake can be handy.
Then if one has big bar stock available (like from the Boeing Aircraft surplus store in Wichita) and a milling machine, one can make a custom enclosure from the big bar stock, all in one piece except for the cover, removing all the interior volume of metal. That gets boring when done by hand without a power feed. Some of the millimeter wave hardware from DB6NT uses that technique, probably hired out to a shop with a numerically controlled mill so someone doesn't have to stand there and turn the cranks. The computer does it. Interior square corners can be a limit, unless one runs one of the edge cuts half the bit diameter past the intersection. Or one can round the PC board with the sander, file, or nibbler. 73, Jerry, K0CQ

On 05/25/2012 04:38 PM, John D'Ausilio wrote:
> Back in January I accidentally got myself involved in the 3D Printing
> world (another money/time sucker) and now I've got the thing running
> well enough to actually print useful things ;)
>
> I just noticed a supplier who has a carbon-loaded ABS filament
> available, which lists it's resistivity at around 10K/cm at the
> surface. This stuff seems to be used mainly for anti-static purposes
> but I'm wondering if that's conductive enough to use as an RF shielded
> enclosure? I can easily make a box that would seal nicely and have
> holes wherever I need them, and the usual way it's done is by painting
> the inside of the box with metal-loaded paint .. but it would be cool
> if I could use the plastic by itself.
>
> de w1rt/john
I would tend to doubt it. When I was still working (I am an RF engineer) I designed things that required shielding, and we had mechanical engineers who knew processes and what was available and possible.

What we wound up doing, and it worked very well, was to mold plastic, and then plate it, first with copper, and then with, I believe, nickel. It made a beautiful shiny surface, perfectly flat where it needed to mate with a cover or with the tin-flashed PCB trace. It had the further advantage, since both the inside and the outside of the plastic were plated; there were now two shields in tandem for RF to get thru. (You will find in the literature that a double shield is more effective than a single shield.) In most cases, a cover could be done away with, since the plastic could be molded into a dish-type configuration, and then the open side bolted to the PCB with self-tapping screws into the plastic. If a live trace needed to pass thru a shield wall, a "mouse-hole"
was molded in.

Note: we specified and purchased the plated plastic shields, they were not done in house. Breadboards were done with conventional thin sheet brass, soldered.

I don't know how to plate plastic, but it may turn out that a carbon-loaded material is conductive enough to simplify the plating process. If you get into plating, be very careful. Some of the solutions are poisonous, and also very corrosive.
Protective clothing and eye ware are essential!--Doug

Probably not, John. RF shielding relies on high electrical conductivity to support the eddy currents to produce bucking H-fields to incident H-field. This is basis of the skin effect, which varies strongly with conductivity. E.g. at 500 KHz (I know - that's DC, but it's where I used to work and where I have some data in organic RAM), skin depth in copper is about 3 mils, but more like 1 - 2 m in living tissue (50 - 200 ohm-cm). Skin depth does drop with the inverse square root of frequency, though, so it might be OK at uWave freqs.73 de Mike W5VSI

uwavers, I know that another division of the company I work for has conductive plastics. They mold them into the shape they want. Then they coat the surface with something and then shine a laser on it in the pattern they want to be conductive. It is then quite conductive. I know how conductive they are, because they make cell phone antennas this way. I tried out a piece of the material and it worked fine for shielding and fine for an antenna at PCS ~2GHz.
I really don't know much more about the specifics and, of course, it is patented. But it does show what is possible in plastic shielding..
We don't use it here, because it is quite a bit cheaper to stamp/break a metal plate and screw it onto the plastic. Gary WE9Y

I've used oven-grade aluminum foil glued to the inside of a foam core enclosure with good results in weight-sensitive high altitude balloon payloads. Elmer's works fine on the paper surface. Foil seams can be bonded together using a series of pin pricks. Not pretty, but it's on the inside.
73 de Mike W5VSI

Another post, which I have lost, mentions using aluminum foil like oven-wrap, to cover plastic enclosures. That brought to mind a 3M product, (which may be made or distributed now by an outfit called JVCC), which is a copper tape with conductive adhesive. This stuff is available in all sorts of widths, starting at 0.25" and is wonderful for all sorts of microwave things. It would make a fine shield, and pieces of it cut to necessary dimensions can be used to modify or even generate distributed circuit elements.
It's 3M number 1181. Go to

http://multimedia.3m.com/mws/mediawebserver?66666UuZjcFSLXTtMxMXOXs6EVuQEcuZgVs6EVs6E666666--
for data. If you use it in a permanent application, solder it down.
The adhesive _is_ conductive, but a soldered joint is more so. If you get in 1/8"
width, it will be close to 50 Ohms on .060 FR4. (47.4 Ohms) But for 1/8", it has to be slit from 1/4"; it's not a standard size. This makes it more expensive. For shielding purposes, probably 1/2" to 2" would be most useful, depending on how big the thing you need to shield is. Don't believe claims that it won't oxidize--unless they've done some magic, it will, but so long as you applied it (and soldered it) when it was still shiny, it will continue to work. This is the material I used for "snow-flaking" over many years. Just cut a little bitty piece and stick it where you think it will help, and see what happens. It's also great for sealing up chassis junctions, covers that don't have enough screws, etc. If 3M hasn't sold it to JVCC it should be available from any 3M distributor, and they can arrange for

slitting to 1/8" if needed. I don't know anything about JVCC--I just found them by Goggling for copper tape with conductive adhesive. (I couldn't remember the part number.)--Doug

Pat, N6RMJ; Mel, WA6JBD and Jeff, KN6VR discuss the Com Plot software brought in by Mel.

What is the stacking distance for two 55 el loopers from Directive system?
Thanks,Dave, K4TO

I found the stacking distance on Directive Systems spec sheet for the 2355. They specify that the beam width for the antenna is 14 degrees, using the formula for optimum stacking distance from chapter 9 of the ARRL Microwave Experimenters Handbook, the stacking distance should be
37 inches. However, Directive systems says 27 inches. That is too much difference for me.
Has anyone on this list experimented with the tacking distance for the 2355L? I would appreciate knowing what you found to be optimum.
Dave

Thanks for asking about that Dave,
It inspires the question: why in the heck do you need to stack arrays away from each other and why do they need to be more separated the more elements in a line.
I read somewhere that there is a kind of shadow cast behind an antenna that is bigger when there are more directing elements. It is as if the waves are sucked in from around the antenna. Is there an intuitive explanation indeed . . . an explanation for how it is that a wire as thin as it is can suck energy out of a wave? On this subject a microwave dish

which captures both E field and H field is more intuitive than a simple dipole.
Walt

Without giving the hard number answer, the exercise is determination of the antenna aperture from its directivity (gain). One uses the formula for gain expressed as a function of effective area in wavelengths^2.
The parabolic dish physical aperture is nearly equal to effective aperture. For yagis and their derivatives (e.g.loop-yagi) the effective aperture is considerably larger than its physical cross-area. Optimum stacking occurs when apertures of two antenna just touch. Closer spacing reduces gain a bit but also reduces sidelobes, so it is all an exercise in trade-offs.
http://tscm.com/antennas.pdf
http://w8ji.com/capture_area_ae_effective_aperture.htm
http://en.wikipedia.org/wiki/Antenna_aperture
http://www.w1ghz.org/antbook/contents.htm
This should give the student ample exercises! ;-)
73, ED - KL7UW

Ed, KL7UW has a nice digestible answer.
There have been one or more interesting papers recently on close spaced stacking of different bands within their mutual aperatures.
Proper spacing doesn't preclude multiple bands with some care

Dick, WB6DNX;Pat, N6RMJ; and Larry K6HLH look at freebe reels of surface mount parts at the June 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 in 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 **or, bburns@mediacombb.net, 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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