SAN BERNARDINO MICROWAVE SOCIETY, Incorporated

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

W6IFE Newsletter
September 2009 Edition

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At the **3 September 2009 SBMS** meeting the "Tech Talk" will be Gary W6KVC on the ATV setup with guest speakers. 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

Last meeting Gary, W6KVC was presented a Technical Achievement Award for the use of ATV to bring the SBMS meetings to people outside of the SBMS on ATV and internet. Ben, KD0EJT of Long Beach, Brian, AF6NA of Corona, Bill, N6MXU of Anaheim Hills, and Edward WA3YLC of Anaheim were our visitors. Welcome. The issue of changing dues to reflect how members received the newsletter was discussed and it was concluded that it was not worth the extra effort needed to keep track of several different levels of dues payers. There were 3 3.4 GHz kits left for people who have not picked them up. It was voted to use these as door prizes at MUD 2009. SBMS purchased 6 of the omni 10 GHz antennas from Dan, W6DFW for future beacon projects. .Doug, K6JEY talked about the use of long DC cables to power mobile microwave transverters, the concerns of using AC inverters and switching power supplies. Robin, WA6CDR talked about the use of liaison radios during the contest. 28 people present.

Scheduling.
12-13 Sept ARRL Sept VHF QSO Party.
19-20 Sept ARRL 10 GHz and up contest
25-27 Sept 2009 ARRL/TAPR Digital Com Conference Chicago, IL.
1 October- Mismatch errors in Noise Figure measurement- Dick Kolbly, K6HIJ

23-25 Oct Microwave Update 2009 Dallas TX
5 November- Rein W6SZ on using WSPR digital mode on microwaves
3 December- 1296 MHz rig designs
7 January- Agilent on New equipment
4 February- Open- Suggestions?
MUD 2010 Wednesday October 20 ----- Sunday October 24 Los Angeles area. SBMS sponsoring it.

Gary, W6KVC (center) receiving his Technical Achievement Award from Jeff, KN6VR secretary (left) and President John, KJ6HZ **.**

Activity reported at the August SBMS meeting: Doug, K6JEY got Rein, W6SZ on 10 GHz and has a 78 GHz dish system; Jeff, KN6VR went to the tune up party to find his radio needed help; Larry, K6HLH has 3456 MHz now on his tower; Brian, AF6NA went to the tune up party and has plans for getting on the air; Jerry, N7EME went to the tune up party, has fixed is rig, built the 3 GHZ kit but found out it needs filter on output and exchanged some devices to improve the NF and output power; Dick, K6HIJ wrote a paper on Noise figure mismatch errors for MUD and the October talk and now has a 17 inch lathe in his shop; Dan, W6DFW built 24 slot 10 GHz omni antennas; Mel, WA6JBD did lots of other stuff than fixing his 10 GHz rig; Rein, W6SZ now has a 10 GHz rig and did some 2 meter EME with K6JEY; Robin, WA6CDR moved the dish in his shop; Ben, KD6EJT has a 2 GHz dish; Ed, WX6DX did a talk at Cal State Fullerton; Chris, N9RIN now has a NF meter and did some 10 GHz rig work; Kurt, K6RRA found a nice crimper at Harbor Freight, built the lock light for the Rubidium; Paul, KB5MU has a Thunderbolt GPS source; Michelle, W5NYV built a DB6NT 10 GHz rig; Tom, WB6UZZwas at the tune up party with a working rig; Dennis, W6DQ had fun hosting the BBQ following the tune up party and is setting up his 10 GHZ rig from the home QTH; Walt Clark gave a demo on G-Line transmission using his 10 GHz demo gear; Ed, W6OYJ indicated that W1GHZ has filters on his web page; Bill, WA6QYR had rig problems as noted on the Tune up party list and is fixing them; Dick, WB6DNX had 24 GHz rig problems noted at the tune up party and is fixing them; John, KJ6HZ had a broken rig at the tune up and now all is well.

Wants and Gots for sale.
Want 25 ft of 18 gage DCC wire Kurt K6RRA@ham-radio.com
Sell- 10 GHz omni slotted waveguide antennas $60.00 kit you solder or $85 assembled Dan Welch W6DFW@apex-scientific.com
Want- 10 GHz parts to build a rig and FT817 or other all mode IF radio and test equipment. Brian Thorson AF6NA 909-226-7015/ 909-930-8426/ thorsbc@sce.com
Sell- Connerflex 24dB 2.4 GHz dish pulled from Australia terrestrial pay TV service Make offer Edward Sum eysum@netzero.net

Threads
[Mw] Crystal Detectors
Hi gang; I acquired a couple of crystal detectors in the weekend....
An HP 8470A (Neg) 10MHz - 18GHz is all the info I know about it, and a Singer (hard to read model #) maybe 1400.I have no freq range info.
But let's just talk about the HP unit. I have never used a crystal detector like this N-Connector RF in and BNC out (presumably DC voltage).
How does one make use of one of these; i.e., assuming it hasn't been destroyed by the previous user ..., what can I do with it? What max input pwr level, etc?

Coming soon will be some Q's on a bunch of circulators and isolators that I haven't been able to find any info on; maybe someone will recognize the make and model # for these items. I will post a set of pix to my www site for you guys to peruse and comment on.
Thanks so much, Dave VK2TDN

VK2TDN & The Microwave Group de K2RIW, 8/17/09.
Dave, Concerning an HP 8470A Crystal Detector.
I think you just obtained a very handy piece of test equipment. I often use these (with RF attenuators, and/or a Directional Coupler) to monitor the specific power output, and the envelope shape (like the rise time) of an RF waveform. I observe this with an oscilloscope (and/or a DVM); with a 50 ohm cable that is connected to the BNC output connector.
I find it is best to first "calibrate" the Detector System by observing the Video Voltage you get for known RF input power levels from a calibrated Signal Generator.
A DATA SOURCE -- If you do a "Google Search" with the word "HP 8470A", you will find data on the subject. The third answer Google supplies is:http://servv89pn0aj.sn.sourcedns.com/~gbpprorg/mil/cavity/HP__coaxialcrystal.pdf This web site is a page of the 1989 HP Catalogue that displays the performance data and pictures of 10 of the HP Crystal Detector products -- including the HP 8470A.
HP 8470A SPECIFICATIONS -- Here is some of the data for the HP 8470A Crystal Detector. I have added some comments; my comments start with a # sign:
(1) The 50 Ohm RF Input (the type N connector) has a VSWR of less than 1.2:1 up to 4.5 GHz, and less than 1.7:1 up to 18 GHz.
(2) The maximum RF input power is 0.1 watt. # Beyond that power you might damage the internal crystal detector element, which is a replaceable cartridge component -- the whole HP 8470A unit can be disassembled.
(3) The "Low Level Sensitivity" is rated at greater than -0.4 millivolt of Video Output per each micro-watt of RF input. # I believe most crystal detectors display this kind of so-called "square law" transfer characteristic (Power input versus volts output), up to a power input of about -20 dBm (10 micro-watts). Then they gradually slide over into a "linear law" of transfer characteristic (RF volts input to Video volts output) for higher input powers.
TERMINATION -- I believe the HP specification requires something like a 50 ohm termination on the BNC Video Output connector, in order to realize the maximum Video Bandwidth. When used that way the Crystal Detector can have a Rise Time of about 5 nano-seconds. Some fast oscilloscopes have a "50 ohm impedance" that can be selected from the front panel. If not, you can provide this by placing a BNC "T" connector with a 50 termination on one leg, at the front panel of the oscilloscope.
If you use a higher impedance termination on the Crystal Detector Video Output terminal, you will get more output voltage, but the response time will be slower. That's the trade-off.
ESD -- Be careful that your cables are properly discharged before you make any connection to the Crystal Detector. A remaining Electrostatic Voltage of about one volt could potentially damage the unit. Their response time is fast, but they are slightly delicate.
Good luck with your new piece of test equipment.
73 es Good VHF/UHF/SHF/EHF/EME DX, Dick, K2RIW

At Last months SBMS meeting Walter brought us a demo on G-lines. Here is some info from the internet...
Bill WA6QYR
Single-wire transmission line --From Wikipedia, the free encyclopedia single-wire transmission line (or single wire method) is a method of supplying electrical power through a single-wired electrical conductor. Single wire earth return (SWER) or single wire ground returns today supply single-phase electrical power to remote areas at low cost.

History In 1729, the English physicist Stephen Gray noticed the phenomenon of electrical conductivity. Essentially, electric currents may be transmitted from one body to another along a conductor, and all conductors contain movable charges of electricity. At the end of the 19th century, Nicolas Tesla demonstrated that by using an electrical network tuned to resonance and using, what at the time would be called, "high frequency AC" and today would be low frequency AC, only a single wire was necessary for power systems, with no need for a metal or Earth return conductor. Tesla called it the "transmission of electrical energy through one wire without return". [1] Tesla stated in 1901,

> "Some ten years ago, I recognized the fact that to convey electric currents to a distance it was not at all necessary to employ a return wire, but that any amount of energy might be transmitted by using a single wire. I illustrated this principle by numerous experiments, which, at that time, excited considerable attention among scientific men." [2]

In the spring of 1891, Tesla gave demonstrations with various machines before the American Institute of Electrical Engineers at Columbia College. His lecture exhibited this feature, the chief import exhibited that all kinds of devices could be operated through a single wire without a return conductor. The one-wire transmission system was protected in 1897 by U.S. Patent 0,593,138, "Electrical Transformer".

A Goubau line, or G-line for short, is a type of single wire transmission line intended for use at UHF and microwave wavelengths. [3] The line itself consists of a single conductor coated with dielectric material. Coupling to and from the G-line is done with conical metal "launchers" or "catchers," with their narrow ends connected for example to the shield of coaxial feed line, and with the transmission line passing through a hole in the conical tips. Planar Goubau Lines with applications at terahertz frequencies have also been demonstrated recently [4].

While Goubau-Line, which uses a conductor having an outer dielectric or special surface conditioning provided to reduce the velocity of the wave on the conductor, has long been known, a more general transverse-magnetic (TM) mode has recently been discovered and demonstrated which does not have this limitation. "E-Line" is similar to Goubau-Lines in its use of launchers couple to and from a radially symmetric wave propagating in the space around a single conductor but different in that it can operate on insulation-free conductors, including those that are polished and completely unfeatured. The propagation velocity of the wave is not reduced and is accordingly quite close to that of a wave traveling in the same medium in the absence of any conductor at all.

Contrary to Goubau's assertions, it has been shown both possible and practical to launch a surface wave around an uninsulated conductor without special conditioning and without reducing the wave velocity, while still using launchers of practical size. In addition, conductors much larger than those used by Goubau have been shown to be completely adequate.

Of particular practical value, common uninsulated single or multistrand overhead power conductor may be used to support very low attenuation propagation over the entire frequency range from below 50 MHz to above 20 GHz while employing a launch device of only 15-20 cm in diameter. This makes available the worldwide installed base of overhead power lines for very high rate information transport. Propagation velocity for this line operating in air has been measured to be within 0.1% of that of a free wave in air. The effects of line taps, bends, insulators and other impairments normally found on power distribution systems have proven to be predictable and manageable.

Numerical solutions of Maxwell's equations for three dimensional models of simple launcher devices coupling to an ideal, smooth conductor have confirmed the low attenuation, high bandwidth, high propagation velocity and that the vast majority of the propagated energy remains quite close to the conductor surface, all in agreement with measurement. An series of articles on the theory, operation and application of this new transmission line type is available as is a more complete article: Introduction to the Propagating TM Mode on a Single Conductor.

Patents

- U.S. Patent 6,104,107, "Method and apparatus for single line electrical transmission". Avramenko, et al.
- U.S. Patent 2,685,068, "Surface wave transmission line". George J. E. Goubau
- U.S. Patent 2,921,277, "Launching and receiving of surface waves". George J. E. Goubau.

- U.S. Patent 7,009,471, "Method and apparatus for launching a surface wave onto a single conductor transmission line using a slotted flared cone". Glenn E Elmore
- U.S. Patent 7,567,154, " Surface wave transmission system over a single conductor having E-fields terminating along the conductor " Glenn E Elmore

References and notes

Citations

1. ^ "Why did Tesla make his coil in the first place? What was it that he was trying to accomplish? Other than just the fun of making one, do they have any practical purposes?", tfcbooks.com.
2. ^ Nicolas Tesla, "Talking with the Planets (1901)". Collier's Weekly, February 19, 1901, page 4-5
3. ^ Geog Goubau, "Surface waves and their Application to Transmission Lines," Journal of Applied Physics, Volume 21, Nov. (1950)
4. ^ Tahsin Akalin, "Single-wire transmission lines at terahertz frequencies", IEEE Transactions on Microwave Theory and Techniques (IEEE-MTT), Volume 54, Issue 6, June 2006 Page(s): 2762 - 2767
5. Further reading

- Toby Grotz, "Wireless Transmission of Power, an Attempt to Verify Nikola Tesla's 1899 Colorado Springs Experiments, Results Of Research and Experimentation". Proceedings of the 26th IECEC Conference, vol. 4 (1991).
- N. Tesla, "The True Wireless". Electrical Experimenter (May 1919).

Helix antennas

To The Microwave Group 8/02/09

INTRODUCTION -- Joe, K0VTY just asked some interesting Helix Antenna questions (E-mail below). I thought others might be interested in my understanding of some answers. I claim to have 35 years of antenna engineering experience. However, I have built very few Helix Antennas during that time. I'm using "general antenna engineering principles" to answer specific Helix Antenna questions. Therefore, please feel free to correct my mistakes. 73 es Good CP & Helix Antenna DX, Dick, K2RIW

K0VTY es The MW Group de K2RIW 8/02/09

SOME HELIX ANTENNA CHARACTERISTICS By Dick, K2RIW 8/02/09

Dear Joe, I believe the Helix Antenna was invented by John Kraus, W8JK, in the late 1940's. I think he said the basic impedance is something like 120 ohms. I'm guessing that the fraction of the first turn with the shim stock, that does the impedance matching, is about 1/4 wavelength long. A "pure" 1/4 wavelength impedance matching transformer in that location should have an impedance of (120 x 50) ^0.5 or 77.5 ohms.

THE IMPEDANCE MATCH -- In reality the first 1/4 turn has a spacing to the Ground Plane (the Reflector) that varies, therefore the impedance is also changing along the length. That doesn't stop it from being a good 1/4 wave impedance matching transformer, it just make the calculation more difficult; and believe it or not, it slightly increases the bandwidth of the match. One of the most broadband impedance matching techniques is called a Minerva Line. This technique uses a line that slowly tapers between the two impedances. But, unfortunately it requires many wavelengths to do it well. A 10:1 frequency range is almost easy with this technique if you have enough wavelengths of the tapered section.

TINKERING IS GOOD -- By empirical experimentation a skilled amateur will find the correct Helix-matching solution that gives a match across most of the frequency range he is interested in.

HELIX VERSUS YAGI -- A long Helix Antenna has a strong similarity to a long Yagi Antenna. In both cases a major portion of each antenna really is a "slow wave structure". The wave being received from space travels more slowly near the boom. That plus Huygens Principle causes the wave to "fold in" toward the "Driven Element" region, similar to the action of a magnifying glass. Every "End-fire Antenna" with significant Gain must have an Effective Capture Area that is a lot larger than what

your eye sees when you look down the axis (boom) of the antenna. For instance, a 19 element 432 MHz RIW Yagi has a Gain of about 15 dB/d, and an Effective Capture Area of a 5.7 foot diameter circle. When you look down that 1" diameter boom you only see a
bunch of Elements that are about one foot long. But, that 432 MHz RF wave "sees" something that is much bigger.
HELIX GAIN -- A well tuned Helix will have a Gain that is very similar to a Yagi of the same boom length, and the number of Turns of the Helix will be similar to the number if Elements of the Yagi. Most of the difference in Gain can be accounted for by comparing the Circular Polarization of the Helix versus the Linear Polarization of the Yagi. A CP signal really has half of its power in the Horizontal Polarization, and half its power in the Vertical Polarization (for instance).
ELEMENT SENSITIVITY -- You can take a well tuned long Yagi, completely remove
the Reflector Element, and re-tune the Impedance Match to the Driven Element. A naive person will think the Gain will fall off by 3 dB because all the signal from the back hemisphere is not being reflected forward any more. In reality you will loose about 0.4 dB of Gain, depending on the antenna length. The Slow Wave Structure of all those Directors out in front is really doing most of the work -- their focusing action is where most of the Effective Area is coming from.
THE PHASE ERROR -- Therefore, I wouldn't worry about the exact phase of the
signal that is propagating across a particular turn of the Helix; the total system is not that sensitive to small changes. Also, a long Yagi that has its Gain Maximized will have Directors that differ in length in a complicated manner -- it's not just a simple taper. The differences in Director Length are forming a Slow Wave Structure that is synthesizing a particular "Velocity Profile" along the boom. That particular Velocity Profile will maximize the Focusing Action. Similarly, a long Helix Antenna with maximized Gain at one particular frequency will have turns that differ in diameter, and spacing.
AXIAL RATIO TESTING -- Measuring the Axial Ratio (AR) of a CP antenna on an
outdoor antenna range is an art form; and on an indoor range it could also be difficult. About the only way I know to do it is to first set up a good Linear Polarized, Reflective Ground Plane Antenna Range. Do some Field Probing to confirm that the area for testing the Antenna Under Test (AUT) is large enough, and it has less than a 1/2 dB of variation across the required area. Then use a purely LP Test Antenna to confirm that there is nothing but an LP signal at the test area -- let's say an apparent Range AR of at least 25 dB; 40 dB would be even better. Then place the Helix at the test location and rotate it about its axis (in Polarization), while not changing the Bore sighting -- that's not easy, without using a fancy rear-mounted ball-bearing rotation assembly, or a greased coaxial tubing plus tripod holding assembly.
HOW MUCH AR IS OK, LP SIGNAL -- Don't be too severe. It would be nice to brag
about having an antenna with an AR of 0.1 dB. However, in many situations a CP Antenna with an AR as bad as 3 dB will work reasonably well. For example, if a particular LP signal from an Oscar Satellite is 10 dB above threshold, than the 3 dB of QSB you'll see during the Satellite rotation will not be very noticeable. Achieving a low AR on a short Helix is not easy; it might require the use of a Quadra-Helix design.
HOW MUCH AR IS OK, CP SIGNAL -- If a CP Oscar Signal had perfect AR, your
antenna would only receive an added 0.13 dB of attenuation because of your antennas 3 dB of AR. I know at first, that relationship doesn't seem to follow "good common sense". You would only loose 3 dB of the CP signal if your antenna was LP (an AR of infinite dB). See the chart labeled, "Polarization Loss between Two Elliptically Polarized Antennas" in the "Antenna Engineering Handbook".

I hope this helps. As you learn more of the crazy characteristics of CP Antennas, your local amateurs may start to call you "an Antenna Guru". Some antenna engineers think that CP is a "Black Art" because the 3D Vector Equations that quantify the operation are quite difficult to understand. 73 es Good CP Antenna DX, Dick, K2RIW

From: k0vty <k0vty@juno.com>
To: k2riw@riwproducts.com
Hi Dick (K2RIW)
I enjoy your ability to explain antenna theory. I have for years attempted to learn more about the helix prime feed antenna. The use of a shim stock soldered to the first 1/4 WL of the helical coil next to the

reflector for a matching method, that has bugged me. The reason is a statement in "Antennas", 2nd edition, by John D Kraus. That statement relates to the need to maintain an equal phase between all turns.
When using the shim stock method of matching, the part of the turn with the shim stock attached is bent, changing the turn phasing. This is done without mention of where the helical turns count begins. I've seen work done by Stan Woods on AO-40 for the 2401 MHz down link helical antenna, and began a somewhat similar approach to learn more. What I accomplished appears to work well for 50 Ohm matching. In fact it is very sensitive to VSWR adjustment. I have not measured the AR to determine if the matching arrangement has impacted the CP. Before I build a far field measuring ability, I had a notion you might teach me more of my wandering ways. Thanks Dick Joe, K0VTY

As usual, a very interesting and informative dissertation from K2RIW.
Kraus determined the Helix to have a free-space impedance of 140-ohms. I have built several using a micro strip impedance transformer of 1/4 turn (very close to 1/4 WL if the circumference is near 1 WL, which was the design dimension that John Kraus used, mostly). Some folks make the impedance strip adjustable at the connection with the Helix (vary the spacing above the ground-plane). I found that it was very forgiving and broadband. However, I did not find that the axial helix gain was as good as a similar length yagi. I much prefer using an X-yagi with phasing to create CP...Or a septum wave guide antenna for mw frequencies 73, Ed - KL7UW http://www.kl7uw.com/raseti.htm
I'I have built 7 helix antennas and beginning work on my 8th for 435 MHz. These covered frequencies 435 MHz, 1.2, and 2.4 GHz. Do to the forgiveness of the helix, all have been successful but I'm still not an expert at this.
Probably the best construction and matching articles are in AMSAT Journal. I would highly recommend them. If you don't have them, I can help you with copying the most important ones. They are so well done that they should included in the ARRL antenna manual.
AMSAT Journal articles on helix construction.
Mar/Apr 2004 VE3NPC
Nov/Dec 2005 VE3NPC
May/June 2006 VE3NPC
July/Aug 2007 VE3NPC
May/Jun 2008 N4NAB
Sep/Oct 2008 VE3NPC
the 140 ohm matching problem can be solved several ways, but VE3NPC's adjustable 1/4 matching technique is the best I've ever built. I would highly recommend this method over the shim method. It's build the antenna then match with antenna with a screw adjuster which will dip the SWR to 50 ohms at match.
There are several websites with construction articles. Please email me and I'll forward them to you. This will give you some ideas for building.
Finally, there are many ways to build a helix and it's all up to the builder's imagination. They are fun to build and make an interesting conversation piece out in the back yard.
All the best from Indiana.
Mike (K9QHO)

Mike, over the years we have tested about 100 Helix antennas on the CSVHFS Ranges and at 3 AMSAT conferences. Only about 1 in 5 could meet the min. definition of circular polarized.
Only about 1 in 10 were circular polarization that matching technique gives you a good SWR, but can completely ruin Axial Ratio. Just because the antenna is a corkscrew doesn't mean it can't
be virtually as linear polarized as a Yagi. Axial Ratios of 10 and 12 dB were common.
Virtually all the AMSAT Helix antennas were copies of copies of copies and few were ever actually tested. I have NEVER seen a Helix wound on a Plastic pipe that actually worked on its design frequency. The plastic pipe introduces a velocity factor into the helix of about 60%. Thus the signal is only going down the helix about .6 as fast as you think it is. The turn's ratio is badly compromised. Yes, the plastic pipe can be made to work, but hours and hours on the antenna range is necessary. Attempts at computer optimizing have gone poorly when translated to the real world. Er of the plastic in water pipe is rarely known, and when published was usually measured at 10 kHz, not 2.4 GHz. Supporting the helix on a single boom with each turn touching the helix at the same point also does not work. G4DDK showed that the dielectric in the boom drags the wave on that side. Thus if you have that support on the top, then the helix has a 10-20 deg squint upward. The squint means the turns towards the end of the helix are not getting all the energy they

are suppose to. Thus squint and poor gain. The traditional NASA technique supporting the helix on as few spokes as possible from a central support is the only technique that seems to work. The on-line calculators for Helix antennas seem to be 3-5 dB too hot. Kent WA5VJB

In the fine print, Kraus admits the gain increases with larger diameter helix, more than one wavelength. I've built a pair with the largest diameter he says works and phased them for 436 satellite up links. They were reported by the user to have worked well. The feed Z also went up. I used a coax line of 1/2" copper pipe with a #16 or 18 center conductor to hook them together as I recall. I also played with terminating the front of the helix with three steps of progressively smaller conductor sat quarter wave increments. 1/4" copper for the main helix, then maybe3/16", then #10 copper weld, then #18 copper weld. Drilling the end of the #10 copper weld for a neat and strong junction to the #18 was a pain as I recall.73, Jerry, K0CQ

Preamp isolation issues
John Randall wrote: Hi all,
So you have just purchased a super duper preamplifier, but are there any pitfalls when connecting/disconnecting it up. For example should one remove power before changing from one antenna to another, should one ground the new antenna before connecting it to remove any static build up, Is there a "norm" in handling one's precious preamplifier What’s the pro's and con's? 73 John - M0ELS

Hello John, Some casual thoughts:
1. Use antennas that have a DC grounded feed system or power dividers/summers that are DC grounded so all components ahead of the preamplifier input are DC grounded.
2. Use good coaxial relays to isolate the preamplifier on TX is using a common coax for Rx and TX and if you use separate coax, one for RX and one for TX. Make sure the relay isolation in the OFF state is high enough to not damage the preamplifier.
3. Some profess to keep the preamplifier powered up all of the time since the active devices have a greater ability to sustain high levels of RF than if it were not powered in TX. I prefer to have lotsa relay isolation, possibly doubling up on relays for added isolation when running very high RF power.
4. Suitably layout your coaxial cables to avoid stray RF pickup. And keep coaxes away from rotator control lines, and high power AC lines.
5 Suitably suppress transients at relay coils; counter EMF, with fast diodes. Also suppress any transients on the DC power leads to the preamplifier with Bypass caps, etc.
6. After the antenna system is all installed, tested, and sealed, short out any static charge on the center conductor, before applying it to the preamplifier input.
7. Add over voltage protection to the DC power line to the preamplifier. Consider reverse power protection diodes at the preamplifier to prevent really stupid errors...
8. Make sure the preamplifier is unconditionally stable so it will not oscillate and radiate into other antenna systems.
9. Be sure to isolate all preamplifiers in your system when you are transmitting on that band or any other band, unless other RF distributions are suitably protected with band pass filters ahead of that preamp, for that band.
The biggest problem I have had causing preamplifier failure is to not isolate that preamplifier when TX on other bands with legal limit.
Just some random thoughts. Time for lunch...Stan, W1LE   FN41sr   Cape Cod

Jim Miller wrote:
There is no reason to use VOX, break in or semi break in on the microwave bands. The rate of exchange is just not that snappy. I would agree if one were talking only about weekend/casual microwaving on activity days or contests. What if one were interested in data communications and wanted to switch a half-duplex link electronically? I've been following this "Preamp Protection" thread in hopes of learning about solid-state T/R switching and/or receiver protection.   I would like to experiment with these things on my boring little 3cm terrestrial rig as well as my club's 3cm EME equipment where we have
>50W on TX with a chain of LNAs on RX. Obviously this can be done mechanically with relays; I wish to learn about other ways of doing it. Personally, I am interested in amateur microwave as a way to expand my technical knowledge and skills - not to make a couple terrestrial QSOs a month (or a couple per year on

3cm EME). Just because full-break-in might not be needed doesn't mean people wouldn't be interested in how to do it. 73 de Jim N8ECI

Jim,
  You have a good point. Digital communications sometimes use a ping-pong protocol where you will transmit for a few milliseconds, and switch to receive for a few. Often what you want to do is build a "booster" which has both a power amplifier and a receive LNA with appropriate switching to simply add to a digital transceiver. I have successfully done so on 900 MHz using a combination of a high quality circulator, bias control and a solid-state T/R switch. The major problem with using a circulator is that you can get into trouble if the antenna return loss is disrupted, such as can happen with ice or birds or their droppings. Therefore, I decided to use a circulator on the transceiver end of the power amp/LNA booster, and a solid state switch on the amplifier/LNA antenna end.
 There are several solid state TR switches made for this purpose, many cheap ones that are meant for 200 milliwatts, a few for 1 watt, and very few for 10 watts. Most of them are designed for the "802.11" 2450 MHz band, but often will show performance parameters at other frequencies.
Some are only available in small quantities (10 units), some suppliers have evaluation boards, usually $100 or more, complete with connectors.
I found that keeping bias ON at the LNA was fine as long as I achieved sufficient isolation for the power being transmitted. Most LNAs will take -10 dBm at their input without any problem, some even higher. If you are transmitting 10 watts, that is +40 dBm, so you will need a total isolation of 50 dB or better to assure no damage in this example.
Interestingly, I found that the power amplifier I was using created an RF spike when I switched its bias on quickly - which may be because the output impedance was not managed correctly. I ended up leaving the bias ON all the time, and never had a problem because the LNA isolation was adequate. Again - this is just my experience - yours will probably be different with different components.
Beware, if you are "switching" both the input and output of your amp/LNA setup, as though you were adding a "booster" to your transceiver, and you decide to always leave EITHER the LNA or Power Amp on all the time, (as I did) then of course the other amplifier (and therefore both) will be on some of the time. Do a gain analysis to make sure that there is no chance of feedback. For instance, if the power amp has +40 dB gain and the LNA has +30 dB gain, that is a total of 70 dB gain. If the input relay and the output relay isolations added together total 70 dB or less, it will most certainly result in a high power oscillator whenever both amplifiers are on at the same time. You might want at least a 20 dB margin, probably even more for at least two reasons: 1) during the transition of the switch the isolation can be worse than in either operating state, and 2) it is possible, even likely that at some frequency other than the operating one, one or both amplifiers will have more gain than stated, and maybe the switches will have less isolation.
Best of luck. Tom WA1MBA

Conversions-
Degrees decimal to sexagesimal (degrees, minutes, seconds)
121.135 degrees
Take the whole number as degrees 121
Take the decimal and multiply by 60 minutes 0.135 x 60 = 8.1 minutes
Take the minutes whole number 8.
Take the decimal and multiply by 60 seconds 0.1 x 60 = 6 seconds
121 degrees, 8 minutes, 6 Seconds

Sexagesimal to decimal
121 degrees 8 minutes 6 seconds

Write the number of degrees		121.
Number of minutes divided by 60	8/60 =	0.133333
Number of seconds divided by 3600	6/3600 =	0.001666
		121.134999

Brian, KI6TWT on Frazier working the 10 GHz contest on his mobile 10 GHz slotted waveguide omni antenna. It was working better than his 30 inch dish at the time.

. 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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