TAPR #109 AUTUMN 2009

PACKET STATUS REGISTER

President's Corner

By Steven Bible, N7HPR, President, TAPR

To say it's been a busy quarter is an understatement! Today I am happy to be writing as TAPR's newest President. At the annual board meeting prior to the Digital Communications Conference in September, we also elected new officers as we do every year.

The TAPR board has named Dave Toth, VE3GYQ, as President Emeritus. Dave is battling cancer and it was really great to see him at the DCC. We all wish Dave the very best as he continues to serve TAPR as President Emeritus.

Scotty Cowling, WA2DFI was elected as Vice President. It is really great having Scotty on the TAPR board and now serving in an officer's position. Scotty has brought a lot of energy into the TAPR leadership and has been instrumental in the HPSDR manufacturing. Simply put, we could not have done it without him.

Stan Horzepa, WA1LOU, has been reelected to Secretary. Stan serves not only as our resident scribe, but also as a board member. His lucid thinking and deep history of ham radio always help keep us on track.

Tom Holmes, N8ZM, was reelected as Treasurer. Tom has been outstanding in his money counting. Tom has helped us with some very big money projects and as you can read in the treasurer's report, TAPR remains very healthy monetary wise. And we plan to keep in that way.

We have a new board member, Mark Thompson, WB9QZB. Mark has been very active in TAPR co-hosting the DCC in Chicago this year and last. We look forward to Mark's new perspectives. A big thank you to Eric Ellison, AA4SW, who has served on the board the past three years. Eric was instrumental in helping along the HPSDR effort.

The 28th Annual ARRL and TAPR Digital Communications Conference is a wrap. It was a great conference with some very interesting technical papers presented. Many thanks to Ron Steinberg, K9IKZ, for the AV equipment; Kermit Carlson, W9XA, for AV setup, control and local co-host; Mark Thompson, WB9QZB,

local co–host; Gary Pearce, KN4AQ, for DVD recording and production; Larry Wolfgang, W1RB, for representing ARRL HQ (hope you gained some new soldering skills :–)); Brennan Price, N4QX, for representing ARRL HQ; Dick Isley, W9GIG, and Howie Huntington, K9KM, for representing the ARRL Central Division; Phil Parton, N4DRO, for representing Kenwood Communications; Scott Honaker, N7SS, for representing ICOM America; Dennis Motschenbacher, K7BV of Yaesu for the donation of the VX–8R for the banquet prize; and Bill Brown, WB8ELK, for being our banquet speaker.

As you can see, there are many people that make TAPR go. You don't have to be an officer or board member. We are always looking for motivated and energetic volunteers. You will find it a rewarding (and sometimes frustrating) experience. Won't you come join us?

– Steve, N7HPR

###

KD2S, TAPR's 1st President, SK

By Tom Clark, K3IO

It is with much sadness that I report the passing of Den Connors, KD2S, on September 3, 2009. Den passed on after a year+ fight to conquer lymphoma.

This morning, Ralph, KD1SM, reported, "Den checked–in to our weekly club information net on 70cm Monday evening. As usual, he sounded pretty chipper. Very shortly after that he developed a serious infection and his non–existent immune system could do nothing."

Den was TAPR's first president, overseeing the transition from a local Tucson club into the multi–national TAPR. He was a major sponsor of the adoption of AX.25 as the amateur packet standard. Under his lead, TAPR introduced the TNC–1, then later the TNC–2.

Den worked with me to define an amateur store–and–forward packet radio satellite; this morphed into the Microsats (AO16–16, IO–26. AO–27 & MO–30).

Den moved to Pepperell, Massachusetts about 25 years ago to work at Wang Computers.

73, Den –– You will be missed by all your friends!

###

All PSR Issues Are Now Online

By Stan Horzepa, WA1LOU

All current and back issues of TAPR's quarterly newsletter, *Packet Status Register* (*PSR*), are now online and accessible at www.tapr.org/psr

The newsletters are in *Adobe Acrobat* format.

Thanks to John Ackermann, N8UR, Phil Karn, KA9Q, John Koster, W9DDD, and Darryl Smith, VK2TDS, for helping to fill in the gaps in the collection.

By the way, we can automatically notify you by e–mail whenever a new issue of *PSR* is available for downloading by signing up here:

https://www.tapr.org/cgi–bin/mailman/listinfo/psr–announce

And we can automatically e–mail new issues of *PSR* to you whenever a new issue is available by signing up here:

https://www.tapr.org/cgi–bin/mailman/listinfo/psr–pdf

###

Short Bits

Codec–2

A new low bit open source codec named "Codec2" is currently under development by David Rowe, VK5DGR. This low bit, 2400 kbit/s codec is being designed to provide communications quality speech and will have applications to meet the low bandwidth requirements of HF/VHF. With a goal of having speech quality near that of MELP and AMBE, this Codec2 should quickly gain acceptance in the ham radio community. To follow along with this project, see David's web site at http://www.rowetel.com/ucasterisk/codec2.html

(From Mel Whitten, K0PFX)

###

TAPR Twitter

We have set–up a Twitter account for TAPR to keep TAPR members and digital enthusiasts aware of TAPR's events & activities.

The TAPR Twitter account can be accessed at: http://www.twitter.com/taprdigital

(From Mark Thompson, WB9QZB)

###

Toward Open Source Hardware

The *University of Dayton Law Review* has published John Ackermann's, N8UR's, article titled "Toward Open Source Hardware."

John quips, "It may be the only law review article in history to include a schematic diagram (as well as samples of netlist and Gerber files)!"

The PDF is about 750 kbytes: here's a link:

http://www.febo.com/law/Ackermann_Open_Source_Hardware_Article_2009.pdf

The Bluebook citation form is John R. Ackermann, Toward Open Source Hardware, 34 U. Dayton L. Rev. 183 (2009).

###

Hear WA2DFI Speak About HPSDR

TAPR's Scott Cowling, WA2DFI, talks about HPSDR, high performance software–defined radio. (16 minutes) on RAIN (http://www.therainreport.com/rainreport_archive/rainreport–10–2–2009.mp3)

###

HPSDR setup at the 2009 TAPR–ARRL Digital Communi–cations Conference (DCC) in Chicago. (K0PFX photo)

Assembly of the HPSDR Transceiver "ZEUS"

Consisting of TAPR boards Ozy, Mercury, Penelope, and Atlas EU, class A driver amplifier and corresponding power supplies

By Hans Hartfuss, DL2MDQ

The HPSDR transceiver has been built into a cabinet similar to the one used for the FLEX–5000A, Schroff, Ratiopac Pro Air ¾, 42TE 315T. Width and depth are identical; the height is smaller by one unit and corresponds to the width of EU boards.

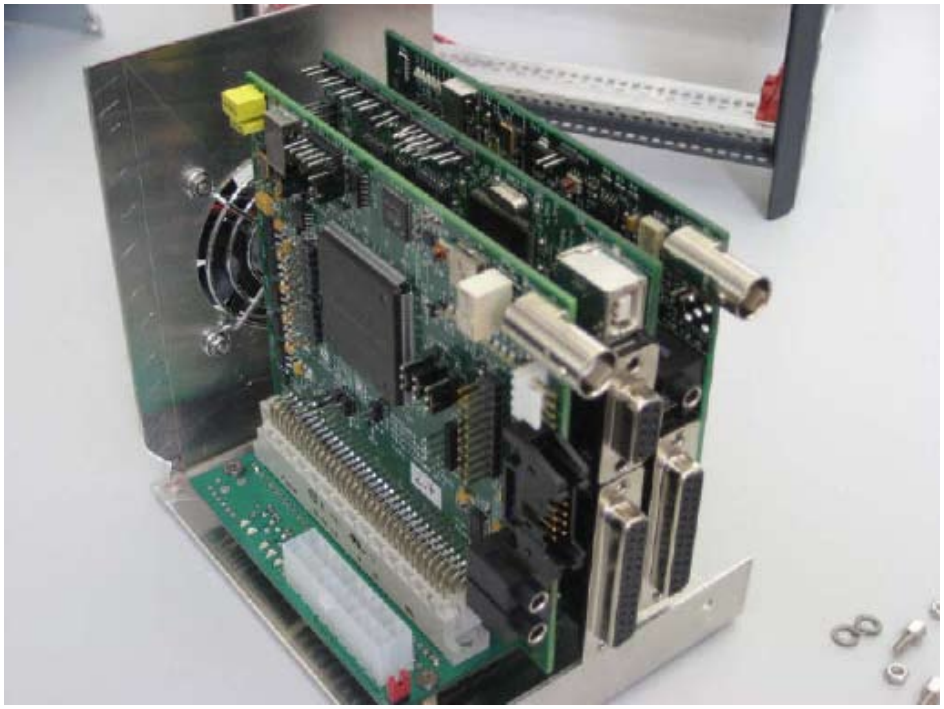

Fig.1: *The 3 boards Mercury (receiver), Ozy (control) and Penelope (transmitter) plugged into the 3 slot Atlas EU board in the common upright position. Atlas is mounted to a bended aluminum sheet whose width corresponds to the width of EU boards. With this open assembly and a PA the first QSOs have been conducted.*

Fig.2: *The connector side of the boards is closed with an aluminum sheet too. All notches have been worked out very carefully resulting in good fitting accuracy; the boards are therefore nicely fixed in the Atlas slots allowing for any mounting orientation.*

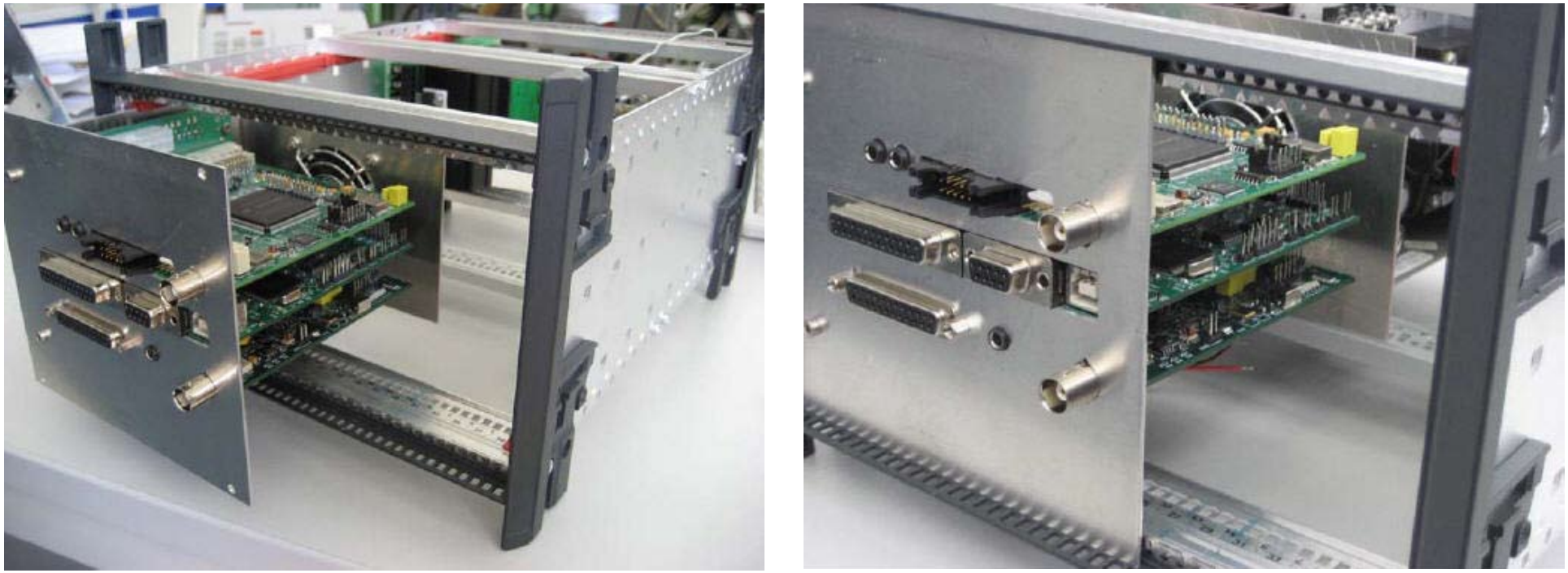

Fig.3: *The assembly in the housing is then accomplished by turning 90 degrees and shifting into the red EU card tracks to the left. The empty space on the right side is foreseen for the Alexiaris boards.*

Fig.4: *View to the closed unit. On the right side another board is mounted which connects Mercury and Penelope to the T/R relays' inside the box. This will later be replaced by the two Alex boards.*

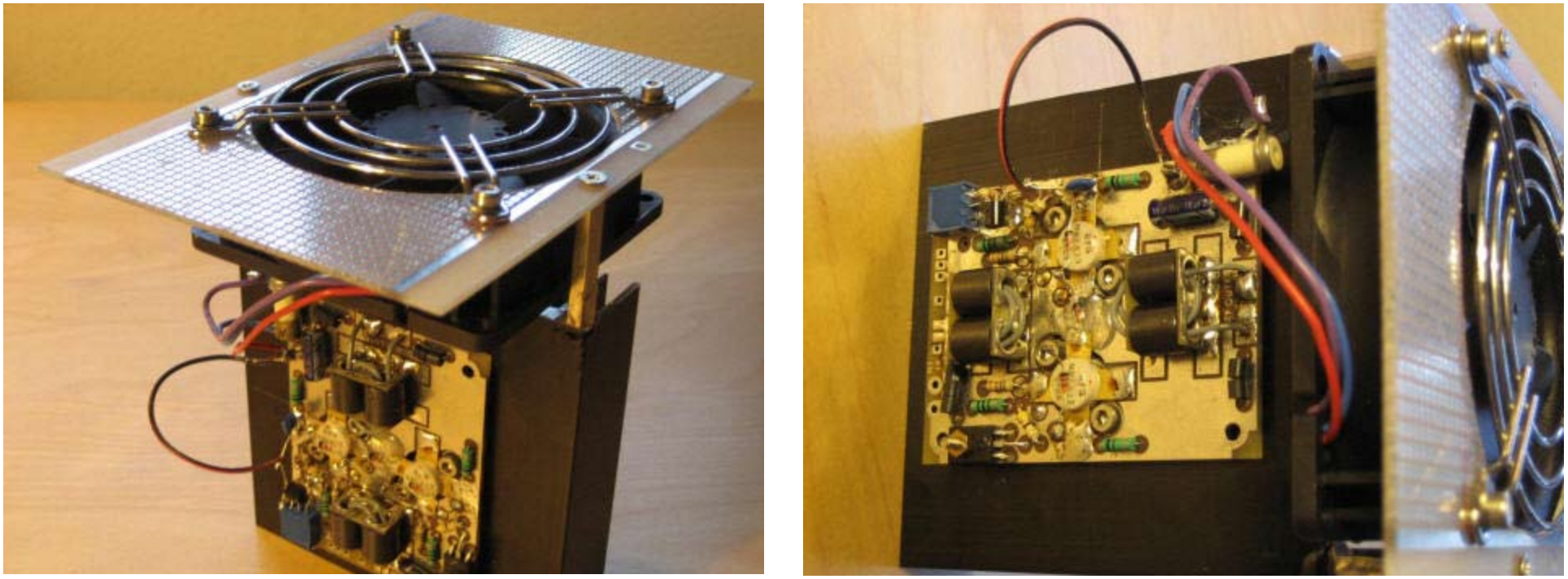

Fig.5: *Because of the high quality (linearity) of Penelope, the following driver stage built of 2 x MRF 433 (modified CCI-kit AN779H) is run in class A with 3.5 A total current, a measure which demands for active cooling. The driver delivers at maximum Penelope output about 10 W. At 6 W PEP, sufficient to drive my MosFET PA to 750 W, IMD3 of the driver is almost –50 dB.*

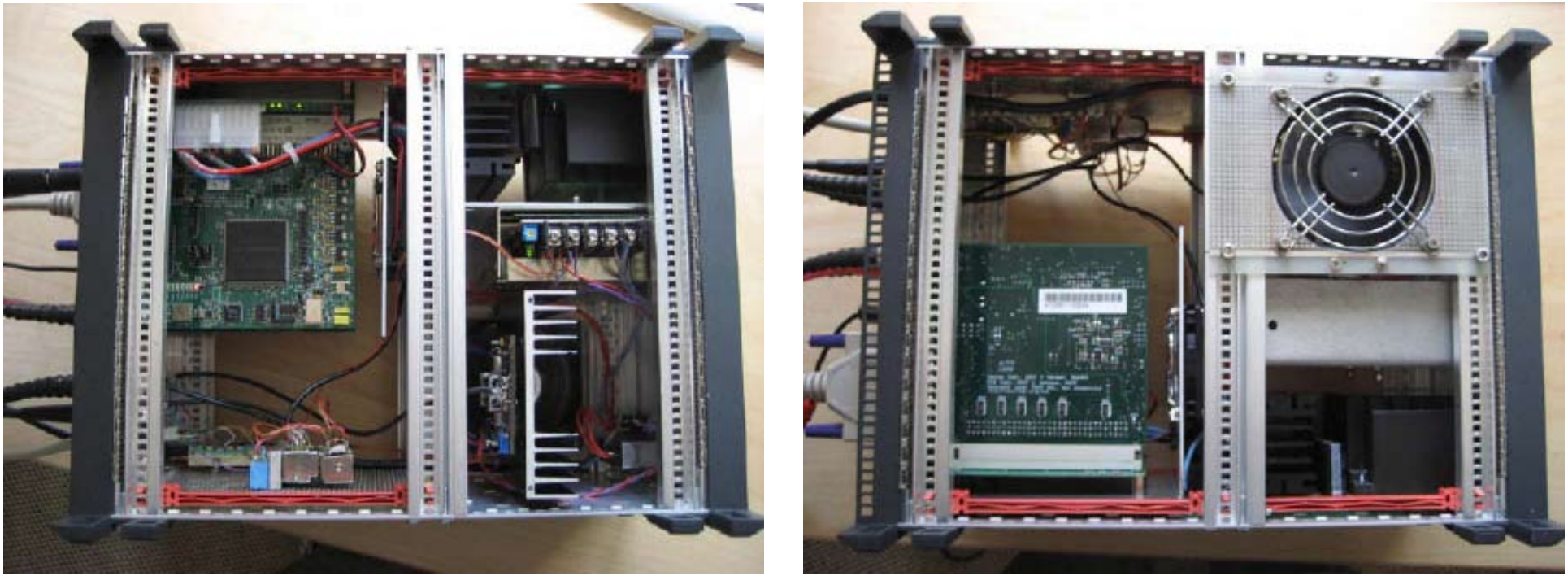

Fig.6: *View from above and below into the fully assembled ZEUS transceiver showing in addition the power supplies, linear regulated ±12V, 5V, for Mercury and Penelope, as well as the 14V, 5A switching supply for the class A driver.*

###

Using APRS in the Polish Alps

By Bob Bruninga, WB4APR

Wife arranged a quick visit to see daughter in Poland, I carried the VX8R, mic/GPS, and lightweight charger to avoid baggage charges on my one rolly bag under 10 kg. Without the manual, there was a lot of on–the–job training. After 12 hours in Heathrow and Stanstead airports in London, I copied two APRS stations.

On arrival in Krakow, Poland, my radio filled completely (40 stations) in 30 minutes. Although it takes five key functions to move from one station text to another, eventually I got into a rhythm and could scan through all 40 stations in a few minutes to see what was going on around me.

Coverage in the Old City Krakow with all the tourists was good. Using the above scrolling technique, I found one frequency object and three stations announcing their frequencies.

Glad to see they were up on the New–N paradigm as well! But since I did not know the repeater offset in Europe, nor the tones, I was never able to make a contact. I sent BLNs asking about the frequencies etc, but never got a message back. Shame on me for not doing my homework before I got there.

The next day we went along with my daughter's student group and their Polish professor south on a bus to Zakopanek, then a small bus to the mountains where we were dumped along side the road and pointed up the mountains saying "its only a short walk from here."

Our rolly bags gave us the big advantage to all the hikers with heavy backpacks... for the first 30 minutes. Then it was a scene out of *Laugh–In* as we had to carry our rolly bags the next 6 km and two hours up the mountain path to the "lodge."

Next day, the short 300–lb Polish professor suggested we go on a short hike (4 km and 600 m straight up). We got to the top of Grzes at 1650 meters with clear horizon in almost all directions on the Slovac border. The HT was buzzing with stations, and I was excited to enter mine.

Anyone who has heard my talks has heard me say that "no one needs a GPS unless they are lost or cannot read a map." So I had left my GPS down at camp, and figured I would just pull it off the map when we got wherever the professor was leading us. Later we learned his nickname was "mountain goat."

The trail had lots of people, everyone had a map of all varieties. No one had a GPS, and none of the maps had any coordinates! So my radio continued to beacon my position as if I was in Krakow! ARGH...

We had lunch sitting amongst the bushes out of the wind and then we started back down, but not the mountain goat. He said "no, this way." My wife and I and the English professor, who was also along suggested "no... this way." Three hours later we were back at the lodge, but I was able to monitor the travelog on my HT from my daughter and her friends who followed the mountain goat up another 6 km along the mountain ridge and 400 m up to the mountain Wolowiec at 2050 m. As they came down, there was snow and a group in front of them slipped and slid and had to be evacuated by helicopter.

Anyway, using only the VX8R slipping in and out of my pocket was a joy. Also, I think next trip I will not take the speaker mic, but just use the GPS attached right on the HT. I normally never use a speaker mic on any of my HTs as just something else in the way, so I think I bought the speaker mic/GPS to make sure it was high on my body. But the sensitivity of the VX8R GPS is so good, that using the GPS mounting clip to the HT itself would better match my style and be more compact.

The radio ran all day (10 hours or more) and the VX8R was still running on its original charge. I did not use the GPS, but I was in frequent QSO with my daughter, so the radio was on the whole time.

###

Minutes of TAPR Board Meeting, September 24, 2009

Begin Meeting – 7:30 AM

Attendance: Steven Bible, N7HPR; Dave Toth, VE3GYQ; John Ackermann, N8UR; Tom Holmes, N8ZM; Scott Cowling, WA2DFI; John Koster, W9DDD; Laura Koster, and two guests

Election of Officers

Dave Toth nominates Steven Bible as president. John Koster moves to close. Unanimous vote.

Dave Toth nominates Scott Cowling as vice president. John Koster moves to close. Unanimous vote.

Steven Bible nominates Stan Horzepa as secretary. John Koster moves to close. Unanimous vote.

Scott Cowling nominates Tom Holmes as treasurer. John Koster moves to close. Unanimous vote.

John Ackermann moves to thank Dave Toth for his four years as president, Dave will serve as President Emeritus. Seconded. Unanimous vote.

Office Report

Sales in 2008 and 2009

Treasurer's Report

Bank Report

Putting money into CDs discussion.

Inventory

Equipment Inventory and depreciation

Updating signature cards on bank account. Motion by Scott Cowling. Second by John Ackermann Unanimous vote.

Policy documents required for IRS: Document Retention Policy, Whistleblower Policy, Joint Venture Policy, Conflict of Interest Policy.

Dave Toth moves to adopt the Document Retention Policy. John Koster seconded. Unanimous vote.

Dave Toth moves to adopt the Whistleblower Policy. John Ackermann seconded. Unanimous vote.

Dave Toth moves to adopt the Joint Venture Policy. John Koster seconded. Unanimous vote.

Dave Toth moves to adopt the Conflict of Interest Policy. Scott Cowling seconded. Unanimous vote.

Break for lunch – Noon

Projects

Timing Projects

Doing another batch of TADD–1s.

Redoing Clock–Block.

Fat–PPS.

TADD–2 sales doing well, people generally happy.

TADD–2 mini prototypes built – this is next priority.

Ultra low noise distribution – no progress since Hamvention.

HPSDR

LPU – Out May at Hamvention. 500 kits made. 1000 PCB ordered.

Pandora – Out since just after Hamvention. Sold 211. Interest list had around 300. 400 Ordered.

John Ackermann makes a motion that TAPR's policy to recognize the efforts of volunteers in a way determined by the President. Scott Cowling seconded. Unanimous vote.

Pennywhistle – 500 kitted. PCBs came in yesterday. Heat sinks are to arrive next week (10–week lead time). Steve Niles, N5EN, and Walter Holmes, K5WH, kitting volunteers.

Excalibur – Waiting on TCXOs, due to arrive 1st week in October. Need volunteers to kit.

Alexiares (Alex) – Trouble with toroids. Have all

sample cores. Next is testing.

HPSDR Engineering Phase

Phoenix – QSD–QSE on one PCB. Alpha boards built.

Hermes/Apollo – Pen and Merc on same PCB.

HPSDR Alpha Funded

Magister – Ozy replacement. Prototypes in testing.

Aussie–II – Ethernet Ozy.

Cyclops – 1GHz Spectrum Analyzer.

No–name – Signal Generator as tracking generator to Cyclopes.

HPSDR Budgeting

Excalibur – Oscillators $12K PCB $1K (October).

Pennywhistle – PCB $1K Heat sinks $6K (October).

Magister – $10K Q4–2009.

Alex – Have to pre–order as expensive kit.

Alex Enclosure – Need plan.

Discussion on PowerSDR support of HPSDR

DCC 2010

Discussion on location for 2010 DCC

Meeting adjourned to online session at 5:30 PM.

###

At its September meeting, the TAPR Board of Directors finalized and adopted policies required by the Internal Revenue Service, i.e., policies regarding conflict of interest, document retention and destruction, joint ventures, and whistleblowers. Those policies, as adopted by the Board, begin on this page and continue on the following three pages.

TAPR Conflict of Interest Policy

This Conflict of Interest Policy of Tucson Amateur Packet Radio Corporation ("TAPR"): (1) defines conflicts of interest; (2) identifies classes of individuals within TAPR covered by this policy; (3) facilitates disclosure of information that may help identify conflicts of interest; and (4) specifies procedures to be followed in managing conflicts of interest.

1. **Definition of conflicts of interest.** A conflict of interest arises when a person in a position of authority over TAPR may benefit financially from a decision he or she could make in the capacity, including indirect benefits such as to family members or businesses with which the person is closely associated. This policy is focused upon material financial interest of, or benefits to, such persons.

2. **Individuals covered.** Persons covered by this policy are TAPR's officers, directors, and employees who have been authorized to make expenditures on behalf of the organization.

3. **Facilitation of disclosure.** Persons covered by this policy will annually disclose or update to the President on a form provided by TAPR their interests that could give rise to conflicts of interest, such as a list of family members, substantial business or investment holdings, and other transactions or affiliations with businesses and other organizations or those of family members.

4. **Procedures to manage conflicts.** For each interest disclosed to the President, the President will determine whether to: (a) take no action; (b) assure full disclosure to the Board of Directors and other individuals covered by this policy; (c) ask the person to recuse from participation in related discussions or decisions within TAPR or, if the person refuses to resign, become subject to possible removal in accordance with TAPR's removal procedures. The President will monitor proposed or ongoing transactions for conflicts of interest and disclose them to the Board of Directors in order to deal with potential or actual conflicts, whether discovered before or after the transaction has occurred.

Adopted by the Board of Directors on September 24, 2009.

###

TAPR Document Retention and Destruction Policy

This Document Retention and Destruction Policy of Tucson Amateur Packet Radio Corporation identifies the record retention responsibilities of staff, volunteers, members of the Board of Directors, and outsiders for maintaining and documenting the storage and destruction of TAPR's documents and records.

1. Rules. TAPR's staff, volunteers, members of the Board of Directors and outsiders (i.e., independent contractors via agreements with them) are required to honor these rules: (a) paper or electronic documents indicated under the terms for retention below will be transferred and maintained by TAPR Office; (b) all other paper documents may be destroyed after three years; (c) all other electronic documents may be deleted after one year; and (d) **no paper or electronic documents will be destroyed or deleted if pertinent to any ongoing or anticipated government investigation or proceeding or private litigation.**

2. Terms for retention.

a. Retain permanently:

Government records – Charter and amendments, Bylaws, other organizational documents, governing board and board committee minutes.

Tax records – Filed state and federal tax returns/reports and supporting records, tax exemption determination letter and related correspondence, files related to tax audits.

Intellectual property records – Copy rights and trademark registrations and samples for protected works.

Financial records – Audited financial statements, attorney contingent liability letters.

b. Retain for ten years:

Pension and benefits records – Pension (ERISA) plan participant/beneficiary records, actuarial reports, related correspondence with government agencies, and supporting records.

Government relations records – State and federal lobbying and political contribution reports and supporting records.

c. Retain for three years:

Employee/employment records – Employee names, addresses, social security numbers, date of birth, INS Form I–9, resume/application materials, dates of hire and termination/separation, evaluations, compensation information, promotions, transfers, disciplinary matters, time/payroll records, leave/comp time/FMLA, engagement and discharge correspondence, documentation of basis for independent contractor status (retain for all current employees and independent contractors and for three years after departure of each individual).

Lease, insurance, and contract/license records – Software license agreements, vendor, hotel and service agreements, independent contractor agreements, employment agreements, consultant agreements, and all other agreements (retain during the term of the agreement and for three years after the termination, expiration, non–renewal of each agreement).

d. Retain for one year:

All other electronic records, documents and files – Correspondence files, past budgets, bank statements, publications, employee manuals/policies and procedures, survey information.

3. Exceptions. Exceptions to these rules and terms for retention may be granted only by TAPR's Board of Directors.

Adopted by the Board of Directors on September 24, 2009.

###

TAPR Joint Venture Policy

This Joint Venture Policy of Tucson Amateur Packet Radio Corporation requires that TAPR evaluate its participation in joint venture arrangements under Federal tax law and take steps to safeguard TAPR's exempt status with respect to such arrangements. It applies to any joint ownership or contractual arrangement through which there is an agreement to jointly undertake a specific business enterprise, investment, or exempt–purpose activity as further defined in this policy.

A. Joint ventures or similar arrangements with taxable entities. For purposes of this policy, a joint venture or similar arrangement (or a "venture or arrangement") means any joint ownership or contractual arrangement through which there is an agreement to jointly undertake a specific business enterprise, investment, or exempt–purpose activity without regard to: (1) whether TAPR controls the venture or arrangement; (2) the legal structure of a venture or arrangement is taxed as a partnership or as an association or corporation for federal income tax purposes. A venture or arrangement is disregarded if it meets both of the following conditions:

(a) 95% or more of the venture's or arrangement's income for its tax year ending within TAPR's tax year is excluded from unrelated business income taxation (including but not limited to: (i) dividends, interest, annuities; (ii) royalties, (iii) rent from real property and incidental related personal property except to the extent of debt–financing; and (iv) gains and losses from sale of property); and

(b) The primary purpose of TAPR's contribution to, or investment or participation in, the venture for arrangement is the production of income or appreciation of property.

B.Safeguards to ensure exempt status protection. TAPR will: (a) negotiate in its transactions and arrangements with other members of the venture or arrangement such terms and safeguards to adequate to ensure that TAPR's exempt status is protected: and (b) take steps to safeguard TAPR's exempt status with respect to the venture or arrangement. Some examples of safeguards include:

(i) Control over the venture or arrangement sufficient to ensure that it furthers the exempt purpose of TAPR.

(ii) requirements that the venture or arrangement gives priority to exempt purposes over maximizing profits for other participants;

(iii) That the venture or arrangement not engage in activities that would jeopardize TAPR's exemption; and

(iv) That all contractors entered into TAPR be on terms that are arm's lengths or more favorable to TAPR.

Adopted by the Board of Directors on September 24, 2009.

###

TAPR Whistleblower Policy

This Whistleblower Policy of Tucson Amateur Packet Radio Corporation ("TAPR"): (1) encourages staff and volunteers to come forward with credible information on illegal practices or serious violations of adopted policies of TAPR; (2) specifies that TAPR will protect the person from retaliation; and (3) identifies where such information can be reported.

1. Encouragement of reporting. TAPR encourages complaints, reports or inquiries about illegal practices or serious violations of its policies, including illegal or improper conduct by TAPR itself, by its leadership, or by others on its behalf. Appropriate subjects to raise under this policy would include financial improprieties, accounting or audit matters, ethical violations, or other similar illegal or improper practices or policies. Other subjects on which TAPR has existing complaint mechanisms should be addressed under those mechanisms, such as raising matters of alleged discrimination or harassment via TAPR's human resources channels, unless those channels are themselves implicated in the wrongdoing. This policy is not intended to provide a means of appeal from outcomes in those other mechanisms.

2. Protection from retaliation. TAPR prohibits retaliation by or on behalf of TAPR against staff or volunteers for making good faith complaints, reports or inquiries under this policy or for participating in a review or investigation under this policy. This protection extends to those whose allegations are made in good faith but prove to be mistaken. TAPR reserves the right to discipline persons who make bad faith, knowingly false, or vexatious complaints, reports or inquiries or who otherwise abuse this policy.

3. Where to report. Complaints, reports or inquiries may be made under this policy on a confidential or anonymous basis. They should describe in detail the specific facts demonstrating the bases for the complaints, reports or inquiries. They should be directed to TAPR's President; or if that person is implicated in the complaint, report or inquiry, the complaint should be directed to the Secretary or Treasurer. TAPR will conduct a prompt, discreet, and objective review or investigation. Staff or volunteers must recognize that TAPR may be unable to fully evaluate a vague or general complaint, report or inquiry that is made anonymously.

Adopted by the Board of Directors on September 24, 2009.

###

Write Early and Write Often

Packet Status Register (*PSR*) is looking for a few good writers, particularly ham radio operators working on the digital side of our hobby, who would like to publicize their activities here.

You don't have to be Vonnegut to contribute to *PSR* and you don't have to use Microsoft Word to compose your thoughts. The *PSR* editorial staff can handle just about any text and graphic format, so don't be afraid to submit whatever you have to wa1lou@tapr.org .

The deadline for the next issue of *PSR* is January 15, so write early and write often.

###

Letters

Concerning LORAN

The article by Poul–Henning Kamp in the Spring 2009 *Packet Status Register* was a most interesting account of a simple but useful digital radio project.

However, in his description of the structure of the LORAN pulses and his chosen method of processing the LORAN signal, I was surprised that he did not mention the one aspect of the LORAN signal that I find the most fascinating, namely the coding of the 8–pulse patterns and the remarkable properties which these patterns have.

The master station emits, in the first group repetition interval, pulses of amplitudes +1, +1, –1, –1, +1, –1, +1, –1, at 1mS intervals, by which I mean that the polarity of the carrier inverts in this pattern. If we feed this signal sequence through a Finite Impulse Response (FIR) filter which has 8 taps spaced 1mS apart, and we multiply the tap values by the SAME ± pattern, and look at the resulting impulse response, we see the following sequence of 15 values..

–1, 0, +1, 0, –1, 0, –3, +8, –3, 0, –1, 0, +1, 0, –1

The +8 in the middle corresponds to the situation where all 8 pulses align with the matching tap coefficients, and the 7 values either side representing the 7 possible misalignments. The +8 value is the one we want to use, but the sidelobes of this filter are not at all pretty.

The master station emits, in the second GRI, the pulse pattern +1, –1, –1, +1, +1, +1, +1, +1. Putting this signal through the matching FIR gives us the output..

+1, 0, –1, 0, +1, 0, +3, +8, +3, 0, +1, 0, –1, 0, +1

This has the same nice +8 in the middle, the same terrible sidelobes, but notice that the sidelobes are inverted compared to those of the first GRI.

Therefore, if we add the output of the first filter from the first GRI to the output of the second filter from the second GRI, the result is a SINGLE pulse of amplitude 16, and NO SIDELOBES.

I have here ignored the contribution of the 9th master pulse. In fact I can't see what it does contribute!

Analysis of the slave pulse patterns will reveal the same property, and further analysis will show that the response of a master filter to a slave pulse (and vice versa) also the same useful features, so this clever choice of pulse patterns enables the receiver to both extract all the energy from all the pulses, and makes it very easy to pick out the desired timing information.

I have built my own LORAN receiver which uses this technique, and I am certain that this was the intention of the original LORAN designers although I have never seen this aspect of the LORAN pulse pattern described in print. I don't know if this technique could be implemented within the 8k RAM of the chip that Poul–Henning used, but other readers of PSR might find it useful – or perhaps just interesting. The LORAN network does indeed provide a very accurate source of off–air frequency and time reference, with no sign of the skywave variability that is a feature of carrier–based off–air frequency standards.

Regards

Peter Martinez G3PLX

###

About the DCC

I just wanted to drop you all an e–mail to say thank you.

My initial impressions of Chicago were that it was a nice friendly City, and that proved to be the case when I got to do the Tourist thing on Wednesday and Thursday morning. Andy invited me to a meal

with his family on Wednesday evening, it was great to see his place, his shack and make the city a bit more 'human' and not just hotel rooms (Apologies again Andy for keeping you up so late)

By chance I happened to share a shuttle bus from the airport with Larry. He immediately inquired if I was going to the conference and was keen to tell me about the recent experiments he had been conducting with PSK and the building of the kit.

Throughout the rest of the weekend, everyone I spoke to was eager both to learn and to educate, in equal measures, this was delightful to experience.

I also now have the knowledge that the proceedings themselves are not a true reflection on the event. While a resource in itself, the heart of the conference is in the presentations, the questions they generate during the presentation and then the ongoing discussion that the presentation sparks of at various stages afterwards.

Other than some sleep on the flight and on the bus I'm going now approximately 34 hours, so I think I'll call it quits.

I may not make it to DCC next year, but I will make it back.

73, many thanks for your hospitality and a great event and regards to all.

John Ronan, EI7IG

###

AIRMAIL Tutorial?

Has anyone done a "great" tutorial on AIRMAIL, the way it has been defined for MARS operators? Maybe a note in the *PSR* is needed.

Ken Zadwick, NE6Y

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USA Packet Network

I am wanting a packet day 24 hours (once a year maybe) where all stations move to one freq and see what kind of network they can make. And who they can copy/link node to node.

Where is the USA packet network, we should have one by now, its 2009 almost 2010.

Anyway, just an idea, wanting to make our Michigan network reach out to other states. So far we have one link to Wisconsin, and one to Canada.

Anyway to get this request in the *PSR*... thought maybe these people may like the idea. Also we need another packet updated list of stations on the air and what freq.

Jeffrey Ross, KC8GKF

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Steve Schultz, WB8WGY, and John Ackermann, N8UR, discuss a finer point at the 2009 TAPR–ARRL Digital Communications Conference (DCC) in Chicago. (K0PFX photo)

Noise Temperature Measurement on Mercury

By Hans Hartfuss, DL2MDQ

Noise power measurements have been conducted at 14.2 MHz on Mercury by using the calibrated digital S–meter indication from which the receiver noise temperature and the noise figure respectively can be calculated. The measurements are conducted with the Mercury input attenuator and the ADC–dithering switched off.

The available noise power P_n is given by the product

$P_n = k*T_n*B_n$

with $k = 1.38*10^{-23}$ W/K*Hz Boltzmann's constant, B_n the noise bandwidth and T_n the noise temperature. The noise power as indicated by the digital S–meter on the PowerSDR console has been used to determine the noise power within 10 different bandwidths within 5000 and 1000 Hz.

One important precondition for this measurement is the linearity of the digital S–meter used. Linearity is demonstrated in Fig.1.

Figs.2 and 5 show the stability of the baseline, an additional important precondition for this kind of measurements.

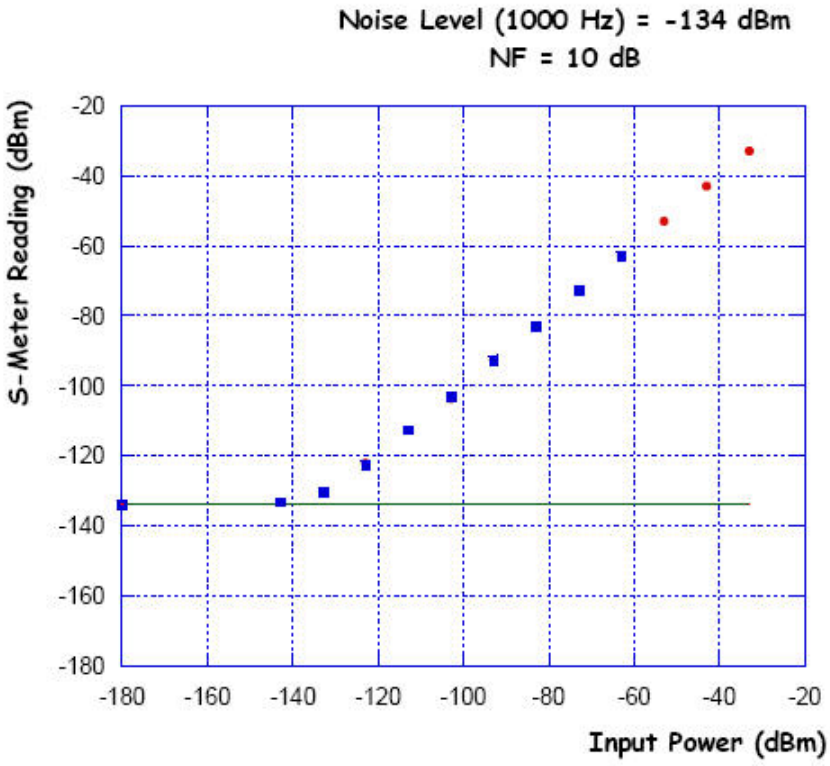
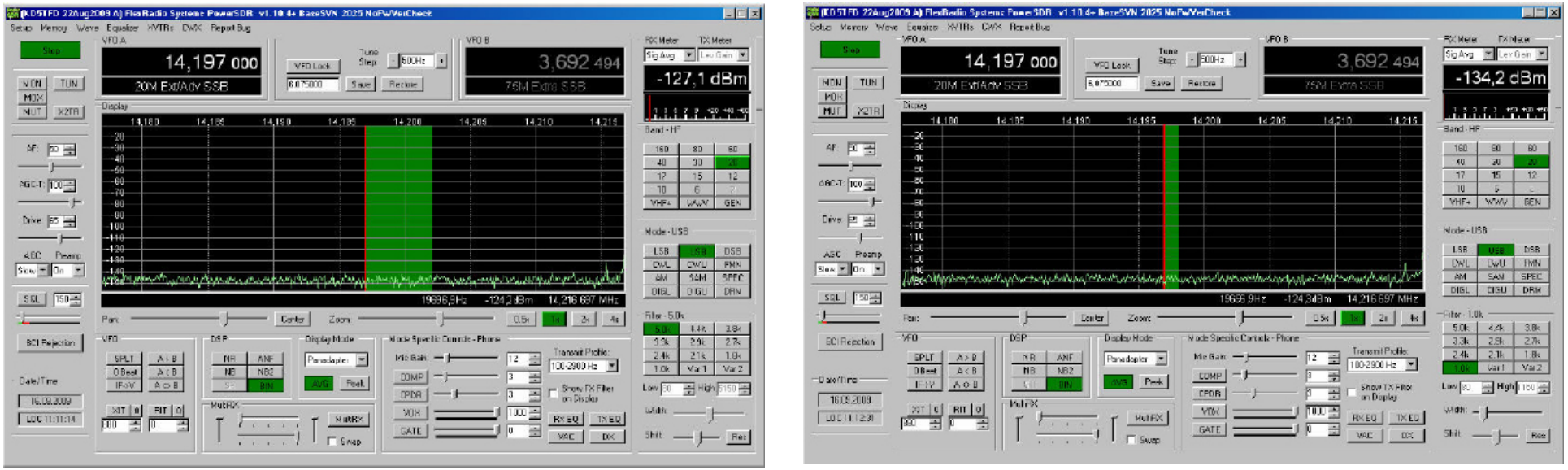


Fig.1: *The reading of the digital S–meter of PowerSDR against a 14.2 MHz input signal. Excellent linearity is obtained. Deviations are a few 0.1 dB in maximum. At very low input levels the reading approaches the noise level corresponding to –134.1 dBm within 1000 Hz (green horizontal line).*



Figs.2: *The screen shots show how the measurements are being conducted using the digital S–meter reading in PowerSDR (upper right). At 5 kHz bandwidth (upper) the total power within filter band is –127.1 dBm. At 1 kHz (lower) it is –134.2 dBm, 7.1 dB lower, in good agreement with expected 7 dB =10*log5. (These screen shots are not taken with a precise 50 Ohm termination directly at Mercury as during the other measurements described. They give higher noise temperatures by about10% corresponding to about 0.5 dB in NF).*

It is assumed that the filter edges are infinitely steep compared to the filter bandwidth which means rectangular shaped filter transfer function, a reasonable assumption. The bandwidth B indicated on the PowerSDR console then equals – at least is very close to the noise bandwidth B_n.

The temperature $T_n = P_n/k*B$ calculated from the 10 different bandwidths are given in Fig.3. They do not vary in a systematic way and do scatter only slightly around the average value confirming the assumptions made. The average noise temperature derived is $T_n = 2538$ K.

The noise figure in dB as calculated by referring $T_n = 2538$ K to $T_0 = 290$ K is given by: NF (dB) = $10*\log((T_n/T_n) + 1) = 10*\log((2538/290)+ 1) = 9.89$ dB.

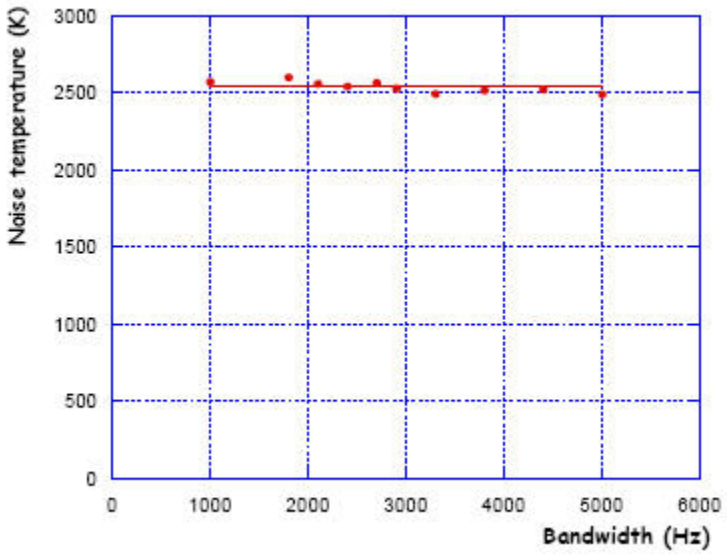


Fig.3: *The noise temperature as derived from noise power measurements at 10 different bandwidths. The average value derived is 2538 K corresponding to 9.9 dB noise figure.*

A second, the standard method used by electronic engineers has been used as well by applying a signal from a generator which increases the power indication by 3 dB (see Fig.4). The measurement has been conducted at a bandwidth of 2700 Hz. The Mercury noise power within this band referred to the input is given by the digital S-meter and is –130.1 dBm. Referring to 1 Hz gives –34.31 dB less noise power.

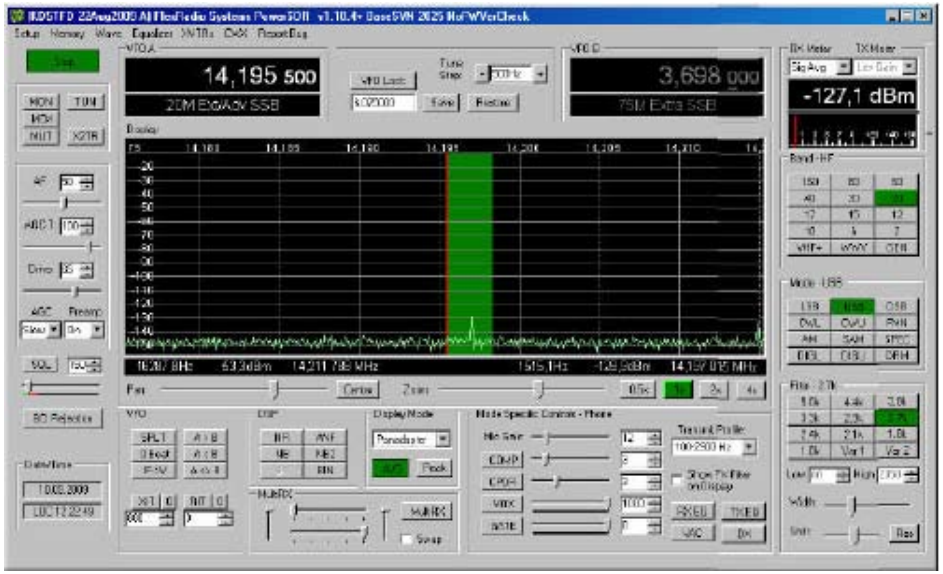


Fig.4: *The standard method of noise figure measurement has been used as well applying a signal which increases the total power within the 2700 Hz bandwidth by 3 dB. The necessary power is –129.8 dBm.*

By adding –129.8 dBm of power from a calibrated signal generator (TTi TGR 1040) through a calibrated attenuator (Narda 4705B–69) the power reading increases by 3 dB to a value of –127.1 dBm. The noise figure derived is:

NF (dB) = –129.8 –34.31 + 174 = 9.9 dB

Trusting the absolute power indication of –130.1 dBm for 2700 Hz bandwidth (Panadapter baseline), NF = –130.1 –34.31 + 174 = 9.6 dB results indicating an (acceptable) overall error of a few 0.1 dB.

The values derived in this way are in good agreement with the value derived via the noise temperature calculations described before.

The preamplifier used in Mercury is the LTC6400–20, a low noise, low distortion differential 20 dB amplifier dedicated to drive the subsequent ADC. The data sheet gives a noise figure of 6.2 dB below 50 MHz corresponding to a noise temperature of 919 K.

The input circuit of MERCURY has in front of the preamp the low pass Nyquist filter and a transformer whose combined loss factor L (L > 1) can be calculated from these figures:

Cascading noise temperatures the total noise temperature of the receiver system T_n is

$T_n = T_p(L–1) + L*T_{pa}$

where the first term is the contribution of the network in front the preamplifier, T_p being the physical temperature of the lossy circuit components, and the second term is the noise temperature of the preamp referred to the input.

With T_{pa} = 919 K from the data sheet, T_n = 2540 K as measured, and T_p = 290 K the physical temperature of the circuit, L = 2.3 results corresponding to about 3.7 dB loss of the input circuit in front of the preamp which seems to be a reasonable value.

Under the same conditions the spectral power density as given by the Panadapter baseline has carefully been measured. It gives the noise power per FFT–bin. Figs.5 give screen shots with a zoomed Panadapter vertical scale with 2 dB steps around about –150 dBm. The value varies with sampling rate (SR) selected.

PowerSDR uses in the Panadapter representation of the spectrum 4096 bins. The width of the spectrum corresponds to the sampling rate. Therefore the noise power density per bin varies with SR and is expected to increase by 3 dB when increasing the sampling rate by a factor of 2. Figs.5 give the result for SRs of 48, 96, and 192 kHz.

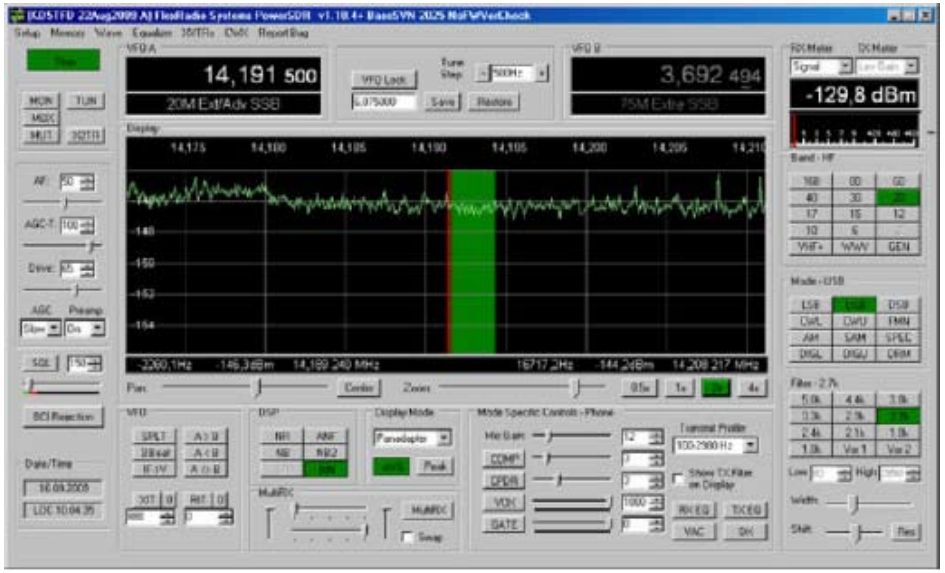
Using the noise temperature of 2538 K as derived before, the noise bandwidth B_b of one bin is

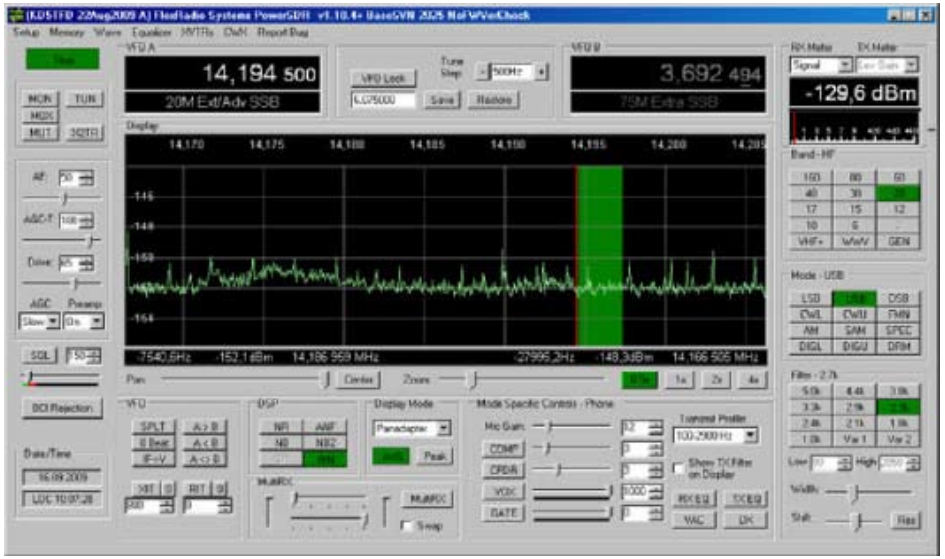
$B_b = (P_n) /(k*T_n) = (P_n) /(1.38*10^{-23}*2538)$

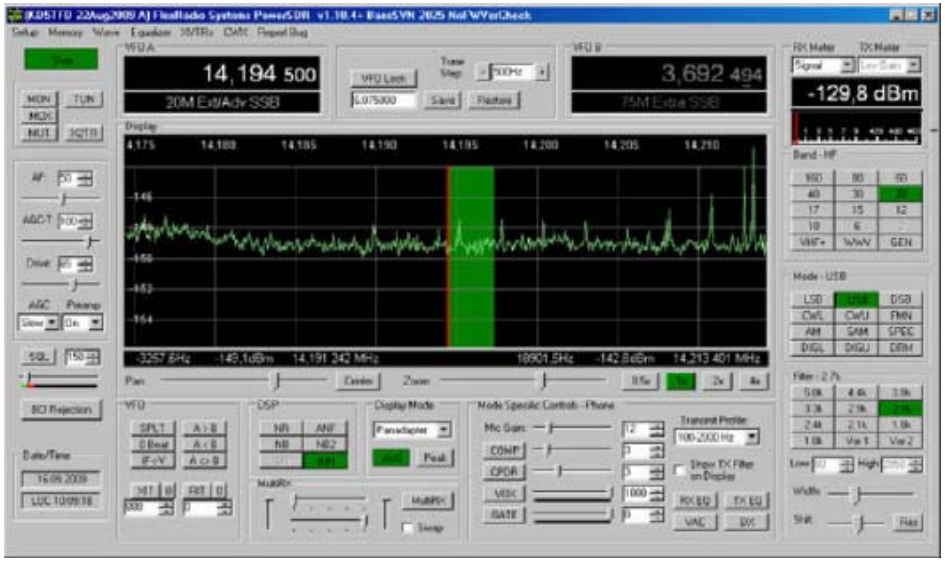
With the 3 measured values of P_n for the various SR, 3 different bandwidths B_b can be derived. For comparison the expected bandwidth B_b^{exp} = SR/4096 is given too:

SR (kHz)	48	96	192
P_n (dBm)	–152.1	–149.3	–146.3
B_b (Hz)	17.6	33.5	66.9
B_b^{exp} (Hz)	11.7	23.4	46.9

The value SR/4096 gives the spectral distance of the bins. It seems that probably due to some smoothing and averaging effects realized in the FFT code, the effective bandwidth of one bin is larger by about a factor of 1.5.







Figs.5: *The Panadapter baseline for 3 different sampling rates 192, 96, and 48 kHz from the upper to the lower screen shot. Vertical scale is 2dB per unit, averaging time is 8000 ms. The baseline gives the noise power per FFT–bin and therefore varies by 3 dB when increasing the sampling rate by a factor of 2 since the number of FFT–bins in the Panadapter is held constant at 4096 bins.*

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