President's Corner

Hamvention with TAPR

By Steve Bible, N7HPR

Hamvention is nearly here and TAPR will be present in full-force! The biggest ham radio convention of the year runs from May 20 to May 22 in Dayton, Ohio and TAPR has plans to fill your Hamvention weekend.

Booths

TAPR's booths will be in the Ballarena section of the HARA Arena (booths 451 through 454; same location as past years) where we will show what we have been up to lately. You can visit our booths and other inside exhibits 9 AM to 6 PM on Friday, 9 AM to 5 PM on Saturday and 9 AM to 1 PM on Sunday.

Board Meeting

An in-person TAPR Board of Directors meeting will occur Thursday evening at The Hilton Garden Inn Dayton South/Austin Landing, 12000 Innovation Drive, just off I-75 (exit 41) south of downtown Dayton. All TAPR members are invited to attend the meeting and speak their piece. The meeting starts at approximately 7 PM.

TAPR Forum

Friday at 9:15 AM, Scotty Cowling, WA2DFI, will moderate the TAPR Forum in Room 1 of the HARA Arena. This years' speakers include:

- My "Introduction"
- Kai Siwiak KE4PT, *QEX* Editor, on "Write for *QST/QEX*"
- Corey Shields KB9JHU, on "SatNOGS - A network of open source satellite ground stations"
- Bryan Fields, W9CR, on "HamWAN High Speed IP Radio Network"
- Chris Testa, KD2BMH, on "SDR Disrupt"
- Michael Ossman, AD0NR, on "HackRF Update"

The full description of the TAPR Forum presentations follows this article.

TAPR is a community that provides leadership and resources to radio amateurs for the purpose of advancing the radio art.

Dinner

The 10th annual TAPR/AMSAT dinner takes place on Friday evening at the Kohler Presidential Banquet Center, 4572 Presidential Way, Kettering, OH 45429.

Attendees will digest a delicious dinner (menu below) and then listen to Michelle Thompson, W5NYV, give an after-dinner speech, "It's just software, right?" Her talk will be about the AMSAT Ground Terminal (who, what, when, where, why, and how we're designing Open Source radio solutions for the next generation of AMSAT payloads).

Michelle is AMSAT's Team Leader for the design and execution of the AMSAT Ground Terminal. Its goal is to create a "5 and Dime" (5 and 10 GHz) digital SDR transceiver to support voice and data modes, for general QSOs and emergency communication for the Phase 4B satellite and future AMSAT projects.

A true renaissance woman, in addition to being an engineer and a licensed Amateur Radio operator, Michelle has worked for Qualcomm, attends Burning Man, and is a longtime DEFCON participant. She is also the lead for Organ Donor (an AI pipe organ). Her Phase 4B Weekly Ground Engineering Reports are fascinating reading.

Doors open to a cash bar at 6:30 PM and dinner begins at 7 PM. Reservations are required and must be made by 6 PM by Tuesday, May 17. Purchase tickets for $35 online at the AMSAT Store <http://tinyurl.com/j378rn6>.

One change this year: there will no printed tickets for the dinner. Rather there will be a list of ticket purchasers at the banquet to check-off as people arrive. So no tickets to dispense or to lose.

Here is the Menu:

- Hors d'oeurves
- Fresh/grilled vegetables with dip
- Prime rib of beef with au ju
- Chevre Apricot chicken breast with sauce
- Panko crusted salmon with Newburg sauce
- Double stuffed baked potatoes
- Broccoli with lemon bleu cheese sauce
- Sweet potato casserole
- Salad and dressings
- Rolls
- Assorted layered cakes and cheesecakes
- Coffee, iced tea and water

Michelle Thompson, W5NYV, Our After-Dinner Speaker

The Crew

The folks behind the scenes at TAPR will be at Hamvention, so you will have an opportunity to say "Hello" and have an eyeball QSO with the TAPR crew.

I hope to see you in Dayton!

73,

Steve Bible, N7HPR, President TAPR

###

2016 Hamvention TAPR Forum Schedule

Friday, May 20, 2016

Moderator: Scotty Cowling, WA2DFI

Bio: Scotty was first licensed in 1967 and has been continuously active since that time. He is active while mobile on HF CW and on APRS. Scotty is an advisor for Explorer Post 599, a BSA-affiliated ham club for teens in the Phoenix area. He has been involved in the openHPSDR project for the last 9 years and is a TAPR Director and past TAPR Vice President. Scotty is also active in the production of openHPSDR components and other SDR projects. He is a co-founder of iQuadLabs, LLC, a supplier of openHPSDR systems and other Software Defined Radio components. He currently works at Zephyr Engineering, Inc, a computer consulting company that specializes in FPGA design and SDR hardware.

Friday, May 20, 2016

9:15 – 9:25 AM

"Introduction" by Steve Bible, N7HPR, TAPR President

9:25 – 9:35 AM

"Write for QST/QEX" by Kai Siwiak KE4PT, *QEX* Editor

9:35 – 10:00 AM

"SatNOGS - A network of open source satellite ground stations" by Corey Shields KB9JHU

Abstract: Cubesat operators tend to have few ground stations of their own and rely on amateur operators to help collect telemetry. With cubesat deployments on the rise, more and more data is lost as there are not enough ground stations listening. The SatNOGS Project is a Network of Open Source Satellite Ground Stations, focusing on Low Earth Orbit (LEO) satellites. In this presentation, we introduce SatNOGS as a way to increase the amount of data collected from these satellites and returned to their operators. Learn what the SatNOGS project is, how it works, and what we have planned for the future of Amateur Radio satellite reception.

Scotty Cowling, WA2DFI, moderates the TAPR Forum

TAPR is a community that provides leadership and resources to radio amateurs for the purpose of advancing the radio art.

Bio: Corey, KB9JHU, was first licensed in 1995 and his interests in radio cover the entire spectrum. The digital space has always been a strong interest, from using APRS in support of public service activities to starting the first D-Star repeater in Bloomington, Indiana. He currently works at Mozilla (the creators of *Firefox*) in IT systems.

10:00 – 10:25 AM

"HamWAN High Speed IP Radio Network" by Bryan Fields, W9CR

Abstract: This presentation will be about an Amateur Radio high-speed IP backbone concept (HamWAN) with an emphases on building regional highly available networks. Utilizing the same techniques which enable the Internet, Amateur Radio networks may be built connecting projects to the Internet or other sites. Included will be an update on the regional HamWAN network deployments.

Bio: Bryan Fields, W9CR, has been a licensed Amateur Radio operator for 20+ years. He serves on the Technical Committee of AMPRnet and as president of Florida Simulcast Group, Inc., a 501(c)3 amateur repeater club. He is a Principal Consulting Engineer with Nokia and has over a decade in the telecommunications industry. At Nokia, he is focused on wireless data performance in carrier networks and IP/MPLS networking.

10:25 – 10:50 AM

"SDR Disrupt" by Chris Testa, KD2BMH

Abstract: Tools and techniques for software defined radio (SDR) continue to evolve at a rapid pace and we'll go over the landscape and advancements in SDR technologies this past year. Numerous technologies are driving the power-price-performance curve to a new level of efficiency. We'll take a look at the mesh project of the late John

Stephensen, KD6OZH, (now a TAPR project), which helps pave the way for next-generation wireless links. Latest developments in digital voice will also be discussed.

Bio: Chris Testa, KD2BMH, got his degree in Computer Engineering from the University of Maryland. His day-job is building cloud-based services and by night, his passion is to design and build computer hardware. Chris lives in Los Angeles and likes to go back-country camping.

10:50 – 11:15 AM

"HackRF Update" by Mike Ossmann, AD0NR

Abstract: Having developed HackRF One, the world's lowest cost wideband Software Defined Radio transceiver, the HackRF project continues to produce open source hardware designs for SDR. Find out about our designs in development now and our ideas for future boards that will enable the next generation of SDR enthusiasts.

Bio: Michael Ossmann is a wireless security researcher who makes hardware for hackers. Best known for the open source HackRF, Ubertooth, and Daisho projects, he founded Great Scott Gadgets in an effort to put exciting new tools into the hands of innovative people.

###

WA1LOU Wins Hamvention Award

Frank Beafore, WS8B, chairman for the 2016 Hamvention awards recently announced winners for the annual Hamvention awards convocation. This prestigious set of awards honors the top Amateur Radio operators in the achievement areas of: Technical, Special, Club and Amateur of the year.

This year, TAPR director, secretary and newsletter editor, Stana Horzepa, WA1LOU, is the recipient of the Hamvention's Special Achievement Award, which recognizes WA1LOU as an advocate for cutting edge technologies that are now commonly used in Amateur Radio. Stana authored five books and wrote over 1,200 articles for the ARRL and TAPR while evangelizing the use of home computers, packet radio, APRS, Digital Signal Processing (DSP) and Software Defined Radio (SDR) in Amateur Radio.

Licensed in 1969 as WN1LOU, Stana has sampled almost every entrée on the ham radio menu and served in a slew of roles including Section Manager of Connecticut. Stana has driven the 735 miles to Hamvention most years since 1978 and

looks forward to doing so forever.

"My fondest memories of ham radio are rubbing elbows and making friends with the makers and shakers of our hobby who show up at Hamvention every year. Winning the Hamvention Special Achievement Award is my new fondest memory. Thanks for the memory."

###

DCC in St. Pete
September 16-18

The 2016 ARRL-TAPR Digital Communications Conference (DCC) will be held in the St. Petersburg, Florida on the weekend of September 16-18, 2016.

Hilton St. Petersburg Bayfront at 333 1st Street, South, St. Petersburg, Florida is the site of the DCC with rooms available at $109 per night (this special rate is good until August 25, 2016).

On-line, you can register for the DCC and make your hotel reservations here:
https://www.tapr.org/dcc.html

Technical papers for presentation at the DCC and publication in the Conference Proceedings must be submitted by July 31 to:
Maty Weinberg, ARRL
225 Main Street
Newington, CT 06111

Do not attach ZIP files, as these will be rejected by the ARRL e-mail server. Technical paper details and guidelines are available here:
https://www.tapr.org/dcc.html#call

###

TAPR is a community that provides leadership and resources to radio amateurs for the purpose of advancing the radio art.

TAPR is a community that provides leadership and resources to radio amateurs for the purpose of advancing the radio art.

Raspberry Pi QRP TX Shield for WSPR on 20 Meters

Nowadays, one of the most impressive QRP modes is Joe Taylor, K1JT's WSPR (pronounced "whisper") mode. WSPR stands for Weak Signal Propagation Reporter. Programs written for WSPR are designed for sending and receiving low-power transmissions to test propagation paths on the MF, HF, VHF and UHF bands. Users with Internet access can watch results in real time at www.wsprnet.org.

The QRPi board (or shield as referred by the community today) is an inexpensive way of turning a Raspberry Pi single-board computer into a QRP transmitter.

Traditionally, a low pass filter removes harmonics from a transmitter output, but leaves any broadband noise intact. With the QRPi board design the harmonics are filtered by a low pass filter and the broadband noise is filtered by a band pass filter.

To protect the clock generator output stage of the Pi, a buffer amp is provided for isolation. This also provides a boost to the TX signal.

So join the group of Whispering Raspberries on 20 meters by ordering a TAPR 20M-WSPR-Pi today.

The price for the 20M WSPR-Pi is:

$ 29 US for members of TAPR

$ 29 US for non-members

plus shipping/handling, if applicable.

For more information, visit
http://www.tapr.org/kits_20M-wspr-pi.html

###

TAPR Wear Now Available

Personalized Land's End clothing with the TAPR logo and your name and call sign are now available from the TAPR Store at
http://business.landsend.com/store/tapr/

Select from the Men's or Women's catalog. (To make shopping easier, there are "TAPR Recommended Shirts" in the Men's catalog including two styles of polo shirts, each available with or without pockets.)

The logo is available in three colors -- red, blue, and white. The name/call sign monogram thread will match the logo color. (We recommend that you use the white logo with dark colored shirts.)

Prices are very reasonable, for example, after adding the logo and monogram, a mesh pocket shirt is $36.95. Processing time is 5-7 days, plus shipping.

###

Real Time Operating System (RTOS)

By Steve Dimse, K4HG

It has never been easier to get started with microcontrollers. Thanks to the large community that has grown up around the Arduino platform millions of makers have been exposed to the joys of making an LED flash. For an entry level system it is capable of impressive feats.

At some point many builders move up to more capable microcontrollers that allow greater control and flexibility. Generally these processors feature more robust interrupt architectures as well as more memory, peripherals, and processing power. As the project complexity increases the programming techniques that worked well for simpler projects are no longer effective. It is time to add an operating system.

An operating system (OS) is a control program that manages cooperation between tasks and manages contention for system resources. While we all are familiar with operating systems like Windows, MacOS, and Linux, these are optimized for desktop and server applications. A microcontroller is usually employed in applications with fewer resources and tighter timing constraints, and the OS must meet these needs. Such an operating system is called a Real Time Operating System (RTOS).

An RTOS has small overhead and allows fine-grained control over how the user programs execute. It is highly efficient and does not provide many of the luxuries of a full OS. Despite this it provides a number of key features that greatly simplify the design and coding of complex microcontroller projects. In this article I will explain some of these features using a popular RTOS, FreeRTOS. FreeRTOS is available for many microprocessor families, is open source with a commercial license option, and has become widely adopted.

A task in FreeRTOS terminology is the building block of the application. Breaking a program up into simple tasks is a concept all programmers are familiar with, one used for anything but the simplest of problems. Let's look at a simple blinky program without an RTOS. LEDs are on pins B0 and B1 which you want to blink at rates of 1 and 4 times a second. One conventional approach would be to set one of the timers to trigger every millisecond and increment a global variable counter (named, say, milli), and for the main loop to check the current clock against the next time each event is scheduled to occur. *(Note about the code examples – these are included to illustrate concepts, not to provide complete program listings. Code for housekeeping like register and variable initialization and error checking is omitted for clarity. The hardware dependent functions are those for a PIC32MX, my current weapon of choice.)*

```
while (1)
{
  if (milli > next1)
{
     PORTBINV = 0x01;
     next1 = milli+1000;
}
     if (milli > next2)
{
     PORTBINV = 0x02;
     next2 = milli+250;
}
}
```

This cooperative method works well for simple projects and when no task consumes enough time to assure the main loop cycles at a rate that is acceptable to all the tasks. This assurance becomes very difficult with real-world problems.

For the FreeRTOS blinky example there will be two tasks, each of which blinks one LED.

```
void blink1(void)
{
  while (1)
  {
     PORTBINV = 0x01;
     vTaskDelay(1000);
  }
}


void blink2(void)
{
  while (1)
  {
     PORTBINV = 0x02;
     vTaskDelay(250);
  }
}
```

vTaskDelay is an FreeRTOS function that puts a task on hold for the

specified number of clock ticks. In this example I will assume 1 tick = 1 msec, but this is user-configurable in FreeRTOS.

The initialization code for this example in FreeRTOS looks like this:

```
xTaskCreate(blink1, "blink1", 100, 0, 1, 0);
xTaskCreate(blink2, "blink2", 100, 0, 1, 0);
vTaskStartScheduler();
```

The initialization code calls the function xTaskCreate twice to create the tasks using these parameters: the task procedure, a character string for debugging purposes, heap size for the task, task parameter pointer (unused un this example), the priority for the task, and a variable if you desire a handle to the task. Once you start the scheduler it has control – the call to vTaskStartScheduler never returns.

The difference between the traditional and RTOS methods is quite obvious. Instead of a single endless loop that somehow has to do everything, there is a separate endless loop for each task. This is important, as it means the timing for the two blinks is (potentially) not affected by anything else that happens in the main loop of the conventional example.

I said potentially because we need to consider the next important RTOS concept, task priority. These user-assigned priorities are used by the scheduler, which assures the highest priority task that is able to run will run. If there is nothing the microcontroller is doing that is more important than timing these two LED flashes then you can run the blink tasks at the highest priority and you can be guaranteed of that

performance. But if later you add another task that is more important all that is necessary is to run it at a higher priority. In a conventional application adding something that is more time-critical can be quite difficult to code and test.

Of course, real application tasks are more involved than blinking LEDs. Let's move on to look at a ham radio related problem, decoding AX-25. It is of course possible to receive AX-25 with a simple 16F84 PIC and an MX614 modem chip as detailed by John Hansen, W2FS, in his 2000 DCC article. This is about the only thing that simple PIC can do however. With a PIC32 the microcontroller has the resources to do many other things, and it is in combining something that is time-critical with a number of other tasks that an RTOS shines.

Some tasks are self-sufficient like our blinky tasks, but many need to coordinate their activity with one or more other tasks. One way this is done in an ROTS is with semaphores. There are several different kinds of semaphores, here we will use the simplest, the mutex (short for mutual exclusion) semaphore. It gets this name from its use to prevent multiple tasks from using the same resource (for example an I2C bus) at the same time, but it is also useful to tell one task an event has occurred in another task.
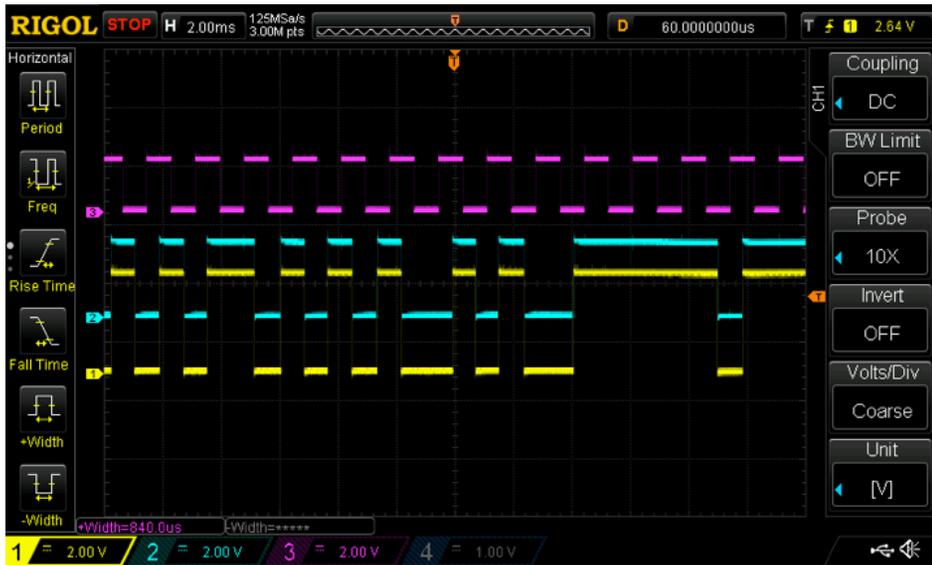
Without repeating too much of the detail in W2FS's paper, a key step is the decoder must synchronize the receiver clock to the transmitter clock. I do this by using the PIC to generate an interrupt when the data line from the modem (MX-614) chip changes state. A semaphore is created with the xSemaphoreCreateMutex call, in the initialization code before starting the scheduler.
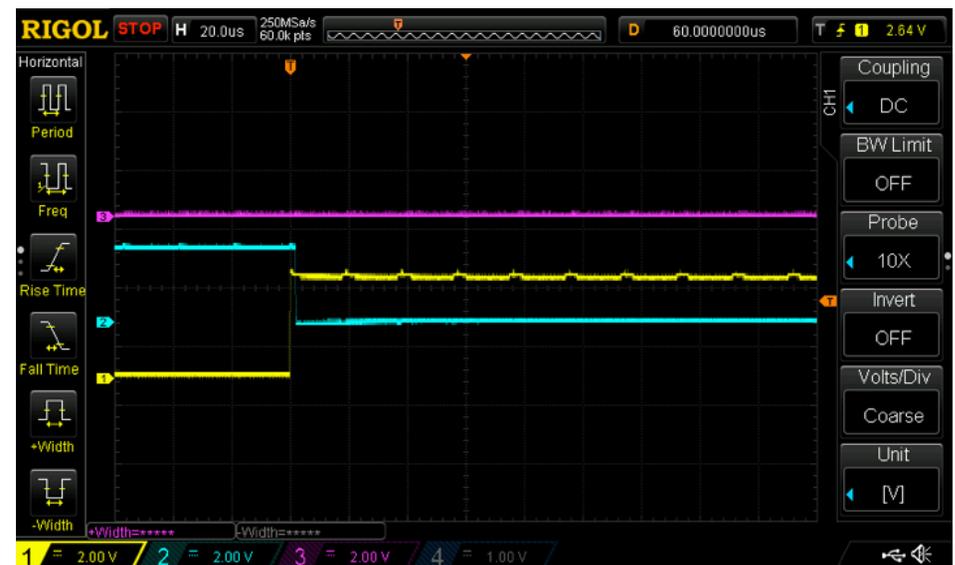
```
b1ChangeSema = xSemaphoreCreateMutex();
```

Here is the interrupt service routine (ISR), which uses a semaphore to signal that a bit transition has been detected. The RTOS terminology is that the semaphore is given by the ISR, so that another task may take the semaphore.

```
void IntChangeNotice(void)
{

    if (CNSTATB & 0x02)   //pin B1?
    {
        int x = PORTB;   //Read PORTB to clear CNSTATB register bit
        xSemaphoreGiveFromISR(b1ChangeSema,0); //send signal
    PLIB_INT_SourceFlagClear(INT_ID_0,
INT_SOURCE_CHANGE_NOTICE_B); //clear interrupt flag
        portYIELD();   //yield to any higher priority RTOS task
    }
}
```
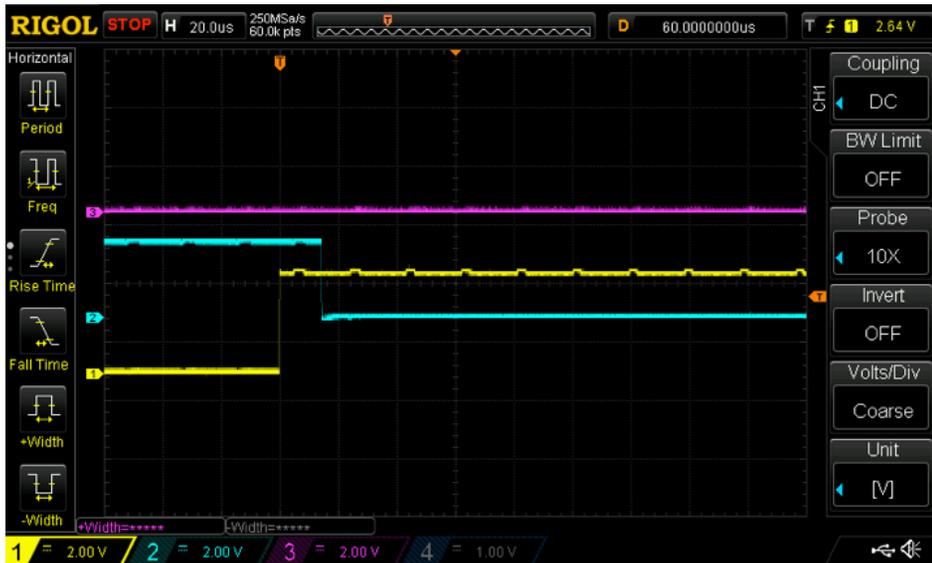
We want to read the data half of a bit width away from the transition. A task does nothing but wait for the signal that the data line to change state, resets the timer to half the baud interval, then goes back to waiting.

```
void DataChangeTask(void)

{

    while (1)

    {

        if (xSemaphoreTake(dataChangeSema,portMAX_DELAY)
== pdPASS)

        {

DRV_TMR_CounterValueSet(tmr,cHalfBaudTimer);

        }

    }

}
```

To clarify, when DataChangeTask executes xSemaphoreTake it is placed in the hold state, and will start executing again when the semaphore is given by the ISR. In a conventional application all this would be accomplished within an interrupt routine, but by using the semaphore we move the event from the realm of the interrupt (which is outside the RTOS) into the RTOS.

Does it work? When the MX-614 is receiving noise the output randomly flips. This is a trace showing the data line from the MX-614 in yellow, an output pin that is flipped when the DataChangeTask receives the semaphore in blue, and a pin that is flipped when the data bit is read in magenta.

It is obvious from the magenta trace that the system is flailing wildly but failing to sync to the noise, as it should. The next trace shows the last data and first flag at the end of an AX-25 packet with the same setup, and clearly the bit reading is synchronized near the middle of each bit.

Of course, nothing is free. There is a latency associated with the use of a semaphore, and we can measure it. Here is a 20 usec/div look at a single flip of the modem data line. The polarity between the modem flip and the program response is flipped but insignificant as it is the change of state, not the state itself, that conveys information in AX-25. In this trace the blue trace line is flipped in the ISR, and shows the microcontroller responds in less than 2 usec.

Here is the same trace with the blue trace toggled when DataChangeTask takes the semaphore.

The microcontroller now responds in about 14 usec. This is very much faster than we need for good performance.

Once we have the correctly synchronized bitstream we need to parse it. This is done in a task that loops while there are available bits, looks for flags, then for the start of data, and buffers data bytes until another flag is received, and finally validates CRC. When a valid packet has been received then it can pass the data along. This is done through another FreeRTOS communication mechanism, a queue. This is created with xQueueCreate in the initialization code; the parameters are the number of elements in the queue and the size of each element.

```
packetQueue = xQueueCreate(5,120);
```

(Interesting aside, semaphores are actually queues; the mutex is implemented as a queue with one element of zero bytes.) When the bitstream parsing hits the flag at the end of the packet the CRC is checked and if the packet (which has been being saved in the variable packetBuffer) is valid then it is sent into the buffer with xQueueSend, the parameters being the queue, the item to add to the queue, and the number of ticks to wait in case the queue is full.

```
xQueueSend(packetQueue,packetBuffer,1000);
```

There is a separate task to process the valid packets; it calls xQueueReceive with the queue, a buffer to copy the item into, and the length of time to wait for a packet to be received, in this case forever.

```
void packetRxTask(void)
{
  char readBuffer[120];
  while (1)
{
xQueueReceive(packetQueue,readBuffer,portMAX_DELAY);
    // process valid packet here
}
}
```

When put together this system is quite effective at decoding packets. With the audio run straight into the modem chip without preprocessing

it decodes 844±2 of track 2 of the WA8LMF CD, which compares well with other modem chip decoders.

The real value of an RTOS became apparent to me as I added more functions to this one microcontroller. One serial port uses an ESP8266 chip to connect to a chat room style program running on a Raspberry Pi 2 through which data from the various nodes in my house and RV share data. Any node can send a packet to be sent on 144.39 through this communication channel. The other serial port receives GPS data from a UBlox 7M. Position, altitude and time info are shared on the LAN. The microcontroller sleeps the GPS for 15-minute periods if stationary. Every APRS packet is parsed for position; any within one mile result in a callsign/bearing/distance message being shared. All K4HG-* packets are shared on the LAN, and there is a special notification when one of my SSIDs arrives within 500 feet after having been more than a mile away.

That is a lot of different functions to cram into a single microcontroller, but the RTOS payoff is that adding all these other functions did not require any change in the AX-25 tasks already written and the decoding success was not affected.

Hardware and Development Systems

If you want to start playing with the PIC32 and FreeRTOS there are a number of different ways to get hardware. The cheapest is to grab a PIC32MX170F256B in a 28 pin DIP package (about $4 from Digikey); a few bypass caps and resistors for the reset circuit are all that are needed. You will need a way to program it, Microchip offers a very nice entry level programmer called the PicKit-3 for about $50 and a more capable ICD-3 for $200. Both of these offer in circuit debugging as well.

Another option is a development board like the SnadPIC-32, available

on eBay for about $30. This uses a PIC32MX795F512L, with twice the flash and RAM and many more onboard peripherals like six UARTS and five I2C buses. On the SnadPIC board are a USB connector, compact flash socket, crystals for the system clock and the Real Time Clock Calendar, power regulators, and eight user LEDs. The chip is preloaded with the Microchip bootloader, which allows the firmware to be flashed without the use of a PicKit or ICD. The bootloader is not automated into the IDE and so requires an extra step for every compile. The PicKit or ICD can be used with this board giving easier programming and in circuit debugging.

Microchip sells a number of evaluation boards as well. These have the distinct advantage of being the reference systems which are used by the example programs. The example code runs on these board without

Write Here!

modification. They are, of course, more expensive.

Software for the PIC32 is written in Microchip's MPLAB Integrated Development Environment (IDE). This excellent program can be downloaded for free from Microchip's web site, and free compilers for the different chip series can also be downloaded. XC32 is the one needed for the PIC32.

Over the last few years Microchip has added a framework they call Harmony to the IDE. This greatly simplifies the process of starting a new project, and it includes FreeRTOS as an option; adding an RTOS (several are included in Harmony) is as easy as checking a box. This makes it much easier to start a new project as the IDE replaces much of the tricky work like configuring the system clocks, ports and processor and writing assembly glue code for interrupt routines with GUI interfaces. There is a learning curve, but after taking a little time to understand it really makes things much easier in the long run.

There is much more, in details, complications, and features to FreeRTOS, this has just been a simple introduction. You can expect to spend some becoming acquainted with a Real Time Operating System, but it is a great way to simplify the coding of large projects. It is worth the time to add an RTOS to your toolkit if you are working on complex projects.

###

Your *PSR* editor is patiently waiting for a few good writers, particularly ham radio operators working on the digital side of our hobby, who would like to write about their activities and have them published here in *PSR*.

You don't have to be Hiram Percy Maxim to contribute to *PSR* and you don't have to use *Microsoft Word* to compose your thoughts.

Your *PSR* editor can handle just about any text and graphic format, so don't be afraid to submit whatever you have to wa1lou@tapr.org, she can handle it!

The deadline for the next issue of *PSR* is July 31, so write early and write often.
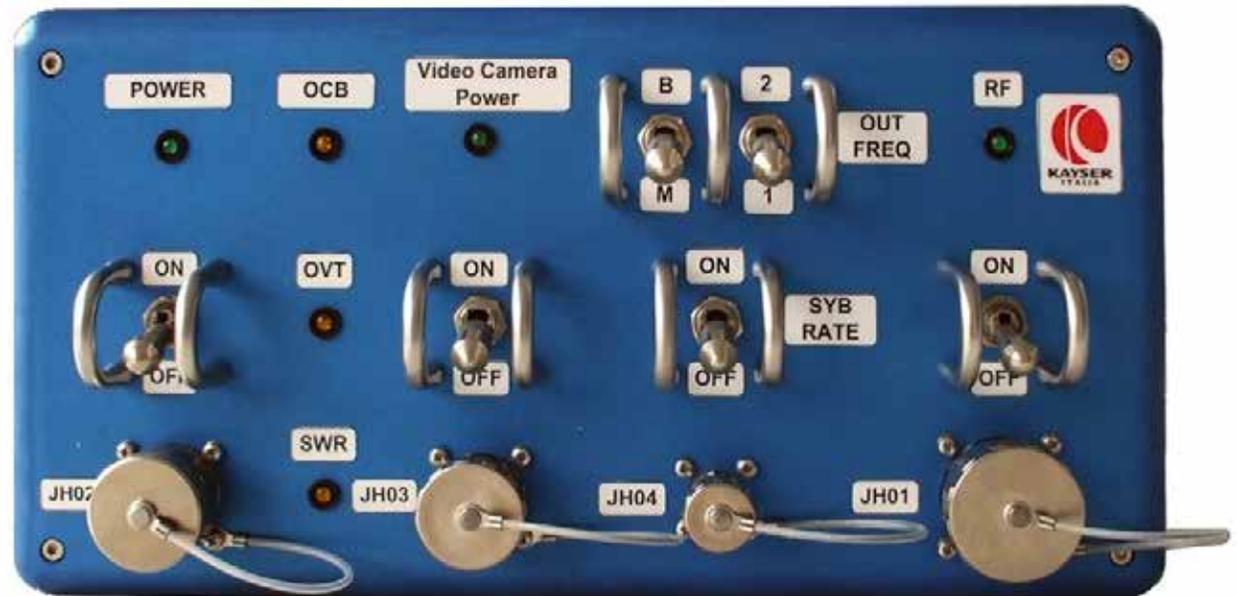
If *PSR* publishes your contribution, you will receive an extension to your TAPR membership or if you are not a member, you will receive a TAPR membership.

###

Ham TV – ARISS

This article was pulled together from information on the ARISS-Europe web pages at http://www.ariss-eu.org/ *by Rosalie White, K1STO, and from Gaston Bertels, ON4WF, of the ARISS Ad-hoc Ham TV Technical Committee, and past ARISS-International Chairman. Congratulations to the ARISS-Europe team!*

DATV (digital amateur television) transmitter, dubbed Ham Video, in the ISS Columbus module.

First Ever ARISS School Contact to Incorporate Ham TV – February 2016!

   The first ever ARISS school contact to incorporate Ham TV took place as a direct contact with students at Royal Masonic School for Girls, Rickmansworth, United Kingdom on February 11, 2016 at 18:11:09 UTC. Astronaut Timothy Peake, KG5BVI, answered 14 prepared questions from students and was also able to transmit live video of the youths' interview using the new amateur radio Ham TV system. The school offers astronomy classes and is one of very few UK schools to have its own planetarium and observatory. Students were amazed when all of a sudden, they could see Tim talking to them! Read a story about the event on the Principia website
https://principia.org.uk/news/second-amateur-radio-call/

   Timothy Peake incorporated Ham TV into several other contacts since then, including a direct contact with students at Gesamtschule Leverkusen Schlebusch, Leverkusen, Germany, on February 29, 2016. Timothy answered 20 questions for students and used the HamTV system to wave at the excited students and send real-time images. Watch the HamTV video at:
https://www.youtube.com/watch?v=DVni1Y9GCIQ

Main Characteristics of the DATV Transmitter Dubbed "Ham Video"

   Downlink frequencies: 2.422 GHz, 2.437 GHz

   Contingency frequencies: 2.369 GHz, 2.395 GHz

   DVB-S like signal (without PMT tables)

Symbol rates: 1.3 Ms/s, 2.0 Ms/s

FEC : ½

Video PID = 256

Audio PID = 257

Antennas: ARISS 41 and ARISS 43 patch antennas on the nadir of Columbus

RF radiated power : approximately 10 W EIRP

Ham Video operates with a Canon XF-305 camera.

A Bit of History: Commissioning

Commissioning of the Ham Video transmitter was performed in spring of 2014. All four frequencies and two symbol rates were checked with each of the two antennas. For each commissioning step, US astronaut Michael Hopkins, KF5LJG, transmitted video and audio during a pass over the Matera VLBI station located at the Italian Space Agency's 'Centro di Geodesia Spaziale G. Colombo' (CGS); Matera is a small town in the south of Italy. The final commissioning test was performed by JAXA astronaut Koichi Wakata, KC5ZTA. The signals were received by several ground stations and streamed to the BATC server (British Amateur Television Club). Ham TV streams are identified ISS1 – 5. The BATC server is available at http://www.batc.tv

Blank Transmission

When "Blank Transmission" is operational, Ham Video transmits a continuous DATV signal with the camera turned off. Ground stations receive a black image and audio at zero level. A « blank » DVB-S signal contains all the data of normal DVB-S. The information tables describing the content and the content itself, i.e. the video (black) and the audio (silence), are the same as for the image and the sound produced by a camera. Receiving a black image and silent sound may seem uninteresting but, from a technical perspective, the digital signal offers an important source of information. Even without decoding, several measurements of the received signal provide valuable information:

analogic HF signal strength (dBm)

analogic Signal/Noise ratio (dB)

digital Signal/Noise ratio = MER (dB)

error/correction ratio = Vber, Cber …

validation of the received transport stream = TS

Reception Reports

Ground stations with S-band capability can provide valuable information. Basic data such as noise level without signal, AOS time (UTC), maximum signal level during pass, LOS time (UTC) can be reported by ground stations without the need of DATV hardware and software.

Windows Computer with TechnoTrend TT S2-1600 Card and Tutioune Software

A Windows computer with TT S2-1600 receiver card can be used for Ham Video reception. The Tutioune software developed by Jean Pierre Courjaud, F6DZP, measures and records the Ham Video signals second per second:

HF signal level

digital Signal/Noise level = MER (dB)

error/correction = Vber

validation of the received transport stream = TS

The recorded file can be forwarded to ARISS. Better yet, the data can be forwarded during an ISS pass to the Tioune Monitor on the www.vivadatv.org website. That means the data can be observed worldwide, real time. Tutioune also shows the constellations during signal reception (see HamTV Bulletin #4). Tutioune also decodes the DVB tables and provides the PIDs and the channel name (« HAMTV ») recovered from the SDT table.

To the reader: Here is your new challenge: set up your own ARISS Ham TV ground station!

Some Resources:

State of the art information is at:

http://www.batc.org.uk/forum/viewtopic.php?t=4102&start=20

Information about the Tutioune software is at:

www.ariss.org/uploads/1/9/6/8/19681527/hamtv_v1.3.ppt

and

http://www.vivadatv.org/page.php?p=tutioune-en

An ARISS Ham TV article by Gaston Bertels, ON4WF, is at:

http://www.amsat.org/?p=2177

A Ham Video article is at:

http://ww2.amsat.org/wordpress/wp-content/uploads/2013/04/ISS-DATV.pdf

ARISS Ham-TV YouTube by Colin Watts, G4KLB, is at:

https://www.youtube.com/watch?v=h0rxS8Ys_Mk

Ham TV on the ISS – AMSAT-UK is at:

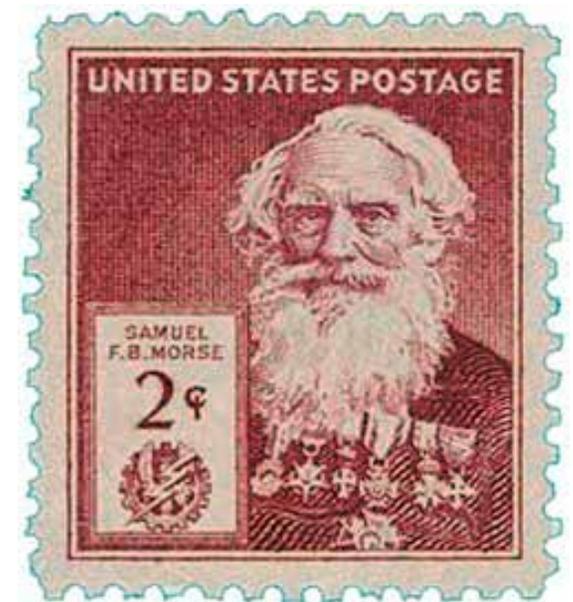http://amsat-uk.org/satellites/hamtv-on-the-iss/

After reviewing the recommended reading list above, if you have questions, you may contact:

Jean Pierre Courjaud, F6DZP, at f6dzp@yahoo.fr

Danny Cussen, EI9FHB, at dan@popst.com

###

KD6OZH Mesh Network List

  A mail list to discuss and further the mesh network technology work of John Stephensen, KD6OZH, is now up and running on the TAPR server. The list is open to all who are interested in John's work and subscriptions to the KD6OZH Mesh list may be had at:
https://www.tapr.org/mailman/listinfo/kd6ozh_mesh

<div align="right">###</div>

DCC Video Online

  Gary Pearce, KN4AQ, HamRadioNow's main man has posted on YouTube a slew of videos from the ARRL-TAPR Digital Communications Conference (DCC) held this past October in Chicago.

  At https://www.youtube.com/user/HamRadioNow/ look for HRN video numbered 218, which is the first in the series of 2015 DCC videos. They continue in ascending order to at least HRN 237 and probably go beyond that number by the time you read this.

<div align="right">###</div>

On the Net

By Mark Thompson, WB9QZB

Facebook

  As you may know, TAPR has a Facebook page, www.facebook.com/TAPRDigitalHam.

  However, I also created a TAPR Facebook Group, www.facebook.com/groups/TAPRDigital/.

  If you have a Facebook account, "Like" the TAPR Facebook page and join the TAPR Facebook Group.

  If you join the group click on the Events link and indicate you're Going to the events.

On Twitter, Too

  Access the TAPR Twitter account at

www.twitter.com/taprdigital.

Also on YouTube

  TAPR now has its own channel on YouTube: the TAPR Digital Videos Channel: www.youtube.com/user/TAPRDigitalVideo.

  At this time, there are a slew of videos on our channel including many from the TAPR-ARRL Digital Communications Conference (DCC) that you may view at no cost, so have at it!

<div align="right">###</div>

TAPR is a community that provides leadership and resources to radio amateurs for the purpose of advancing the radio art.

TUCSON AMATEUR PACKET RADIO CORPORATION

COMPILED FINANCIAL STATEMENTS

For the month and years ended
December 31, 2015 and 2014

C O N T E N T S

S. J. MEYER & ASSOCIATES, INC.

CERTIFIED PUBLIC ACCOUNTANTS
BUSINESS ADVISORS

MEMBER
American Institute
of Certified Public
Accountants

Ohio Society of
Certified Public
Accountants

370 HULS DRIVE
CLAYTON, OHIO 45315

(937) 832-5209
(937) 836-7095 FAX
(877) 756-1040 Toll Free
www.sjmeyer.com

Steven J. Meyer, CPA-PFS
William H. Frazer, CPA

Accountants' Compilation Report

Board of Directors
Tucson Amateur Packet Radio Corporation
P.O. Box 852754
Richardson, TX 75085-2754

Management is responsible for the accompanying financial statements of Tucson Amateur Packet Radio Corporation (a nonprofit organization), which comprise the statements of assets, liabilities, and net assets – income tax basis as of December 31, 2015 and 2014, and the related statements of revenues, expenses and other changes in net assets – income tax basis for the month and years then ended, and for determining that the income tax basis of accounting is an acceptable financial reporting framework. We have performed a compilation engagement in accordance with Statements on Standards for Accounting and Review Services promulgated by the Accounting and Review Services Committee of the AICPA. We did not audit or review the financial statements nor were we required to perform any procedures to verify the accuracy or completeness of the information provided by management. Accordingly, we do not express an opinion, a conclusion, nor provide any form of assurance on these financial statements.

The financial statements are prepared in accordance with the income tax basis of accounting, which is a basis of accounting other than accounting principles generally accepted in the United States of America.

Management has elected to omit substantially all the disclosures ordinarily included in financial statements prepared in accordance with the income tax basis of accounting. If the omitted disclosures were included in the financial statements, they might influence the user's conclusions about the Company's assets, liabilities, net assets, revenues, and expenses. Accordingly, the financial statements are not designed for those who are not informed about such matters.

January 16, 2015

S J Meyer + Associates, Inc.

Tucson Amateur Packet Radio Corporation
Statements of Assets, Liabilities and Net Assets - Income Tax Basis
December 31, 2015 and 2014

ASSETS

	2015	2014
Current assets		
Cash in bank-checking	$ 4,692.92	15,077.68
Cash in bank - savings	41,766.71	35,174.11
Inventory - TAPR	68,662.64	78,111.97
Total current assets	115,122.27	128,363.76
Property and equipment at cost		
Equipment - Dayton	1,678.95	1,678.95
Equipment - Richardson	3,391.29	3,391.29
Equipment - Oklahoma	0.00	1,976.63
	5,070.24	7,046.87
Less: accumulated depreciation	(5,070.24)	(7,046.87)
	0.00	0.00
	$ 115,122.27	128,363.76

Tucson Amateur Packet Radio Corporation
Statements of Assets, Liabilities and Net Assets - Income Tax Basis
December 31, 2015 and 2014

LIABILITIES AND NET ASSETS

	2015	2014
Current liabilities		
Texas sales tax payable	$ 41.83	110.88
Total current liabilities	41.83	110.88
Net assets		
Net assets	128,252.88	154,415.82
Net increase (decrease) in net assets	(13,172.44)	(26,162.94)
Total net assets	115,080.44	128,252.88
	$ 115,122.27	128,363.76

Tucson Amateur Packet Radio Corporation
Statements of Revenues, Expenses and Other Changes in Net Assets - Income Tax Basis
For the Months and Years Ended December 31, 2015 and 2013

	Current Month	% of Sales	Prior Year Month	% of Sales	Current Year to Date	% of Sales	Prior Year to Date	% of Sales
Revenues								
Sales - inventory	$ 1,128.00	83.31	$ 3,383.00	139.83	$ 55,312.99	76.31	$ 64,634.35	76.59
Shipping and handling	260.00	19.20	505.00	20.87	4,982.00	6.87	5,530.35	6.55
Sales discounts	(34.00)	(2.51)	(1,428.64)	(59.05)	(6,309.00)	(8.70)	(3,462.32)	(4.10)
DCC convention income	0.00	0.00	(40.00)	(1.65)	20,450.00	28.21	20,490.00	24.28
DCC convention discounts	0.00	0.00	0.00	0.00	(1,955.00)	(2.70)	(2,802.00)	(3.32)
Total revenues	1,354.00	100.00	2,419.36	100.00	72,480.99	100.00	84,390.38	100.00
Cost of sales								
Cost of sales	742.00	54.80	2,985.50	123.40	33,106.90	45.68	43,841.63	51.95
Bank and credit card fees	598.21	44.18	160.26	6.62	4,232.70	5.84	4,828.00	5.72
Postage	306.38	22.63	456.30	18.86	4,404.30	6.08	5,359.40	6.35
Rent - storage	55.00	4.06	(1,490.00)	(61.59)	660.00	0.91	660.00	0.78
Rent	1,600.00	118.17	3,145.00	129.99	19,200.00	26.49	19,200.00	22.75
Shipping - general	0.00	0.00	25.26	1.04	377.58	0.52	934.79	1.11
Shipping - kits	70.00	5.17	90.00	3.72	1,785.03	2.46	1,398.75	1.66
Total cost of sales	3,371.59	249.01	5,372.32	222.06	63,766.51	87.98	76,222.57	90.32
Gross profit (loss)	(2,017.59)	(149.01)	(2,952.96)	(122.06)	8,714.48	12.02	8,167.81	9.68
Expenses								
Accounting fees	510.00	37.67	640.00	26.45	5,325.00	7.35	4,975.00	5.90
Convention	0.00	0.00	0.00	0.00	3,633.82	5.01	4,590.10	5.44
Convention - DCC	3,292.00	243.13	0.00	0.00	25,177.67	34.74	22,281.34	26.40
Insurance	0.00	0.00	0.00	0.00	1,405.00	1.94	1,323.00	1.57
Internet	52.29	3.86	54.04	2.23	669.06	0.92	1,045.57	1.24
Legal fees	0.00	0.00	0.00	0.00	75.00	0.10	75.00	0.09
Meals and entertainment	0.00	0.00	0.00	0.00	0.00	0.00	36.90	0.04
Office supplies	42.17	3.11	0.00	0.00	805.64	1.11	958.58	1.14
Kit assembly	0.00	0.00	0.00	0.00	1,095.00	1.51	702.00	0.83
PSR newsletter	0.00	0.00	0.00	0.00	1,500.00	2.07	1,500.00	1.78
Repairs and maintenance	335.04	24.74	0.00	0.00	450.18	0.62	16.23	0.02
Research and development	0.00	0.00	0.00	0.00	758.62	1.05	225.03	0.27
Server hosting	256.51	18.94	256.51	10.60	3,465.67	4.78	2,870.12	3.40
Taxes	0.00	0.00	0.00	0.00	817.86	1.13	315.40	0.37
Telephone	69.14	5.11	69.15	2.86	883.85	1.22	890.79	1.06
Travel	0.00	0.00	0.00	0.00	7,155.72	9.87	1,426.83	1.69
Travel/hotel (board)	600.00	44.31	0.00	0.00	5,158.88	7.12	4,291.64	5.09
Total expenses	5,157.15	380.88	1,019.70	42.15	58,376.97	80.54	47,523.53	56.31
Other (income)/expenses								
Other income	0.00	0.00	0.00	0.00	(25,000.00)	(34.49)	(1,500.00)	(1.78)
Interest income	(15.87)	(1.17)	(5.96)	(0.25)	(115.05)	(0.16)	(67.78)	(0.08)
Dues	(675.00)	(49.85)	(475.00)	(19.63)	(11,375.00)	(15.69)	(11,625.00)	(13.78)
Total other (income)/expenses	(690.87)	(51.02)	(480.96)	(19.88)	(36,490.05)	(50.34)	(13,192.78)	(15.63)
Net increase(decrease)in net assets	$ (6,483.87)	(478.87)	$ (3,491.70)	(144.32)	$ (13,172.44)	(18.17)	$ (26,162.94)	(31.00)

PSR

Submission Guidelines

TAPR is always interested in receiving information and articles for publication. If you have an idea for an article you would like to see, or you or someone you know is doing something that would interest TAPR, please contact the editor (wa1lou@tapr.org) so that your work can be shared with the Amateur Radio community. If you feel uncomfortable or otherwise unable to write an article yourself, please contact the editor for assistance. Preferred format for articles is plain ASCII text (OpenOffice or *Microsoft Word* is acceptable). Preferred graphic formats are PS/EPS/TIFF (diagrams, black and white photographs), or TIFF/JPEG/GIF (color photographs). Please submit graphics at a minimum of 300 DPI.

Production / Distribution

PSR is exported as Adobe Acrobat and distributed electronically at www.tapr.org

PSR Editor:

Stana Horzepa, WA1LOU

E-mail wa1lou@tapr.org

TAPR Officers

TAPR Board of Directors

TAPR is a not–for–profit scientific research and development corporation [Section 501(c)(3) of the US tax code]. Contributions are deductible to the extent allowed by US tax laws. TAPR is chartered in the State of Arizona for the purpose of designing and developing new systems for digital radio communication in the Amateur Radio Service, and for disseminating information required, during, and obtained from such research.

PSR Advertising Rates

Full Page Ad for 1 issue: $100, 4 issues: $350
Half Page Ad for 1 issue: $75, 4 issues: $250
Quarter Page Ad for 1 issue: $50, 4 issues: $175

TAPR is a community that provides leadership and resources to radio amateurs for the purpose of advancing the radio art.

Membership Application

TAPR

P. O. Box 852754, Richardson, TX 75085–2754

Phone 972–671–TAPR (8277), Monday–Friday, 9AM–5PM Central Time

E-mail taproffice@tapr.org   URL http://www.tapr.org

Join or renew online at https://secure.tapr.org/np/clients/tapr/login.jsp

Benefits of a TAPR Membership:
- *Subscription to the quarterly PSR*
- *10% off most TAPR kits and publications*
- *Access to the TAPR digital library*
- *Latest information on TAPR R&D projects*
- *Co-sponsor of the annual TAPR-ARRL Digital Communications Conference (DCC)*

Name_____Call Sign_____

Address_____

City_____State/Province_____Postal Code_____

Country_____ Daytime Phone No._____

E-mail Address_____

New ☐   Renewal ☐ $25 X _____ number of years = $_____ total

Payment Method: Check ☐   Money Order ☐   Credit Card ☐

STOP! Provide the following information only if paying **by mail** with a credit card:

VISA ☐   Mastercard ☐   Discover ☐

Credit Card No. _____ Expiration Date_____Security Code_____

Card Holder's Name_____

TAPR is a community that provides leadership and resources to radio amateurs for the purpose of advancing the radio art.