Getting Started: Doodle Labs DL435-30 420-MHz Broadband Data Radio
By David Bern, W2LNX

In the previous TAPR *PSR*, Steve, KB9MWR, introduced the Doodle Labs DL435-30 420-MHz broadband data radio miniPCI cards [KB9MWR 1]. This article relates my experience getting started with these miniPCI cards.

Introduction

My interest in ham radio is primarily in digital modes and earlier this year, Chris, KB3CS, a fellow member of the Montgomery Amateur Radio Club (MARC), Rockville, Maryland, suggested I take a look the Doodle Labs website about their 420-MHz broadband data radios for Amateur Radio [Doodle]. This prompted me to do a Google search on "Doodle Labs" where I found Steve's blog entry about these data cards [KB9MWR 2]. There he references a short video by Kyle, N0KEW, where he demonstrates a speed test using these radio cards. Then I found a detailed description by Joseph, N9ZIA, on how to use a DL435-30 in a Ubiquiti RouterStation with its DD-WRT firmware [N9ZIA]. This motivated me to order four DL435-30 cards from Singapore.

Getting Started

I ordered two Ubiquiti RouterStation Pro router boards [RS Pro], and four MMCX male-to-N female connector pigtails [pigtail] for the DL435-30 cards, several Wistron CM9 Wi-Fi miniPCI card from mini-box.com [Wistron] and from eBay. The RouterStation Pro boards were reflashed with their DD-WRT firmware using TFTP [reflash]. While waiting for the DL435-30 cards to arrive, I played with Wistron Wi-Fi cards to learn and understand DD-WRT. In theory, the DL435-30 cards are a drop-in replacement for Wistron Wi-Fi cards. My first exercise was configure one of the RouterStation Pro boards as a Wi-Fi client in Client Wireless Mode [client] to access our household Wi-Fi access point. Likewise, I configured the second RouterStation Pro as a Wi-Fi access point in AP Wireless Mode [AP] to be accessed by my laptop. And finally I connected the two RouterStation Pro boards.

When the Doodle Lab DL435-30 cards arrived, I replaced the Wistron cards with the Doodle Lab cards in both router boards (see photo 1), configured DD-WRT to use a 5-MHz bandwidth and, to my disappointment, it did not work. I had made two mistakes: first, a dummy load is a very poor antenna at 500 mW, the RF power output, spread over a 5-MHz bandwidth. Second, I had set the speed to 1 Mbps. I replaced the dummy load antennas with two home brew ¼-wave antennas cut at 422.5 MHz; a large tuna fish can is used as the ground plane (see photo 2). The SWR of the antennas were trimmed with my MFJ-269 antenna analyzer to be less than 1.5:1. Then when I set the minimum and maximum transmissions rates to Auto, it worked! In Client mode, the DD-WRT has a Site Survey button on the Wireless Status page; the client router board had found the access point router board. Both router boards needed to be set to the same wireless network name (SSID). Clicking on Join on the Site Survey page sets them both to the same SSID. The SSID I use is BOARnet, Broadband Over Amateur Radio network.

Testing

My test application is the Yawcam webcam software [Yawcam] that I learned about in a recent *QST* article [scope]. It has a built-in web server that streams video from a webcam. At the highest quality of 30 frames per second, it uses about 1.2 Mbps. Together with a file download, it goes at about 3.3 Mbps (see photo 3). For this photo, the two antennas were about six feet apart. At the lowest quality of one frame per second, it uses about 50 Kbps. I needed a video application since, after all, I am in the 420-MHz ATV sub-band.

Continuing work

I am impressed and encouraged with this technology, but this is just the beginning of our experimentation. A partial list of more work that needs to be done is:
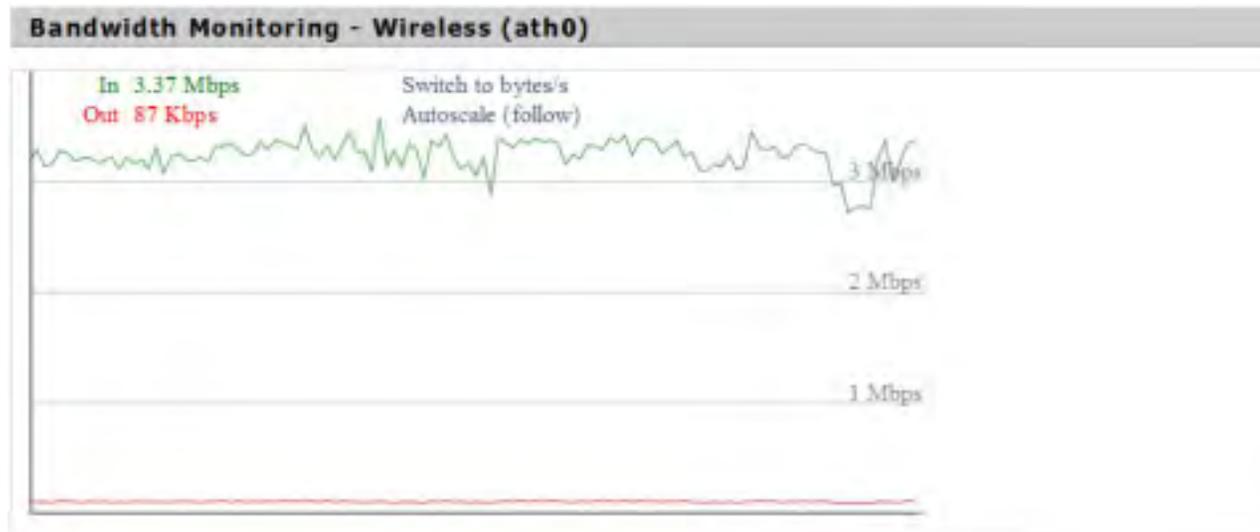
• Do range testing with 420-MHz omni-directional and directional antennas.

• Set up a test link to the house of another MARC member about a mile away.

Doodle Labs DL435-30 miniPCI card in Ubiquiti RouterStation Pro

Homebrew quarter-wave 70-cm antenna on a large tuna fish can

Bandwidth of highest quality video with a file download

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

• Shop for high-gain highly directional antennas in the 420-432 MHz range.

• Shop for high quality bi-directional linear broadband amplifiers for the 420-432 MHz range.

• Set up four routers with the DL-435-30 cards and configure DD-WRT in a mesh or ad-hoc configuration instead of an access point/client configuration.

• Test the x86 version of DD-WRT on an Intel Atom PC motherboard using a PCI to miniPCI adapter. Can an inexpensive low electrical power consumption PC motherboard running DD-WRT or a more generic Linux distribution be an effective broadband router?

• Evaluate the Xagyl XC420M miniPCI cards [Xagyl] when I receive them. I am interested in comparing the Xagyl cards with the Doodle Lab cards.

• Internetwork with separate 2.4 GHz Wi-Fi mesh networks running HSMM-MESH™ on Wi-Fi routers [HSMM-MESH]. Can we establish a super mesh network?

Goals

Our immediate goal is to set up a test network between four MARC member's houses to gain experience with these Doodle Lab broadband data radios. A long term goal is to set a local broadband metropolitan area network (MAN) for hams to use in the local Rockville, Maryland area. More importantly, our public service long term goal is to ensure that this broadband data network can be used as a self-contained backup for local hospitals and other public safety agencies.

Ideas, suggestions, questions and comments are welcome; please email them at W2LNX at arrl.net. Thank you.

Resources and References

[AP] Wireless Access Point, http://www.dd-wrt.com/wiki/index.php/Wireless_access_point

[client] Client Mode, http://www.dd-wrt.com/wiki/index.php/Client_Mode

[DD-WRT] DD-WRT is a Linux based alternative OpenSource firmware suitable for a great variety of WLAN routers and embedded systems, NewMedia-NET GmbH, http://www.dd-wrt.com/site/index

[Doodle] 420 – 450 MHz Embedded COFDM Transceiver (DL435-30), Doodle Labs (SG) Pte. Ltd., Singapore, http://doodlelabs.com/products/amateur-radio/420-450-mhz-band-dl435.html

[reflash] TFTP flash, http://www.dd-wrt.com/wiki/index.php/TFTP_flash

[HSMM-MESH] David Rivenburg, AD5OO, robert Morgan, WB5AOH, Richard Kirchhoff, NG5V and Glenn Currie KD5MFW, HSMM-MESH™, http://www.hsmm-mesh.org/

[KB9MWR 1] Steve Lampereur, KB9MWR, Doodle Labs DL-435, TAPR PSR #117 Winter 2012, http://www.tapr.org/psr/psr117.pdf

[KB9MWR 2] Steve Lampereur, KB9MWR, Doodle Labs DL435-30 Reports, Advancing Ham Radio.. different ideas, January 29, 2012, http://kb9mwr.blogspot.com/2012/01/doodle-labs-dl435-30-reports.html

[scope] Wayne Smith, WA4WZP, Webcam Microscope for the Radio Amateur, *QST*, March 2012, page 38

[N0KEW] Kyle Whitney, N0KEW, quick test of the Doodle labs DL435-30, N0KEW, February 5, 2012, http://n0kew.blogspot.com/

[N9ZIA] Joseph Loritz, N9ZIA, Doodle Labs DL435-30 420-450 MHz OFDM Transceiver Experiments, http://www.qsl.net/n9zia/dl435/index.html

[pigtail] CA100 Pigtail Cable N Jack or Female Bulkhead to MMCX Male Right Angle (RA), 8 Inches (20.3 cm), http://www.air802.com/product.php?productid=18505

[RS Pro] Ubiquiti RouterStation Pro, Ubiquiti Networks, Inc., http://www.ubnt.com/rspro

[Wistron] Wistron CM9 Atheros 802.11a/b/g miniPCI, http://www.mini-box.com/s.nl/it.A/id.387/.f

[Xagyl] XAGYL XC420M 420-450MHz 1000mW miniPCI, Xagyl Communications, LLC, http://www.xagyl.com/store_us/product.php?productid=31

[Yawcam] Magnus Lundvall, Yet Another WebCAM software, http://www.yawcam.com/

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