Boulder Amateur Television Club
TV Repeater's REPEATER

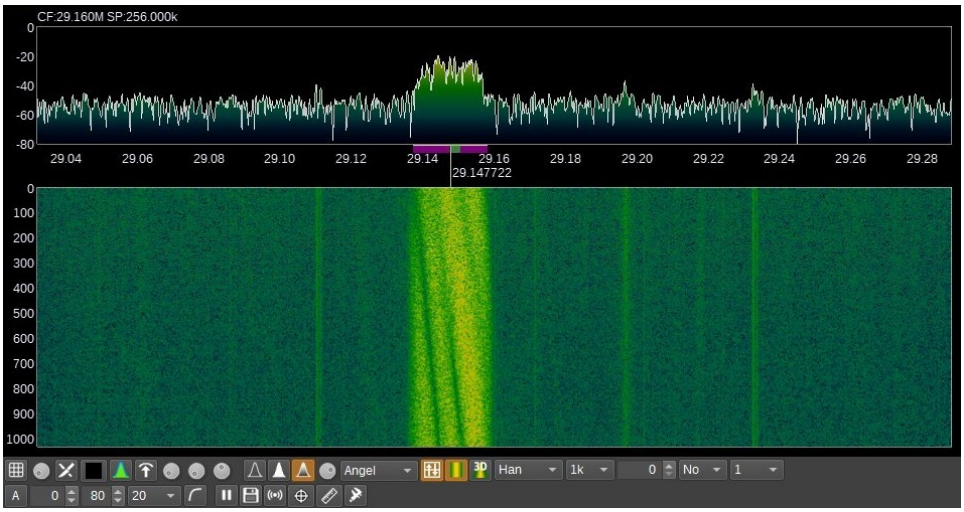
December, 2022
issue #117

BATVC web site: www.kh6htv.com

ATN web site: www.atn-tv.com

Jim Andrews, KH6HTV, editor - kh6htv@arrl.net www.kh6htv.com

DVB-S from England to Maryland, USA
Trans-Atlantic on 10 Meters ! ! !



M0DTS' DVB-S signal at 29.16 MHz as seen by K0ZAK

Flash News as of 22 Nov. ---

John, K0ZAK, in Maryland has been able to successfully receive Rob, M0DTS' DVB-S signal from the U.K.

John writes "...The band is a bit crappy today, but I was able to decode multiple images from M0DTS's transmission this morning. As I am using really marginal equipment here, it looks like this might be a doable thing. So far the testing has been focused on using DVB-S at 18KHz bandwidth. All I am using to receive this is a $20 RTL-SDR dongle and the free SDRAngel software hooked to my 4 element 10 meter yagi, so anyone could repeat this with a minimal investment or parts they already have. I do have other equipment that might work better, but I figured I'd start as simple as possible first.

There has been 29Mhz video chatter on groups.io. Latest on the continued testing on the BATC forums.
https://forum.batc.org.uk/viewtopic.php?f=15&t=8183&start=80

Maybe this testing is what it will take to get the ARRL & FCC to actually look into the legality issues involving transmitting this mode in the US."

John Kozak, K0ZAK

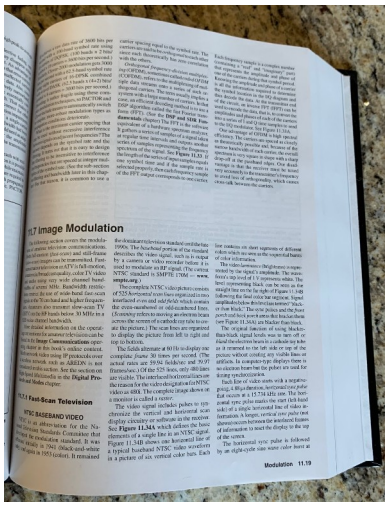
The ARRL Handbook for Radio Communications for 2022 is a must-have for every radio amateur's bookshelf. Whether you're an experienced ham or new to the hobby, you'll find information you can use to advance your amateur radio knowledge and skills. This current, comprehensive, and complete reference is available in four formats — traditional hardcover, softcover, a six-volume, shrink-wrapped book set (box not included), and digital eBook. The Handbook six-volume book set, is $59.95 retail.. The bound hardcover book is $79.95. The e-book is included with the printed versions, but must be later down-loaded.

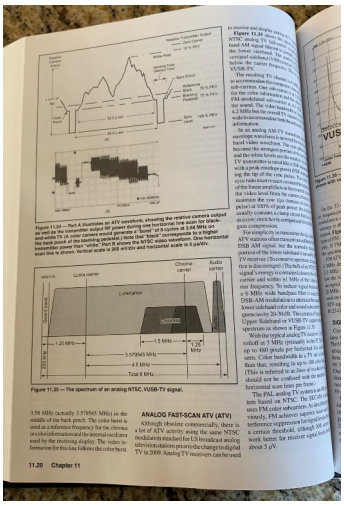
In years past, I purchased a new ARRL Handbook about once every ten years. There were only minor changes made from one year to the next. so it didn't make sense to buy every copy. Obviously, over a span of almost 100 years, and 100 editions, major changes have occurred in our hobby and the technology we use and these are reflected in what is included and not included in the handbook. Significant new (to me) items I found in this 100th edition are: (1) A chapter on "DSP and SDR Fundamentals" (2) A big (40 page) chapter on "Digital Protocols and Modes" and (3) a chapter on "Amateur Radio Data Platforms".

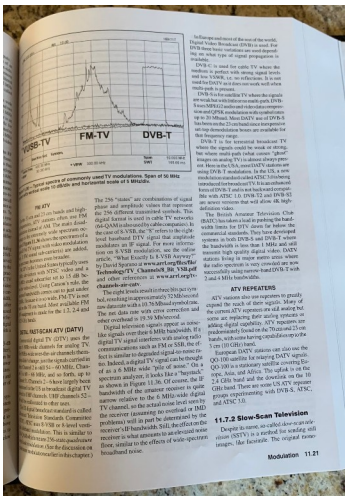
ATV in the New Handbook

Several years ago, I was always disappointed by the limited coverage of ATV in the printed ARRL handbook, which I found in newer books which I had borrowed from friends. So I wrote a letter to the ARRL offering to write the ATV chapter hoping to improve the situation. Tom O'Hara, W6ORG, had been writing the ATV part for many years previously. So for next couple of years, Tom asked for input from me on DATV. Finally Tom retired from writing for the handbook. At that point the editor, Ward Silver, N0AX, asked me to write the section on ATV for the 100th editon.

Well, I then found out, the reality of the Handbook is they were only willing to devote a limited number of pages in the printed version for ATV (2 1/2 pages to be exact). Thus the extremely limited coverage of ATV in previous editions, which I had found objectionable. They were willing to have more supplemental material available electronically. This additional material can only be accessed once you purchase the handbook. Then you are given the access code to download the complete handbook in .pdf format, along with the supplemental material.



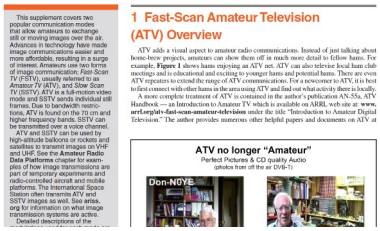




The 3 pages in the 100th edition of the ARRL Handbook devoted to ATV

The section on ATV in the latest handbook is found in the Chapter on Modulation. It is section 11.7 entitled "Image Modulation". The ATV supplemental material in the e-book version is hard to find. You need to scroll down in the "Bookmarks" all the way to the bottom, find "Image Communications", click on it. This leads you to a 28 page .pdf file. The first 14 pages deal with Fast Scan TV. The remainder deals with SSTV.

Image Communications



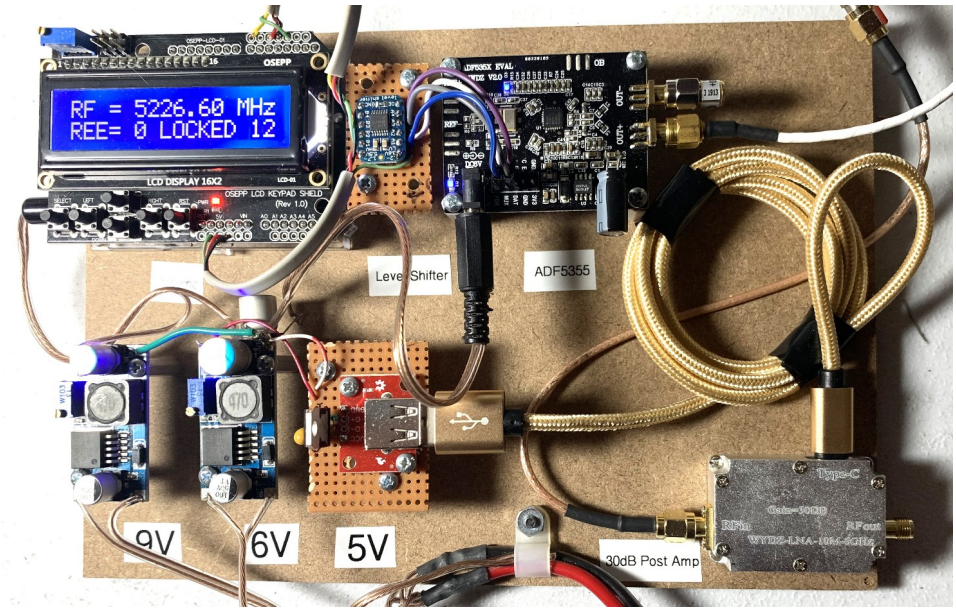
What I wrote for Ward for the supplemental material on fast scan TV was about 32 pages in length, plus an additional 12 pages of figures to be integrated into the text. I did work back and forth with Ward over several iterations. These are the topics I covered in the supplemental material: ATV & Public Service, Analog TV (AM ATV, FM ATV), Digital TV (CATV, ATSC, DVB-S & DVB-T), Narrow-Band DTV, Analog TV Signal Quality Reporting (i.e. P units), Performance Comparison of AM, FM and Digital TV, Latency in DTV, IDing on ATV, ATV Frequencies, ATV Propagation, Propagation Prediction, ATV Repeaters, TV Repeater Streaming (BATC), Equipment for ATV, Video Sources, AM TV Receivers, AM TV Transmitters, VUSB-TV, FM-TV equipment, DTV equipment, DVB-T receivers, DVB-T modulators, ATV Go-Kits for ARES, Portable ATV Repeaters, RF Power Amplifiers for ATV (for AM, FM & Digital), Antennas for ATV, and ATV Suppliers (27 listed). Ward did insist upon retaining some of Tom's older material.

Fortunately, the ARRL makes some ATV material free on their web site (www.arrl.org) If you go their website, home page search box and enter "ATV", click on the first offering "ATV - Fast Scan TV". The first reference offered is in fact my application

note, AN-55, ***"ATV Handbook - an Introduction to Amateur TV"*** (44 pages in .pdf format) It covers most of what is also covered in the handbook's supplemental material.

Also of interest, another fellow ATVer, Mel, K0PFX, St. Louis, MO, was another contributor to the handbook. His contribution was an update on digital HF voice chapter 15.4.5

73 de Jim KH6HTV, Boulder, Colorado



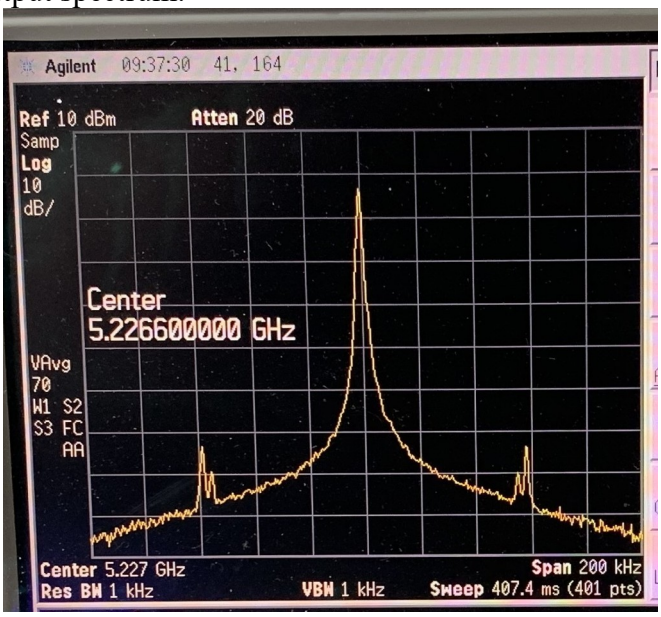
BREAD-BOARD ADF-5355 FREQUENCY SYNTHESIZER

Pete Goldman, WB2DVS

I decided it would be fun and educational to "roll my own" ADF5355 synthesizer. The synthesizer board was purchased from AliExpress. After some testing by programming the ADF5355 from a PC using a USB to i2C adapter (the synthesizer board is controlled over an i2C interface) I used an Arduino and LCD display/push button "Shield" to control the synthesizer. This provided a decent user interface with a display and buttons to enter the frequency. An Arduino Shield is a peripheral board that is mated with the Arduino by pressing its pins into the pin sockets on the Arduino. The firmware was a significant rewrite from open source code that was written for a different synthesizer chip. Since the Arduino uses 5V I/O and the synthesizer uses 3.3V I/O I had to add a level shifter between the two. The entire system works on 12V so it can potentially be used in the field as an LO for a transverter. The necessary voltages (6V for the

synthesizer and 9V for the Arduino) are produced using inexpensive switching supplies available on Amazon. I added some additional filtering on the 6V synthesizer input to avoid spurs on the synthesizer output spectrum from the switching power supply noise.

The system works well, but the phase noise was high on the output. This phase noise is a result of very low level noise from the 5V regulator on the synthesizer board that powers the synthesizer chip's (ADF5355) internal VCO. In other words, noise on the VCO power supply very slightly frequency modulates it. Analog Devices recommends using their very low noise regulator for that power supply. These cheap synthesizer boards use a less expensive regulator. The solution, discussed on various websites, is to add an additional electrolytic cap to the output of the 5V regulator. I used a 1000uF 6.3V Rubycon AX capacitor. This change, as well as the well filtered 6V switching supply produced a good output spectrum.



WB2DVS's Bread-Board ADF-5355 pcb output (power amplifier not used) spectrum. Phase noise measurement. Center frequency = 5226.6 MHz, span = 200 kHz, resolution bandwidth = 1 kHz, 10dB/div & 20kHz/div

The other change I made was to improve the accuracy and stability of the synthesizer by replacing the inexpensive 25MHz XTAL oscillator with a TCXO (temperature compensated crystal oscillator). I found the improvement significant and well worth it. I also made a minor change to the synthesizer board to allow the ADF5355 to be driven by a single ended output oscillator rather than a differential output one. The cost of the Taitien TT type TCXO was about $14.

With several separate modules, including power supplies, there were issues with ground loops that was sending some of the switching power supply noise through the synthesizer, causing spurs to appear in the spectrum. That was solved by a careful grounding

arrangement between the boards. It was important not to have multiple grounds on the synthesizer board that come from different places, like the power input and the Arduino. The post amplifier on the board was powered from a 5V linear supply that was powered from the 6V switching supply. The power connection to the amplifier is a USB cable.

I found it was useful to coil that USB cable to introduce some common mode impedance (a choke) to further reduce noisy ground currents in the synthesizer.

You may wonder why I didn't just use linear regulators throughout to eliminate the noise problems and simplify things. The reason was energy efficiency and heat. Since this design could be run off a 12V battery I was trying to be careful about wasting power with linear supplies that had to drop 12V to 9V, 6V and 5V. I was comfortable powering the 5V linear regulator from the 6V supply since it would waste minimal power.

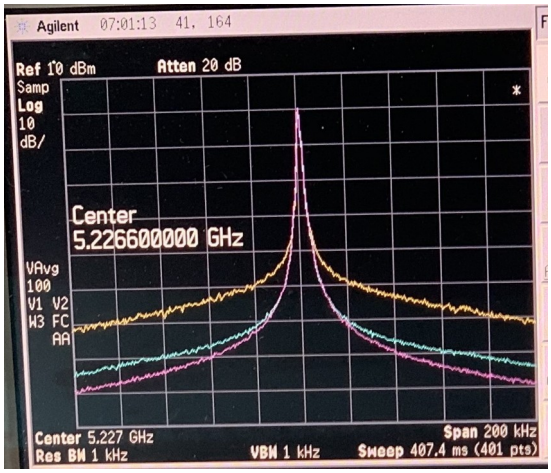
Above is a photo of the total system. I realize it looks a bit like a high school science project built on a sheet of wood, but the idea was to make it easy to modify and measure things.

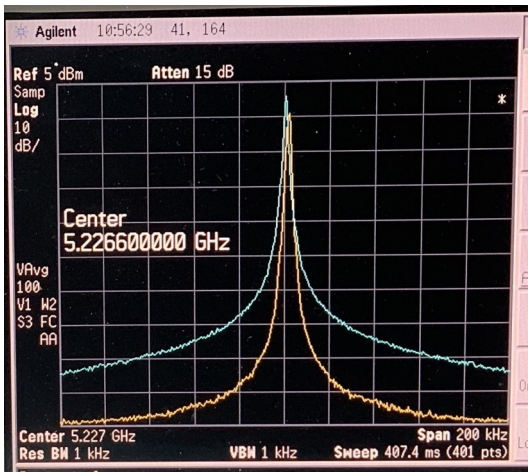
Although this project met my goals of building a synthesizer system partially from scratch, you might want to buy a complete system that is packaged in a metal case or can be easily put in a metal box. If so I would definitely add the filter capacitor and replace the oscillator. One of the advantages of the pre-made system is that ground loops are eliminated by having everything built on one circuit board.

73 de Peter Goldman, WB2DVS, Boulder, Colorado

Analog Devices ADF-5355

At this point it is well worth revisiting the past. See our TV Repeater's Repeater, ATV newsletter issue # 71 (March, 2021) for more about mods & phase noise improvement. The box treated then was the expensive version in an all metal enclosure. It is still available out of China on E-Bay. The price is all over the place ranging from a low of $160 to $235.





ADF-5355 mods 10dB/div & 20kHz/div Calif Microwave (yellow) & ADF-5355 (cyan)

The spectrum on the left shows the effect of making simple modifications to this box. The box was a new production, recently purchased. The yellow trace is the original spectrum from the factory in China. The cyan trace is after adding 1000µF cap. on the output of IC1 (+5Vdc) regulator. The magenta trace is then after adding a second 1000µF cap, this time on the output of IC2 (+3.3Vdc) regulator. Also added 1000µF caps on U3 (+6Vdc) and U4 (+3.3V) regulators, but saw no improvement in phase noise. The spectrum on the right now compares the modified ADF-5355 with a California Microwave "brick" LO on the same frequency. The 5355 is clean, but still has higher phase noise than the reference standard "brick". Getting closer !

73 de Jim, KH6HTV, Boulder, Colorado

A Field Day Test of Digital Amateur Radio Television

Mike Kennedy, VA3TEC
Orleans, Ontario, Canada

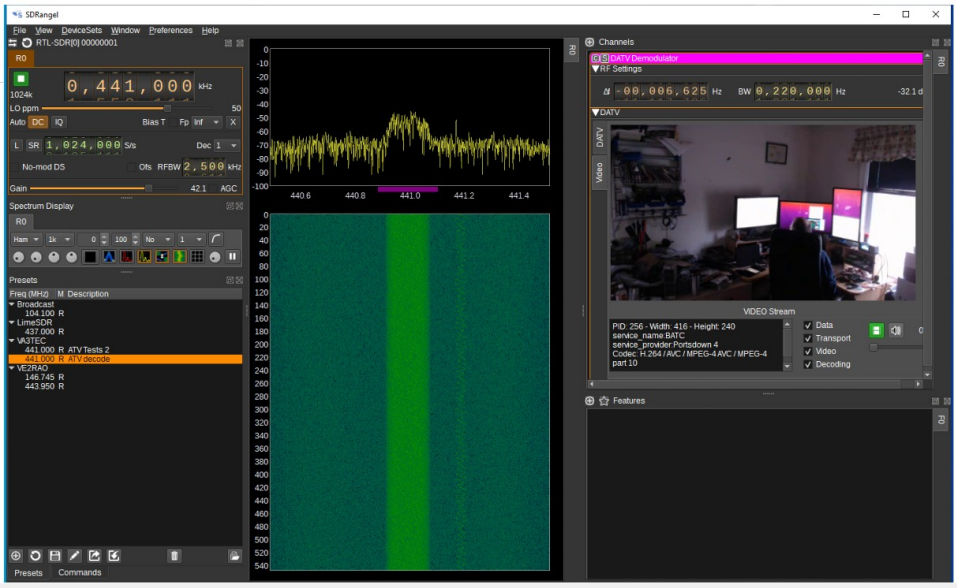
The British Amateur Television Club (BATC) has created an amateur radio television software, known as Portsdown. This software has been designed by Dave Crump G8GKQ to get you “up and running” with a Digital ATV (Amateur radio television) at relatively low cost.

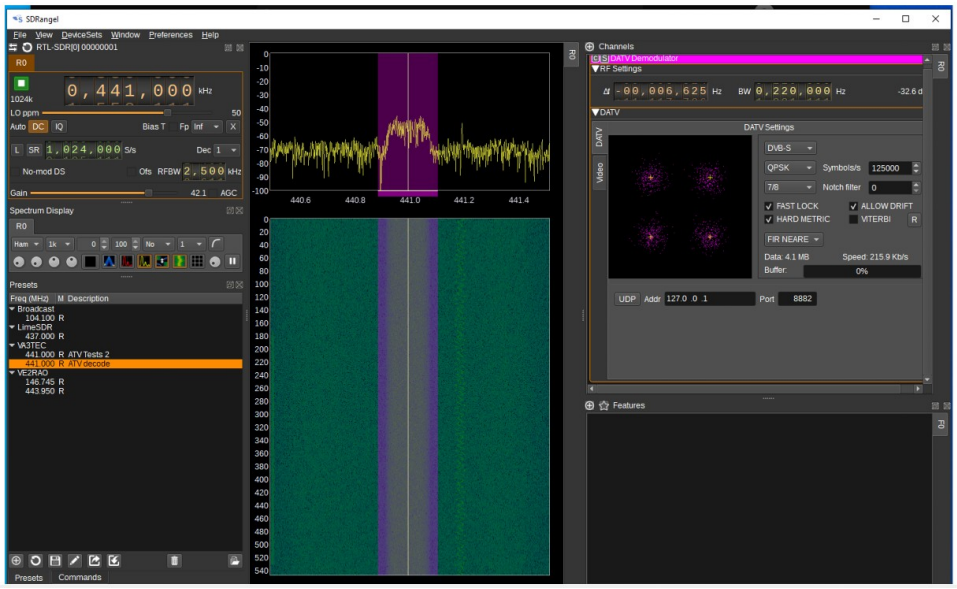
My DATV station consists of RPI software running on a Raspberry Pi 4, a radio transceiver and the PA (Power Amplifier) connected to a combined J pole 2 meter and 70 cm antenna on my roof. The Portsdown software project is a Linux based digital video modulator that takes video from a camera or digital video, encodes it, modulates it, and then sends it out to the SDR radio transmitter. In my setup I am using the LimeSDR-mini as a SDR radio that has a transmitter section built in. This transmitter automatically up converts the DATV modulated signal to the VHF or UHF bands. In my setup I use a carrier frequency of 441 MHz. This is in the amateur television portion of the band plan, 438.000–444.000 designated for amateur television.

The Power Amplifier (PA) is from Jim KH6HTV model 70-9B. This is a 70 watt, wide bandwidth amplifier that is useful for DATV signals.

Of interest for those more technical inclined, the modulated video uses MPEG-2 or H264 video compression. DVB-S is typically set to QPSK (Quadrature Phase Shift Keying) with a Symbol rate of 333K symbols/sec. The Forward error correction is typically set to 7/8 FEC. This provides a raw data rate of approximately 440Kbits/sec, with a total signal bandwidth of approximately 500KHz. All this from an RPI 4 is totally amazing with reasonable picture quality for full motion 30 frames per sec video!

On the receive side, I use a free/open source SDR software package called SDRangel. In my opinion, this is one of the best open source software packages for both SDR receive and transmit. It was written by ED Griffiths F4EXB and is available from GitHub. They are windows executable files and source code for more experienced Linux users. While challenging to set up and run, it is very rewarding once you succeed. Once working, a typical RTL-SDR Radio can be used as your SDR receiver. The best settings are to use the 2.4 Msps (Mega a sample per second) data rate. The SDR can go to 3.2 Msps but I found that extra noise would come into the signal on the spectrum and ruin your signal decoding. In an another data link the screen captures, I was able to set to a symbol 125Ks/s with a raw data rate of ~215Kb/s and a received signal strength of -32.6 dB. This is a link of 14Km between my transmit QTH (VA3TEC) in Orleans, Ontario to the receive location of Gatineau, Quebec of the QTH of Luc (VA2RLM).

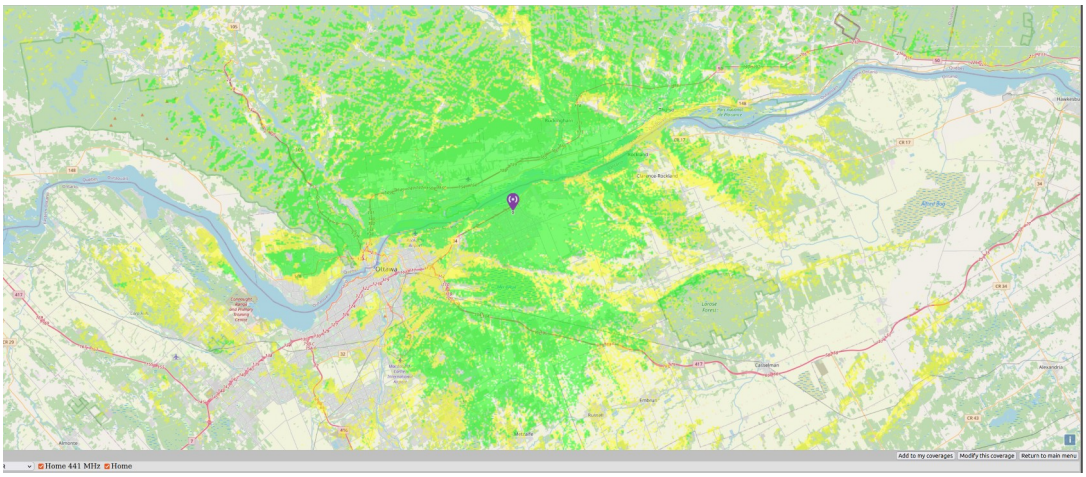




This is a photo of my roving remote "station" that was setup for testing before field day 2022 near park "la baie" in Gatineau. At this distance and with such a wide bandwidth signal a multi-element Yagi beam antenna is required. As you can see my 440 MHz beam is pointing to my house in Orleans and the received strength is quite good at -15 dB for a quick demonstration.

GENERAL REFERENCES
https://wiki.batc.org.uk/Portsdown_software
https://github.com/davecrump/portsdown
http://www.awarc.org/wp-content/uploads/2020/05/Complete-Portsdown-System.pdf
https://limemicro.com/products/boards/limesdr-mini/
https://www.sdrangel.org/
https://kh6htv.com/

(*reprinted with permission from Ottawa Valley Mobile Radio Club, "Rambler" newsletter, Oct. 2022, vol. 65, issue 2*)



This is an RF coverage map of the Ottawa, Ontario area from VA3TEC's DATV QTH. He is on 441 MHz with 40 Watts of RF. He is using a Raspberry-Pi 4 connected to a LimeSDR-Mini. The software is Portsdown 4 from the BATC.

IN MEMORIUM

It is with a sad heart that we report the recent passing of fellow Boulder ATVer, AB0MY, Bill's lovely wife Mary. Bill says there will be memorial service for Mary, sometime next summer, probably in June, in accordance with Mary's wishes.

BARC - HF & ATV demo - Cross Roads Mall - 1976

A Bit of BARC Club History -- Ham radio was active in Boulder as early as University of Colorado station 9XAQ in 1920. BARC was formally organized and became affiliated with the ARRL on May 7, 1953 through the efforts of local hams and National Bureau of Standards (NBS) engineers moving to Boulder, during construction of the lab on south Broadway. The NBS (now NIST) building was dedicated in-person by President Eisenhower in September 1954. Above is a photo from

a BARC ham radio demonstration held at Boulder's Crossroads mall in 1976 (*photo credit and thanks to Jim KH6HTV, then WA0NHD*). It included a live demo of ATV along with a operational HF station.

73 de Mike Derr, W3DIF, Broomfield, Colorado

10 GHz Band Feed-Back:

Hi Jim --- Animate your US people that they go more to 10 GHz. You probably have a lot more surplus parts than we do in Europe. DMC is USA manufacture as far as I know. With DMC UPconverter it is possible to have up to 15mW DVB-T output on 10GHz with HV320. Simply mix up, e.g. 9.1GHz LO + 23cm DVB-T signal = 10GHz DVB-T.
You can see my post OE7DBH - Technik in Oberland - Seite 15 - OE7 Amateurfunkforum (oe7forum.at) ,Here are some other links of interest
https://www.eb3frn.net/?p=118
https://www.radio741.com/43626-310mhz-up-converter-coaxial-sma-dmc-110415.html
https://picclick.co.uk/DMC-110365-UP-CONVERTER-FROM-24GHz-MICROWAVE-EQUIPMENT-124139318171.html

Vy 73, Darko, OE7DBH, Austria, oe7dbh@drei.at

Editors Note: *Digital Microwave Corp (DMC) was located in San Jose, California. However, I suspect they are no longer in business. Googling them I am unable to find any web site for them.*

FEED-BACK on HF DATV: There is an existing HF transmission format with 24 kHz B/W that's been used successfully for single-hop 15 fps video over a 1300 km path, it's MIL-STD-188-110C.now superseded by MIL-STD-188-110D

http://tracebase.nmsu.edu/hf/MIL-STD-188-110D.pdf

It is a proven HF technology with effective rate for data of up to 120 kbs in a 24 kHz B/W. The data stream it carries can of course contain anything you want, Video stream, Still Images, Documents, even Internet (but painfully slowly). There's some brief info on a typical transceiver, with a PDF of rig's spec at bottom of page, see
https://www.l3harris.com/all-capabilities/an-prc-160v-wideband-hf-vhf-manpack-radio

73 Trevor, M5AKA, Chelmsford, England

W0BTV Details: **Inputs:** 439.25 MHz, analog NTSC, VUSB-TV; 441MHz/6MHz BW, DVB-T & 1243 MHz/6MHz BW, DVB-T
Outputs: Channel 57 --- 423 MHz/6MHz BW, DVB-T, or optional 421.25 MHz, analog VUSB-TV. Also, secondary transmitter, FM-TV output on 5.905 GHz (24/7).
Operational details in AN-51a Technical details in AN-53a. Available at: ***https://kh6htv.com/application-notes/***

W0BTV ATV Net: We hold a social ATV net on Thursday afternoon at 3 pm local Mountain time (22:00 UTC). The net typically runs for 1 to 1 1/2 hours. A DVD ham travelogue is usually played for about one hour before and 1/2 hour after the formal net. ATV nets are streamed live using the British Amateur TV Club's server, via: *https://batc.org.uk/live/kh6htvtvr* or *n0ye or ab0my*. We use the Boulder ARES (BCARES) 2 meter FM voice repeater for intercom. 146.760 MHz (-600 kHz, 100 Hz PL tone required to access).

Newsletter Details: *This is a free newsletter distributed electronically via e-mail to ATV hams. The distribution list has now grown to about 500. News and articles from other ATV groups are welcomed. Permission is granted to re-distribute it and also to re-print articles, as long as you acknowledge the source. All past issues are archived at: https://kh6htv.com/newsletter/*

ATV HAM ADS

Free advertising space is offered here to ATV hams, ham clubs or ARES groups. List here amateur radio & TV gear For Sale - or - Want to Buy.

ANALOG, 23cm FM-TV EQUIPMENT INTEREST SURVEY

Back in 2011-2012, I designed a complete set of equipment for 23cm FM-TV. The intent at the time was to provide a replacement for the great transmitter and receiver from the

1990s era from HF Technology. I spent quite a few man-months in the development. The products which resulted included:

Model 23-1, 3 channel, 3 Watt, FM-TV Transmitter
Model 23-8, 3 channel, 50 mW, FM-TV Modulator
(*requires external rf power amplifier*)
Model 23-4 Low Noise Pre-Amp (*now sold today as the 23-LNA*)
Model 23-7 Low Noise Down-Converter, 3 channel
Model 23-5 70 MHz IF Amplifier & FM-TV Demodulator
(*useful for all microwave bands with a suitable down-converter*)

The resulting products were all top quality and performed extremely well. I had designed the modulator and de-modulator to have extreme flexibility to be able to be customized for most any ATV repeater group's local standards. For example adjustable deviation, polarity, pre-emphasis or not, mono or stereo audio, etc.

The designs relied upon using 1970-80s era ICs when FM-TV was in it's hey-day. By 2012, these ICs were long since obsolete and difficult to procure. Thus, I was forced to find them on the obsolete market and had to pay quite high prices and buy in quantity, enough to last several life-times. Every thing in my products was very small volume and had to be purchased at retail. As a result, the prices for my finished products were quite high. As of Dec. 2021 a year ago, I was advertising them at: Model 23-1 $575, Model 23-5 $375, Model 23-7 $350 and Model 23-8 $375. At these prices, essentially nobody was interested. Plus add in the transition from analog to digital TV. The only product that had moderate interest, aside from the LNA, was the model 23-7 Down-Converter.

Then on 30 Dec. 2021, we had the major Fire Storm which destroyed 1,000+ homes in Boulder County, Colorado. It included Janet's and my home, plus our daughter's. The stock inventory of all those old, obsolete ICs used in these FM-TV products was lost. So, I dropped from my product line all of those products. The sole remaining item was the model 23-LNA, low noise pre-amp which I am still able to build and sell and have sold some of them this year.

Now, I have just received a request from an ATV ham to build the model 23-8, 23cm FM-TV Modulator for his local ATV repeater transmitter. Should I go to the effort of trying to track down once again the obsolete ICs, etc. ? ? ? This is the reason for my posing these questions to the readers of this ATV Newsletter.

? #1 Do you have an interest in purchasing 23cm FM-TV equipment from me ?

? #2 If so, are you willing to pay high prices, at least as high as previously advertised?

If you need to know more about these old products, send me an e-mail for the detailed spec. sheets and instruction manuals. (kh6htv@arrl.net)

Jim Andrews, KH6HTV, Boulder, Colorado