Boulder Amateur Television Club
TV Repeater's REPEATER

December, 2022
2ed edition, issue #118

BATVC web site: www.kh6htv.com

ATN web site: www.atn-tv.com

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LATEST UP-DATE on TRANS-ATLANTIC, 10 meter DATV

Hi Jim --- I just read your latest newsletter. It is great as usual. I figured I'd update you with some more details regarding the 29Mhz transatlantic ATV attempts that are currently being done.

The receive setup I have here for this testing is rather simple. The receiver is nothing more than a NEWELEC NESDR Mini SDR dongle and SDRAngel software running on my PC, connected to a 10 meter beam. It is pretty much the same setup as described and pictured in more detail in your later article on 'A field day test of digital amateur radio television by Mike Kennedy, VA3TEC', so anyone could easily duplicate the setup and join the fun.

I did have to add a FM broadcast band filter as I am having a bit of an issue with a local FM broadcast station injecting noise on the SDR at the testing frequency which complicates the decoding. The FM band filter helps, but doesn't eliminate that problem entirely, so there is room for improvement on my end.
Prior to today, the signals that I have been able to decode from G0MJW, M0DTS & G4XAT have been better described as random captured video frames rather than actual moving video.

But this mornings testing went better. After decoding more random images from M0DTS & G4XAT, I was able to tweak the decoder enough to eventually capture about 10 seconds of full motion video from Mike, G0MJW as he was walking around his shack. I was quite surprised, as the band was shifting around quite a bit. So today's testing finally proves that usable full motion video is achievable. Unfortunately, I hadn't set up a way to record this full motion video. :(

All the testing thus far has been done using DVB-S at 18 KHz bandwidth. We are now setting up to try DVB-T at 150 KHz bandwidth. This will require completely different equipment as SDRAngel is not currently able to decode DVB-T.

I will be using a BATC Knucker receiver with a Ham It Up up converter, as the Knucker currently won't tune below 44 MHz, or decode lower than 125 MHz bandwidth.

I will let you know if the DVB-T works better with the fading on HF

(email 12/5/22) de John Kozak; K0ZAK/3, Reisterstown, Maryland

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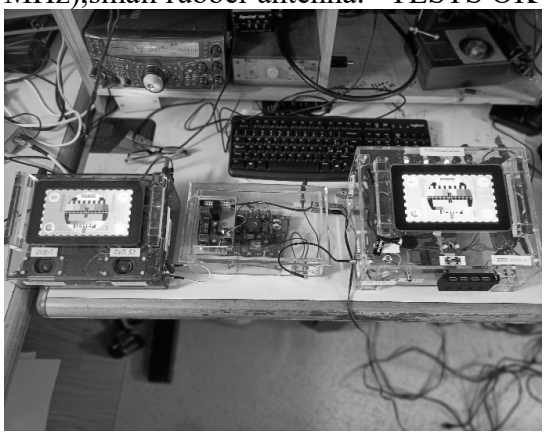
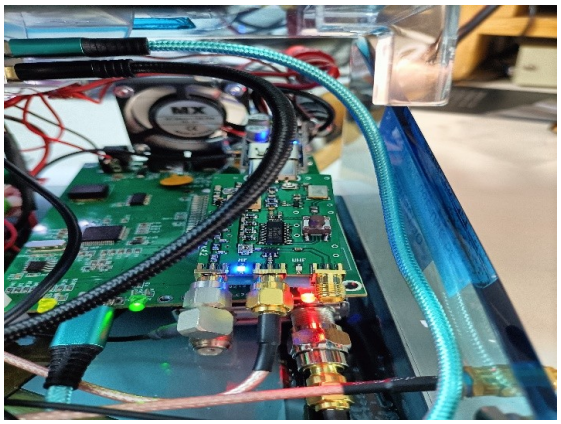
10 meters with Portsdown

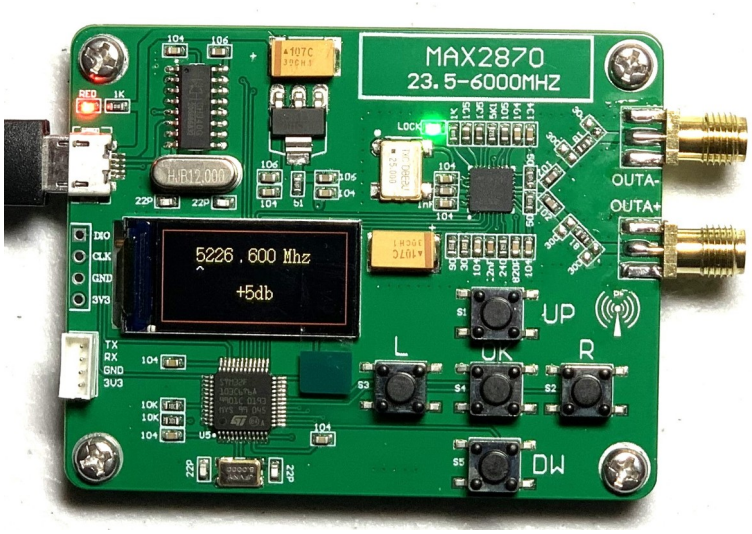
Up and down converter with LO at 370 MHz. Receive chain gain 10 dB. Noise less than 2 dB. Transmit chain input of 0 dBm for output of +20 dBm (100 mW). In the 370+29.250 MHz (399.250 MHz) transmit test, Pluto -0 dBm up converter 100 mW, to rubber antenna. In receive, used an up converter with LO at 125 MHz +29.250 (154.250 MHz),small rubber antenna. TESTS OK !





There are two receivers, one with 370 MHz LO and one with 125 MHz LO. I used the 125 MHz one because it is internal to the Portsdown. See photo. As for CB amplifier 50 Watt, 26/28 MHz in class AB.

Saluti ! de IZ5TEP, Filippo Cassone, Viareggio, Italia



Another Microwave LO to Evaluate

The past several issues of this newsletter have been focused on getting on the air with digital ATV on our microwave bands. The key to success there is finding a suitable local oscillator (LO) with low phase noise. The Nov. 2022 newsletter, issue #115, discussed several oscillators which we have evaluated recently. Now here in mid-November, Colin, WA2YUN, has made another discovery while surfing the internet. See the above photo for a still different pc board version of the MAX2870. The MAX2870 works from 23.5 MHz to 6 GHz. Colin found this on AliExpress. It comes from China and sells for $30 + $5 shipping. He has kindly loaned his new purchase to your editor for testing and evaluation.

1. The number one observation is "Yea !" this one finally answers one of our biggest complaints about the various pc board frequency synthesizers coming from China. Namely that none of them would immediately put out RF on frequency when DC power was applied to them. The $35 ADF-4351 with a keyboard for data entry would not even remember the frequency when DC power was removed. It had to be keyed in, every time the synthesizer was powered up. This draw-back thus prohibited their use being embedded within any piece of gear. Or for any gear to be remotely located, such as at a repeater site. **This new MAX2870 synthesizer board (a) remembers the previous frequency entered and (b) puts out rf on the correct frequency immediately upon powering up.** No human interaction required.

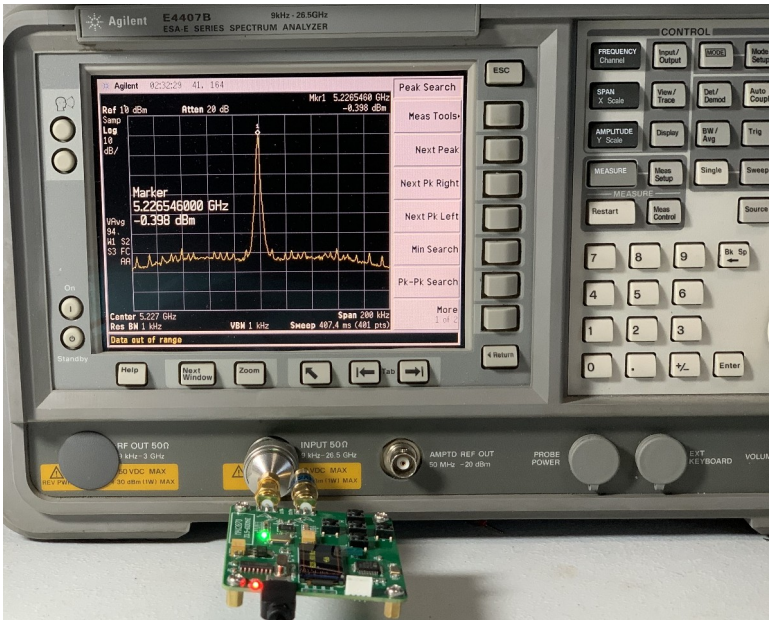
2. As seen in the above photo, a simple, on board display shows the frequency. Data entry is with 5 push buttons. Up, Down, Right, Left and OK (i.e. Enter). Any frequency from 23.5 MHz to 6.0 GHz can be entered with 1 kHz resolution. A second screen displays the options of operating in either CW (single frequency) or sweep mode.

3. Also seen on the display screen is an rf power level in dB. The value displayed can be changed, but it does nothing. The rf output power is fixed. The spec. sheet for the MAX2870 says the rf power can be programmed from -4dBm to +5dBm, but this feature is not activated on this pc board.

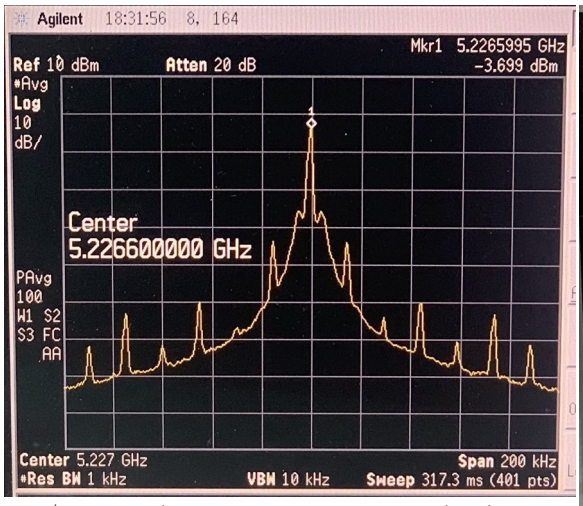
4. The board has two RF SMA outputs. The rf output is a square wave with very fast rise and falltimes. As a result, it is strong in odd order harmonics. The rf output level is fixed and is of the order of -1 to +2dBm into 50 Ω. There are pads on the pcb for pi network attenuators on each output. They are not populated, but have a 0 Ω jumper installed. I found it best to terminate the unused SMA output. If left unterminated, it messes up the generator's output Z match. For example, testing at 400 MHz, I measured +2dBm when both outputs were terminated, but it dropped to 0dBm when the unused port was left open.

5. The frequency accuracy is quite good, but not perfect. At 5.2 GHz, the Agilent E4407B spectrum analyzer said the particular board tested was about 50 kHz low. There are no provisions on this board for using an external frequency standard.

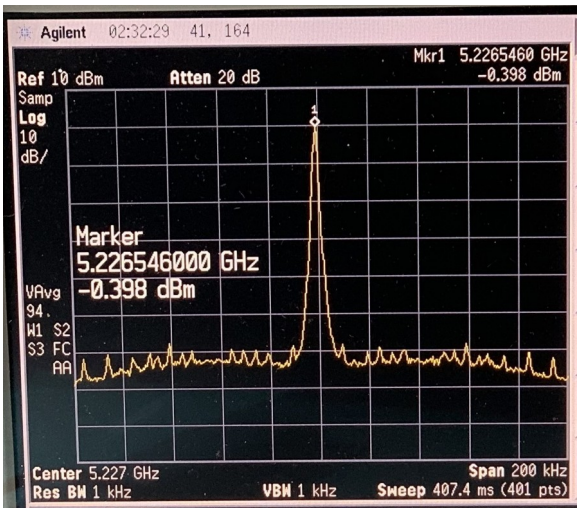
6. The phase noise as measured with the Agilent E4407B (200 kHz span, 1 kHz RBW) showed good performance. It actually showed considerably better performance than the previous MAX2870, $75 pc board purchased from Amazon with the touch screen display. See the comparison photos on the following page.



New MAX2870 pcb being tested on Agilent, E4407B,
26 GHz spectrum analyzer



$75 touch screen Amazon synthesizer



new $35 AliExpress synthesizer

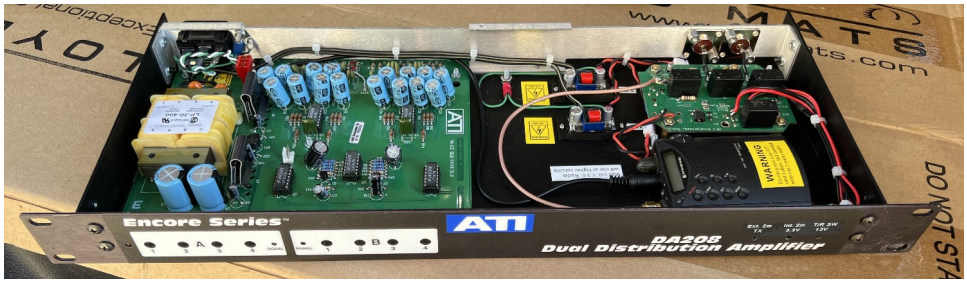
Comparison of two different MAX-2870 frequency synthesizer pc boards. Phase Noise measurements at microwave frequency of 5.2 GHz. 200kHz span, 10dB/div & 20kHz/div, 1 kHz resolution band-width.

So Do We Have a Winner Yet ?

Well, not really. The following table compares the DVB-T receiver sensitivities for the various microwave synthesizers tested previously. None really come close to the performance of the California Microwave brick LO.

The RF frequency was 5678 MHz, 6 MHz BW, QPSK modulation. The LO used for all was that of the California Microwave brick, i.e. 5226.6 MHz, The resultant IF was thus 451.4 MHz. The mixer used was a Watkins-Johnson M-14 with +7 dBm LO drive. The rf outputs from the synthesizers under test were all of the order of 0 dBm. An SBB5089 amp was used to boost the LO power. A suitable value SMA attenuator was then used to set the proper LO drive to the mixer. A Taoglas, 5.8 GHz band-pass filter was used on the RF input to the mixer. The LNA used was from Down-East Microwave with 13dB of gain and 0.7dB NF spec.

Frequency Synthesizer	**Mixer Only Sensitivity**	**LNA+Mixer Sensitivity**	**Notes:**
California Microwave	-90 dBm	-96 dBm	1970s era - telecom eqpt. "Brick" (reference standard)
MAX2870	-78 dBm	-84 dBm	$75 pcb with touch screen
MAX2870	-80 dBm	-78 dBm	$35 pcb with on-board data entry actually worse with LNA !
ADF5355	-66 dBm	-79 dBm	$160 all metal enclosure with added 1,000µF caps modification
ADF5355	-64 dBm	-74 dBm	$?? pcb - WB2DVS bread-board



integrated audio distribution amplifier and dedicated control receiver with the cover removed

DAYTON ATV NEWS

DARA ATV Repeater Control Receiver and Audio Distribution Upgrade Now Complete

On the Nov. 23ed ATV net, K8FIX (Bruce) and I discussed in detail the integration project that he took on. This build involved an upgrade to the control receiver and audio distribution subsystem that was in dire need of redesigning at the ATV repeater site. Also, the ATV Repeater system schematic that Bruce has been working on is 99 percent complete. It will be distributed once it is ready for prime time.

Here is a recap: During the ATV repeater schematic layout CAD drawing project, K8FIX and I decided to go ahead and rework the audio distribution system within the ATV repeater as this system was in dire need of re-designing. The system provides DTMF tones to three separate DTMF decoders, along with voice audio channels for the separate ATV repeater transmitters at the site. The in-place audio distribution system had no adjustments for setting audio output levels and also all of the input lines were running in parallel on a single speaker output line from the 2 meter control receiver. Miraculously, this "hodge podge" of audio control wiring somehow worked flawlessly, but it was far removed from any good engineering practice. To that end, I sourced an audio distribution amplifier manufactured by ATI. The DA-208 was designed to allow for two audio inputs with a pair of four each adjustable audio outputs. After opening the chassis I noted that there was a lot of spare room within the enclosure(See Photo A below). The empty space within the chassis could be used to house a separate repeater project we had in mind . This other project at hand was directly related to ATV repeater control issues. We have had issues with club personnel using the 2 meter control

transceiver for various reasons while inside the repeater room, and on occasion, the 2 meter control transceiver would not be returned to the ATV repeater control frequency (144.340). On other occasions, power bumps would also sometimes cause the transceiver to switch to the NOAA weather radio receiver frequency. My solution was to recommend the integration of a dedicated 2 meter ATV repeater control receiver inside of the audio distribution amplifier chassis, so the protected control receiver would not be subject to inadvertent frequency changes. Additionally, I opted to obtain a pass-through RF sensing T/R switch inside the audio distribution chassis so the existing 2 meter transceiver could be used by club personnel while working in the ATV repeater room. After I acquired the needed components, Bruce Kobe, K8FIX volunteered to fully configure the dedicated receiver, power supplies and RF sensing T/R switching circuit. Bruce also made 3D printed brackets for the receiver, supplies and LED panel lights, and he added RF connectors to the back of the distribution amplifier. After we installed the distribution amplifier at the site, a burn-in period indicated the system worked as planned. For club members using the 2 meter transceiver within the repeater room, this has allowed for continued usage of the 2 meter transceiver with no worries regarding the receiver's required return to the ATV repeater receiver control frequency.

DARA ATV Repeater's 1258 MHz Amplifier/Driver/FM Exciter Repaired and Back On the Air

Here is a recap: The integrated chassis consisting of a ComTech FM exciter, a Mitsubishi RA18H1213G RF Module, and a W6PQL dual transistor amplifier(two XRF-286's) stopped functioning about three weeks ago, after five years of operation. Troubleshooting indicated a hard failure of the RF Module/driver. I replaced the RF module and two fans, a front panel LED and a power strip. While I R&R'ed the chassis, K8FIX, Bruce volunteered to create a cut-out in the lid of the chassis for an exhaust fan. The plan was to add an active air exhaust for additional chassis cooling. Bruce used a mini-mill with a fly cutter to cut the new exhaust port. He also installed four studs that aligns with 4 screw holes on the muffin fan. This approach had three purposes: The fan is placed externally, on top of the chassis over the exhaust port and prevents vibration from moving the fan. Also, the placement of the fan externally allows for the chassis to clear the other equipment in the rack when the unit is pulled out or placed back in after servicing. Lastly, the external fans also allow for their replacement without having to take the unit off line and make them a breeze (no pun intended) to swap out. This additional ventilation has brought down the internal ambient temperature of the system, indicated by the temperature monitor on the front of the chassis. I suspect the eventual RF module failure was likely due to thermal stress and this additional modification should extend the life of the components.

73 de Dave, AH2AR

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ATN - Arizona Christmas Party

Put **Sunday December 11th** on your calendar and plan to spend most of the day celebrating Christmas and ATV with wonderful ATN-AZ friends.

Kids of all ages are welcome. Children, be sure to supervise your adults so they don't get out of line.

We're calling this the 2022 ATN-AZ SUMMER MEETING AND CHRISTMAS PARTY. Better late than never... :)

The day is dedicated to our members and their families with technical, business, social and food experiences all wrapped up in one big Christmas package.

Whether you join us in person (best by far) or over the Internet (for those who are travel-challenged), do not miss out.

Plan to attend at Rod and Cheryl's home, 8334 E Culver St, Mesa AZ 85207 or on www.whereby.com/atn1.

This is what to learn ok forward to...

1pm to 5pm - ATV WORKSHOP - Bring equipment to work on or come to learn about what we have here. Tools and test equipment will be provided along with snacks and soft drinks. Equipment will be given away and sold. Bring items to sell. We'll have show and tell, brainstorming and demonstrations. We can get you on the air!

4pm to 5pm - EARLY BIRD SOCIAL TIME - You're welcome to arrive early for the meeting and party. Meet new and old friends in our festive Christmas environment. View the 12-foot tree in all it's glory. If you want, bring ornaments to place on the tree, tagged with your names. Enjoy our decorations and play with many toys that Santa has provided me through the years. Most of them move and talk in fascinating ways. Light snacks and drinks will be provided. More food and dessert will be available at about 5:30pm.

5:00pm to 5:30pm - SUMMER MEETING - This will be a brief business meeting to bring everyone up to date and introduce ideas we have in mind for 2023.

5:30pm to 7pm - CHRISTMAS PARTY - We'll begin with a white elephant gift exchange. If you want to participate, bring a wrapped gift with a value under $20. It can be a gag gift or something useful. Mark it FOR MALE, FOR FEMALE or FOR BOTH. Food and dessert will be served. All will be provided but you are welcome to bring

something special to share if you wish. We will have a chocolate fountain with a few dipping items. You can bring your own dipping items if you have favorites.

Email me at **wb9kmo@gmail.com** if you have questions or suggestions.

Please join us to make this a special and memorable time for all.

Best regards from your ATN-AZ Officers...
Ed Olague N5OLA - President
Rod Fritz WB9KMO - Vice President
Lee Weitzel K0CCU - Treasurer
Joel Wilhite KD6W - Secretary

NEW APP NOTE:

KH6HTV has posted a new application note to his web site **www.kh6htv.com**

It is AN-65 entitled **"Combo DVB-T & DVB-S Receiver Instruction Manual"**

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/*

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