Boulder Amateur Television Club
TV Repeater's REPEATER
May, 2020
2ed edition

BATVC web site: www.kh6htv.com

ATN web site:
www.amateurtelevisionnetwork.org
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ATV NETS: The Boulder ATV group now is holding two nets weekly.   They are on Thursday and Sunday afternoons, stating at 3 pm local time (MDT).   Net control for the Thursday net is Don, N0YE.   For the Sunday net, net control is rotated around to various hams. Each net has a bit different format.   The Thursday net typically runs for about 1 1/2 hours, while the Sunday net runs for an hour.   There is sometimes video material, such as a vacation DVD, playing either before or after the nets.

The ATV nets use the Boulder ATV repeater, W0BTV, on 423MHz / 6 MHz bandwidth with DVB-T modulation.   Full details about the repeater are found in KH6HTV application note, AN-51a (www.kh6htv.com)   We use the BCARES, 2 meter, FM repeater for our voice intercom and net control.   It is on 146.760 MHz, -600kHz, and 100 Hz PL tone required. All hams are invited to participate, even if you don't have ATV capability.

The nets are steaming free on the internet. We use the U.K. server of the British Amateur Television Club (BATC). You do not need to be a member of the BATC to go to their web site and watch streaming video from W0BTV, or any of the other 60+ ATV repeaters, world-wide.   To watch the W0BTV stream, go to: https://batc.org.uk/live/kh6htvtvr

Micro-Hams Digital Conference - 2020   (Saturday,   May   9th)
The Micro-Hams Amateur Radio Club is a club of Microsoft current and former employees in the Seattle area.   Each year, in the spring, they sponsor a digital hams conference. In the past, it has been held at the Microsoft campus in Redmond, Washington. This year due to the corona-virus pandemic they have had to convert their conference to a webinar.

This year is our 13th annual Microhams Digital Conference. This year has required us changing directions too many times to count but we are determined to provide a great

show. One of the virtues of going online is that we were able to invite presenters that would be impractical to bring to the Seattle area. We have a number of presenters who will be speaking to us from the future. David Rowe, the author of Codec2 and FreeDV will be speaking to us live from his home in Adelaide, Australia. He's 16 hours 30 minutes ahead of us so it will be Sunday morning for him. John Wiseman G8BPQ, the author of BPQ32 will be presenting from the UK and we have much of the Winlink development team all over the US. This is just a sample and the entire current agenda can be found at: https://www.microhams.com/ mhdc/mhdc2020/.

We will be streaming directly to You Tube so we can have an unlimited number of attendees. The conference is free but we do request a donation via the web site to cover our expenses. There is a chat channel in You Tube to ask questions and these will be passed to the presenters (who may wait until the end). To provide a more interactive experience, we will have a Zoom breakout room available at the end of the session where the presenters can hang out and answer questions in person for the next hour. Of course, the whole thing will be recorded on You Tube and available for viewing later if you miss anything.   The links to the stream and Zoom breakout room are being finalized and will be posted on the MHDC 2020 web site when complete.

<div align="center">https://www. microhams.com/mhdc/mhdc2020/

Hope to see you Saturday --- 73 de Scott, N7SS, MHDC Chair</div>

The MHDC-2020 Program for this coming Saturday is as follows. Note: all times are Pacific Daylight Time (PDT)

Time	**Speaker**	**Call Sign**	**Presentation Title**
8:45am	Scott Honaker	N7SS	Introductions
9:00 am	John Kruk	N9UPC	Yaesu System Fusion
	& Phil Sherrod	W4PHS	
10:00 am	Steve Waterman	K4CJX	Winlink Tips and Tricks
11:00 am	John Wiseman	G8BPQ	BPQ32
12:00 noon	**Jim Andrews**	**KH6HTV**	**Amateur Hi-Definition Digital TV**
13:00	Budd Churchward	WB7FHC	Nexus DR-X Board and Supporting
	& Steve Magnuson	AG7GN	Growth of Digital Mode
14:00	Andy Sayler	KF7VOL	-- TBD --
14:30	Syed Karim	KD9GII	Othernet
15:00	David Rowe	VK5DGR	Free - DV
16:00	Randy Neals	W3RWN	VARA
17:00	Scott Honaker	N7SS	Wrap up & final remarks

ATV gets Publicity on Podcast:

Jim Andrews, KH6HTV, was recently interviewed by Eric, 4Z1UG, for his podcast show, **QSO-Today.** (www.qsotoday.com) His interview will air soon as episode # 302.

Eric says " **QSO Today** is a podcast about the international hobby of amateur radio also known as ham radio. Every week, I interview a "hams" to hear their ham radio story and what they are doing now. Many of the technologies that we enjoy today including television and radio, cell phones, computers, and the Internet were born out amateur radio hobbyists experimenting with electronics and radio in their basements and garages. Amateur radio was and still is the frontier where hams conducted electronic experiments in order to make that wireless contact around the World."

Each of **QSO-Today's** podcasts typically lasts about one hour.   To date, Eric has conducted 300 podcast interviews.   A new podcast airs weekly.   All of the previous podcasts are archived and available on his web site.   Among the hams interviewed in the past on QSO-Today are: Ward Silver, N0AX, editor of the ARRL Handbook; ATVer Fred Kemmerer, AB1OC; Gordon West, WB6NOA;   ATVer Bill Brown, WB8ELK, Ulrich Rohde, N1UL of Rohde & Schwartz; our own Mike Mussler, AI8Z; Kai Siwiak, KE4PT, editor of QEX; Dave Sumner, K1ZZ, former CEO of ARRL; Roy Lewallen, W7EL, creator of EZNEC antenna modeling software; our own Rob Sherwood, NC0B, transceiver tester extraordinaire; ATVer Art Towslee, WA8RMC;   and Paul Wade, W1GHZ, microwave expert.

A/V Techniques & Hints (adding audio to HDMI):

Many of us D-ATV hams have struggled with the issue of how to incorporate audio commentary when we are showing off something on our computer screens, such as power-point slides, schematics, antenna patterns, etc. We often have had to resort to simply talking over our 2 meter, 146.76 intercom to add commentary.   In the old analog days, it was a simple matter. Just plug in the appropriate devices in the A/V RCA jacks. Now with video and audio being digitally imbedded into the HDMI data stream, it is not so easy to accomplish.   I struggled with this myself recently when trying to work up my DATV talk for the up-coming Micro-Hams Digital Conference where I needed to submit it pre-recorded to the tele-conference organizers.

Mike, NJ0L, has come to the rescue.   Like many other things, it is very possible to do this with a modern computer.   Because of the complexity of the operating systems and the multiple buried menus, it really means having someone hold your hand and lead you through the menus.   So here are Mike's guide-lines for a PC with Windows-10.

This morning there was some discussion about ways to combine audio and video in the HDMI cable that feeds a digital ATV transmitter. On my Windows 10 PC I use a television as my computer monitor, connected via an HDMI cable. I use the television's built-in speakers for audio, sent through the HDMI cable along with video. In place of the TV, this could also be your Hi-Des modulator for your DATV transmitter. With a microphone connected to the computer, I found that I can direct the microphone audio to

be heard through the TV speakers (i.e. microphone audio is sent along with video through the HDMI cable). This could also be the built-in microphone in your PC. In principle an HDMI splitter could be used to simultaneously send the PC's HDMI output (audio + video) to both the TV/monitor and to your DATV transmitter. Once you do this, anything that you show on your computer display (slide show, video, video from your own webcam, desktop) should be simultaneously transmitted through the digital ATV transmitter along with the microphone audio.
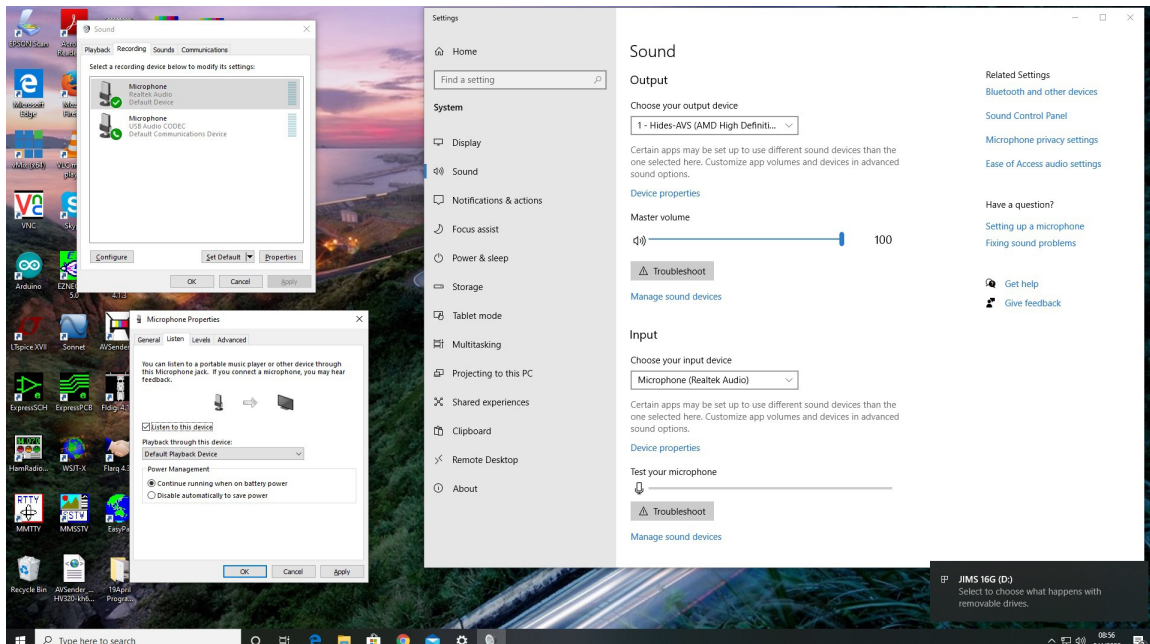
1.   First set up the PC to use the HDMI TV/monitor as the default audio output. In the lower left of your PC screen on the task bar, find the icon of a loudspeaker.   Left click on it.   This brings up a slider volume control, but also lists which device has been selected. Click on the ^ arrow to get a list of all available audio output devices.   Select the new one you want to direct your audio to and click on it.   For your Hi-Des modulator, it will be displayed as "Hides-AVS (AMD High Definition Audio Device)".

2.   Now again on the icon of the loudspeaker, right click on it.   Select "Open Sound Settings" and click on it. This brings up the Windows-10 "Settings" window.

3.   This lists the Output and Input devices. It should already show you have selected the Hi-des-AVS for the output.   On Input, chose which input device you want to use. For initial testing, chose the built-in microphone.

4.   Now in the upper right in this window choose "Sound control panel" This will open an additional, smaller, "Sound" window.

5.   Go to the "Recording" tab of the "Sound control panel" window, and scroll down to the default device, and click on it. Select "Properties" which brings up still another

small menu. Under the "Listen" tab set the "Listen to this device" checkbox. Then finally click the "OK" button.

6.   You have now configured your PC to output to the Hi-Des modulator (or other external monitor, etc.) your audio commentary along with the computer screen video. You can now close out the various settings menus.

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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.**

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Stop The Presses ! ! -- NEW, IMPROVED PXO DISCOVERED ! ! !

In the April newsletter, issue # 41, pages 4-10, we reported on the work of John, WB0CMC, Dave, AH2AR, Tom, W6ORG and Jim, KH6HTV to come up with a PXO, crystal replacement for PC Electronics, AM-TV transmitters.   At the time, they had found a satisfactory, but not perfect PXO.   Since then, John has made a major discovery. He found a PXO from Silicon Labs which is a Perfect replacement for a crystal. It has the same identical phase noise performance as a crystal.   To find out more about this fantastic discovery, read the attached, revised application note, AN-56a.

Replacement for Crystals - PXOs

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with significant contributions from
especially John Gebuhr, WB0CMC,
also Dave Pelaez, AH2AR   and Tom O'Hara, W6ORG

"Where can I buy crystals ?"   This is a lament heard often from hams owning older ham gear. Crystals were a very necessary item in many ham transmitters and receivers.   The major supplier for many years, since 1951, was International Crystal Manufacturing (ICM) in Oklahoma City, OK. ICM went out of business in 2017.   They were the last manufacturer in the US that made crystals to order in quantities as little as a single piece, and most recently, at a cost $35 each.

Don, N0YE, has just made an inquiry to the Microwave Reflector inquiring about sources for crystals. This search has now found a few crystal manufacturers that will make custom crystals in small quantities.   In the USA, it is Bomar (www.bomarcrystal.com) Bowmar however requires a minimum order of $100.   In the U.K., it is QuartSLab (www.quartslab.com).   They offer more reasonable prices of about λ35 for a single crystal. In the Czech Republic, it is Krystaly (http://old.krystaly.cz/index.htm). It has been reported that Krystaly's crystals sell for $22.   It is also reported that QuartSLab & Krystaly take credit cards and will ship to the USA. There may also be others ?

For the amateur TV market, the major supplier for many years has been Tom O'Hara, W6ORG, of PC Electronics (www.hamtv.com), Arcadia, CA.   All of Tom's AM-TV transmitters, prior to 2004, were crystal controlled.   In 2017, when ICM announced their closing, Tom and I were discussing options. With Tom's big installed base of thousands of his TV transmitters, he needed somewhere to refer hams to get crystals for them. I mentioned Programmable Crystal Oscillators (PXO) as an option. At the time, we agreed

that I would investigate their possibility for use in Tom's TV transmitters.   I purchased some Epson PXOs for experimenting, but found they did not work well in PCE transmitters.   They had spurs in their spectrum which caused horizontal tearing of the TV picture. Thus, we lost interest and dropped the project.

Most recently, in the BATVC newsletter (issues #33 & 38), we had two articles from hams about using PXOs in PCE transmitters.   The hams were Dave Pelaez, AH2AR, Dayton, Ohio and John Gebuhr, WB0CMC, Omaha, Nebraska.   This revived Tom, W6ORG's interest in pursuing using PXOs as replacement crystals in his TV transmitters. So, as a result, Tom, Dave, John and I have been having four way, e-mail conversations on the topic.

John and I in particular have been evaluating several PXO models and comparing results. We evaluated several models from Epson and found them to be unsatisfactory for various reasons. The Epson models evaluated were the models: SG-8003, SG-8002 and the SG-8101. *Finally John found a "winner" from the company Silicon Labs. It was their model 510CBA*.   Figs. 1 & 2 show the measurements of the phase noise of the various PXOs and for comparison an HC-50/U, 5th overtone crystal.   They were all measured in the same oscillator circuit shown in Fig. 3. This oscillator circuit is similar to those found in the PC Electronics AM-TV transmitters.   **The 510CBA's phase noise is almost a perfect replica of that measured from the crystal**. The only difference noted is very tiny spurs at ± 425 kHz that are -80 dBc.

The issues with the Epson PXOs were related to unsatisfactory phase noise and spurs. When they were used as a crystal replacement in Tom's 70cm, ATV transmitter, they created various undesirable artifacts in the resultant TV picture.   The SG-8003 caused horizontal tearing. The SG-8101 caused background white noise, thus a P3 picture.   The least objectionable was the SG-8002, but it still introduced some residual noise in the TV image, resulting in a P4 picture. The TV picture using the 510CBA was P5 and identical to using a crystal in the oscillator.

The result is our conclusion that the Silicon Labs 510CBA, PXO can work as a suitable replacement crystal in PC Electronics, AM-TV transmitters.

Thus, KH6HTV VIDEO has agreed to help Tom by building and selling these to ATV hams for their PCE transmitters at a price of $20 each, including postage.
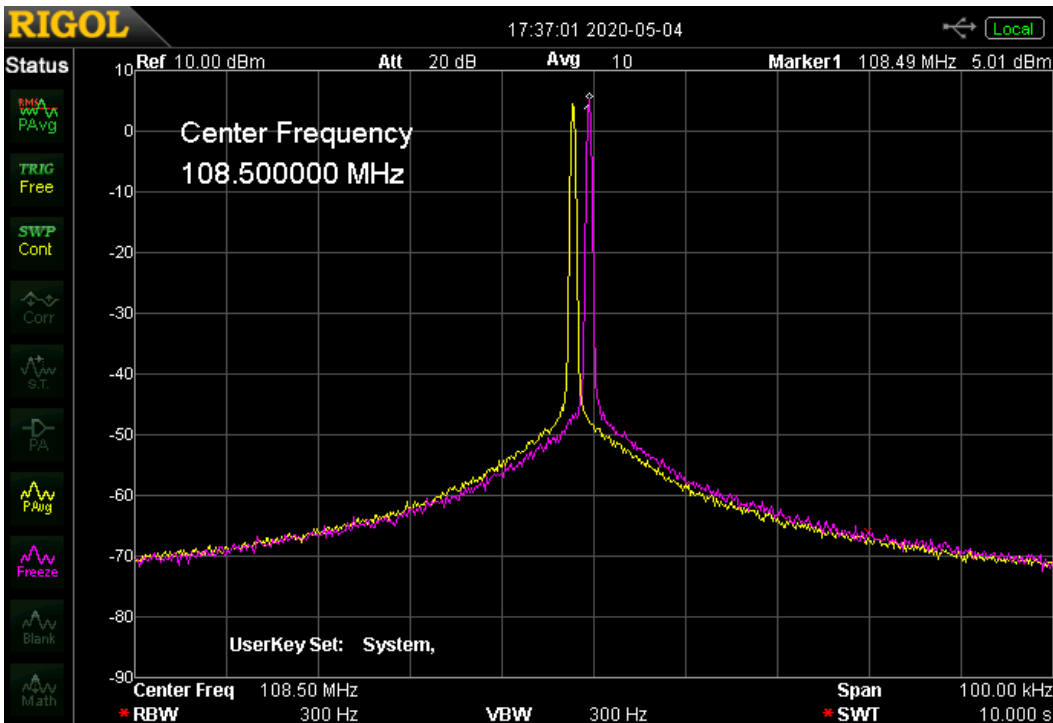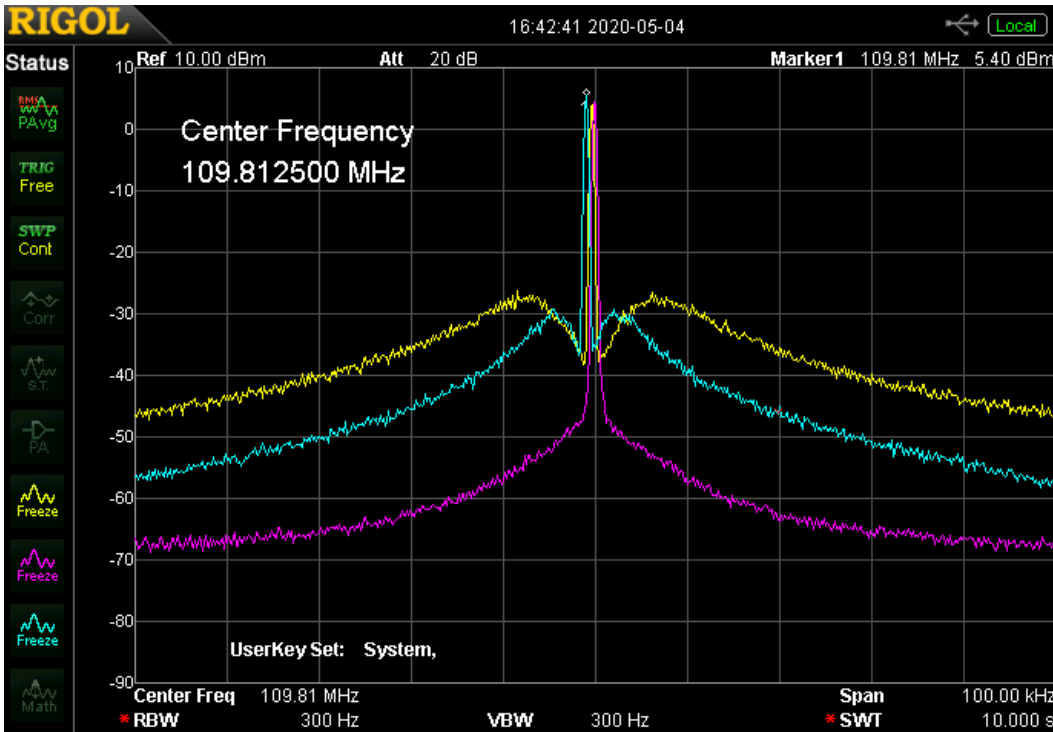
Fig. 1 Close in, ± 50 kHz, Phase noise of various oscillators:
10dB/div, 10kHz/div, 300 Hz bandwidth.
top photo: yellow = SG-8003, magenta = SG-8101, cyan = SG-8002 PXOs
bottom photo: yellow = HC-50/U crystal, magenta = 510CBA PXO
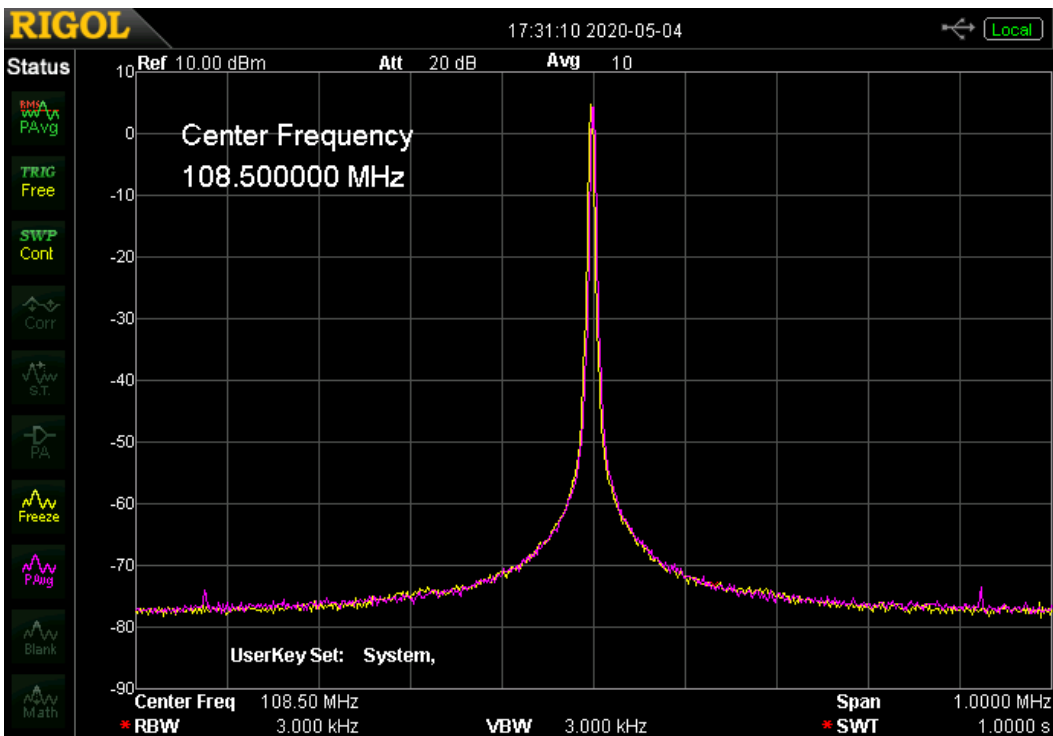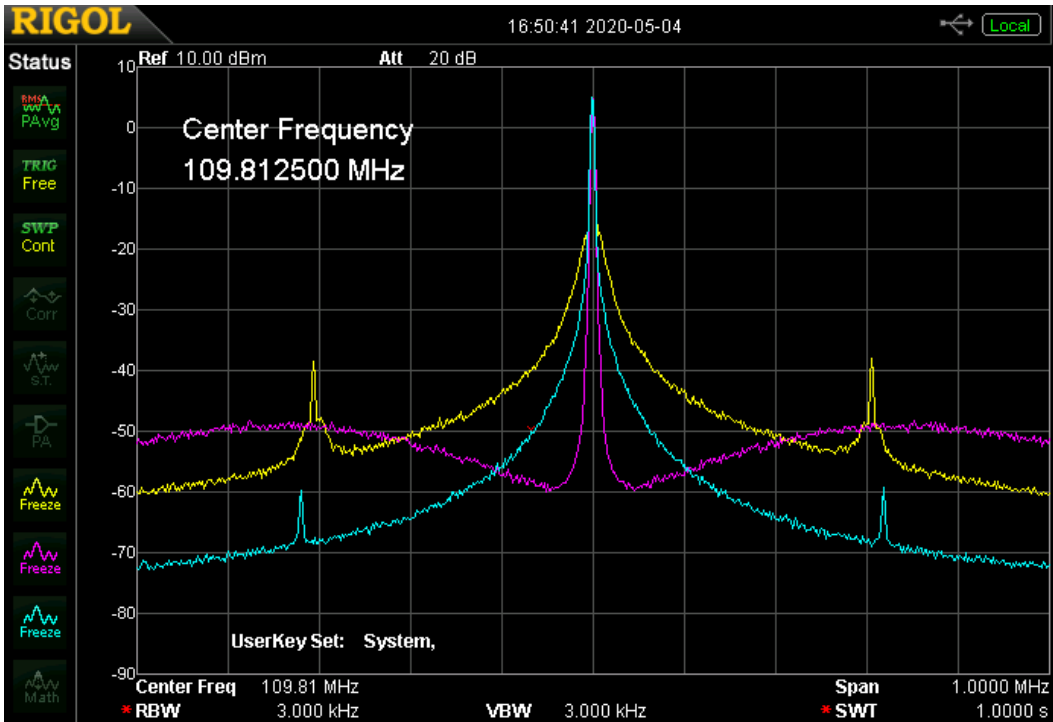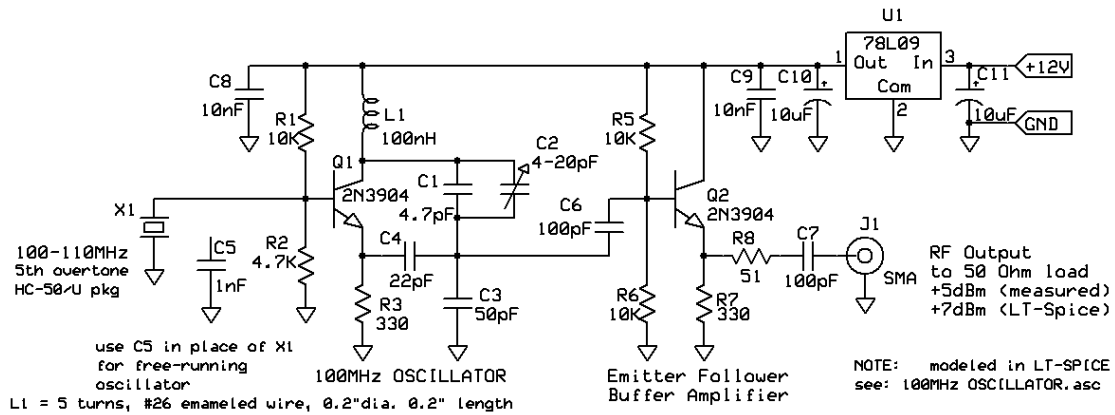
Fig. 2 Wide-band, ± 500 kHz, Phase noise of various oscillators:
10dB/div, 100kHz/div, 3 kHz Bandwidth
top photo: yellow = SG-8003, magenta = SG-8101, cyan = SG-8002 PXOs
bottom photo: yellow = HC-50/U crystal, magenta = 510CBA PXO

Fig. 3   100 MHz, Overtone Crystal Oscillator --- Test oscillator for crystals and PXOs
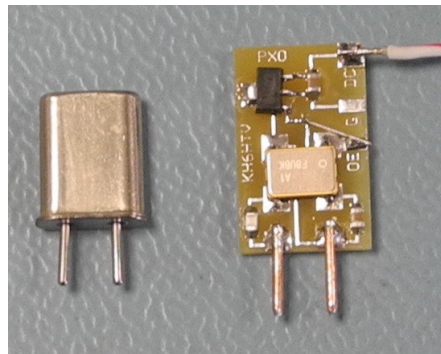

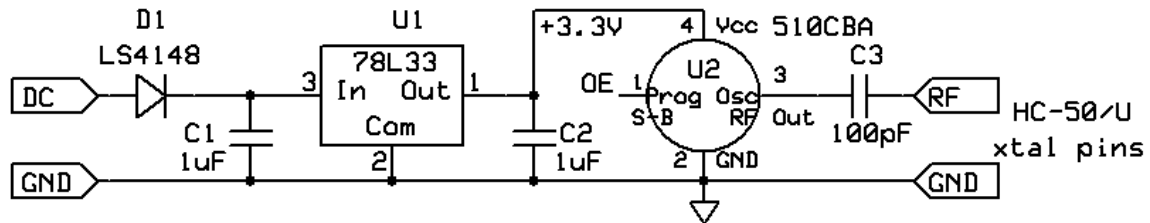Fig. 4 an HC-50/U crystal and it's PXO replacement

Fig. 5   KH6HTV Video PXO schematic

Fig. 4 Shows a typical crystal and the new KH6HTV Video PXO replacement using the Silicon Logic 510, PXO. Fig. 5 is the schematic diagram. The SL 510, PXO, U2, is a CMOS circuit requiring +3.3Vdc.   U1 is the 3.3V voltage regulator.   This PXO is intended to be directly plugged into an existing crystal socket in a crystal oscillator circuit. The PXO pc board is provided with 0.04" dia. pins to match those of an HC-50/U crystal package.   All connections on the board are labeled.   Care must however be exercised as one pin is a DC ground pin and it must be plugged into the appropriate pin in the oscillator circuit. Another requirement is that DC power must be supplied to the PXO.   A solder pad is provided on the top right hand corner.   Fig. 4 shows a DC power wire attached to this pad.   DC voltages from +8 to +15Vdc may be applied.   There is another solder tab labeled as OE, for Output Enable.   This is a logic input to U2. Normally it is not used and is left open.   U2 has an internal, pull-up resistor on OE.

Model PXO-xxx
PROGRAMMABLE XTAL OSCILLATOR
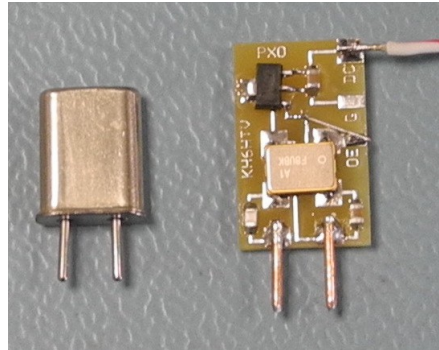
The **NEW** **KH6HTV VIDEO** **Model PXO-xxx is a Programmable Crystal Oscillator.**   **With the demise of International Crystal, it has become very difficult for radio amateurs to obtain replacement crystals for older equipment.   To assist in solving this problem, we are offering to supply HC-50/U type oscillators which can often be used in place of the original crystal.   We will stock oscillators for the PC Electronics, 70cm, AM-TV transmitters for standard TV frequencies (www.hamtv.com) The price is $20 each, including 1st class postage.   The price for any other frequencies is $30 each. When ordering, please specify: desired oscillator frequency.   The frequency is programmed by the factory. It can not be reprogrammed by the user.**

The PXO is a CMOS oscillator running from 3.3V. It includes an on board 3.3Vdc regulator.   One of the "xtal" pins, labeled Gnd, goes to ground. The other "xtal" pin, labeled RF, is the ac coupled RF output. Solder a wire to the pad labeled DC. This wire must be attached to a dc power source of +6 to +15Vdc.   In the PCE transmitter, the two channel crystal relay provides the ground circuit, thus disabling the power to the unused PXO. For additional details, see Application Note, AN-56a.

PARAMETER (*)	Value
PXO Device	Silicon Labs, model 510CBA CMOS, 3.3 V
Frequency Range	100 kHz to 212 MHz available. 105-110 MHz stocked, see list p. 2
Frequency Tolerance	± 50 ppm
Temperature Range	-40 to 85 C
Output Voltage	2.3 V
Output Current	± 8 mA, max.
DC Current	30 mA
DC Supply Voltage	+6 to +15 V range, internal voltage regulator
Dimensions	similar to HC-50/U crystal package --- 0.5" x 0.8" with 0.25", 0.04" pins

Stock Oscillators are available for the following frequencies for use in PC Electronics, 70cm, TV Transmitters. Note: the PCE transmitter output is a 4 X multiplier of the crystal or PXO frequency.

PXO Frequency	70cm Frequency	TV Channel
105.5125 MHz	421.250 MHz	57
106.5625 MHz	426.250 MHz	
106.8125 MHz	427.250 MHz	58
108.3125 MHz	433.250 MHz	59
108.5000 MHz	434.000 MHz	
109.8125 MHz	439.250 MHz	60
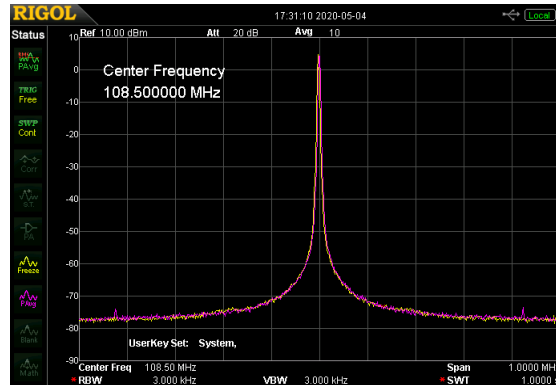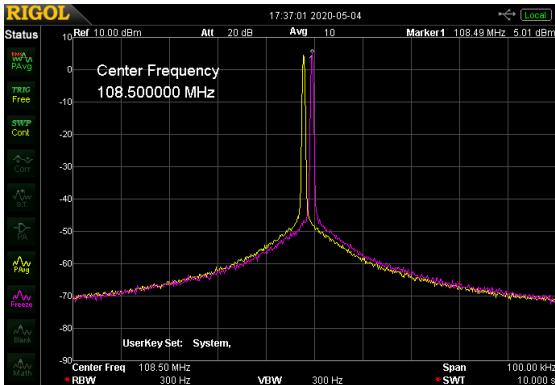
Phase Noise measurement: Comparison of 108.5 MHz, 5th overtone, crystal (yellow trace) and a PXO (magenta trace). Tested in the same oscillator circuit. Left: 10dB/div & 10kHz/div, 300Hz BW Right: 10dB/div & 100kHz/div, 3kHz BW.
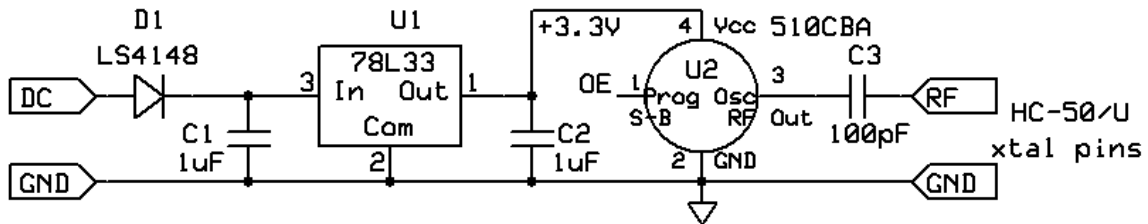
PXO-XXX specs. revision 1.0, 4 May 2020

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