In the spring of 2014, I had become aware of the amateur DVB-T supplier, Hi-Des in Taiwan (www.hides.com.tw) I purchased their model HV-110 receiver and HV-100EH modulator. I had very good success with them in setting up an amateur radio, digital TV station on the 70cm band (420-450 MHz). I became a strong advocate of DVB-T and Hi-Des as a result. I documented my DVB-T work using the HV-100EH & HV-110 in QST [1] and also in several application notes, the most relevant to this note are AN-17 & AN-18a [2-3]. In the winter of 2015-16, Hi-Des introduced two new products of interest. They were the Model HV-120 DVB-T Receiver and the Model HV-320 DVB-T Modulator / Transmitter. I purchased one of each for evaluation. This application note is the result of my evaluation of the model HV-120A Receiver. I include comparisons to the performance of the older HV-110.
Model HV-120A DVB-T RECEIVER

The HV-120A is advertised as an improved version of the HV-110. It sells for $209 vs. $169. It is still packaged in the same case and looks very similar to the HV-110. The significant differences include:

Enhanced Frequency Coverage: The HV-110 covered from 170 - 950 MHz. The new HV-120 tunes from 100 - 950 MHz and 1150 - 2650 MHz. There are now two SMA antenna connectors, one for each band. The new HV-120 thus covers the amateur 70cm, 33cm, 23cm & 13cm bands. It also covers the amateur 2m and 1 1/4 m bands, but wideband TV is not allowed on either of those bands in the USA.

Functional LED Numeric Channel Display: The original HV-110 had a 2 digit numeric display, but it was non-functioning. It always displayed "00". The new HV-120A display actually works. Unfortunately, the new numeric display LEDs are mounted flat on the pc board, rather than vertical as in the HV-110. They can only be viewed from above looking down at a 45° angle.

Up / Down Channel Push Buttons: On the old HV-110, you could only change channels using the remote control. Now on the new HV-120A, you can change channels using either the remote control or a pair of push buttons (CH- & CH+) on the front panel. This makes it far easier to change channels, particularly in an installation with several receivers where it is difficult to only control a single receiver with a remote control without inadvertently also changing the channels on other receivers.
DC Power: The old HV-110 required +5 Volts DC at $\approx 0.6$ Amp. The new HV-120A operates on $+12Vdc$. This makes it more convenient for mobile/portable operation from 12V batteries.

Bandwidth Switch: The old HV-110 had a rear panel switch to select bandwidth. This is now eliminated on the new HV-120.

TESTS & OBSERVATIONS

RESOLUTION: The HDMI output was tested and found that it can be set to any PAL or NTSC resolution ranging from 480i, 576i up through 1080P. The composite video output will only work when the resolution is set to either 480i (NTSC) or 576i (PAL).

BOOT-UP TIME: It takes approximately 8 seconds from applying DC power until a valid picture and audio appear on the HDMI monitor. The same was found for the HV-110.

RF ACQUISITION TIME: The time required for either the HV-110 or HV-120 to acquire a valid picture after the RF signal was turned on was measured to be approximately 3 seconds.

LATENCY: Latency is the word used to denote time delay. For this test, the camcorder was put in "live camera" mode. I waved my hand in front of the camera lens and timed how long it took to see it happen on the HDMI monitor. I used the HV-320 modulator. Both the HV-110 and HV-120 have a significant latency of approx. 2 seconds. Setting the HV-120 to "Low Latency Mode" reduced the latency to approx. 1 second. Note: measured latency includes the processing latency in the modulator used. It was very difficult to get an accurate measurement with this method.

DC POWER: The new HV-120A draws 390mA at $+12Vdc$ (4.7 watts). The older, HV-110 operates from $+5Vdc$, being powered thru a mini-USB cable. Using a 12V to 5V USB power adapter, it draws 290mA from $+12Vdc$ supply. (3.5 watts)

SENSITIVITY: I do not have proper equipment to perform this test accurately in my lab in Maui, Hawaii. This data will need to be measured this summer after I return back to Boulder and set up my new ham shack lab. Results will be reported in a future revision to this application note.

HV-120A ISSUES: I did have some issues with the new receiver.

SOFTWARE ISSUE: The first was that it would not work as received initially with either my older HV-100EH or the new HV-320 modulator. E-mail correspondence with Hi-Des technical support ensued. They informed me that they supplied special "low latency" software when they received an order for an HV-120 & HV-320 combo. They assumed that these customers were purchasing them for FPV applications. Hi-Des
then sent me their "Normal" software, rev. 0.0.5.72.79. I installed it per their detailed instructions in the instruction manual using a micro SD memory card. The HV-120 then worked on the 70cm, 33cm and 23cm bands with either my old HV-100EH or the new HV-320E modulator. It also worked on the 13cm (2.4GHz) band with the new HV-320.

Note: wikipedia defines FPV as First Person View. The FPV intended usage is for installing a TV camera in the pilot position in an unmanned aircraft (drones). For flight safety reasons, extremely low latency is very important. With analog TV, there is almost no latency. With DTV, it can be a dangerous issue.

OSD IMAGE TEARING: This was not a new problem, but one that also existed previously with the older, HV-110. When the OSD was activated (via the remote control), the video displayed image suffered from a lot of "tearing" and occasional freezing. See the above photo for an example. It appeared that the receiver did not have enough computing horse power to keep up with both the incoming video and also adding the OSD overlay screen.

After sending the first draft of AN-27 to Hi-Des, which included, the above comments about OSD image tearing, the software engineers at Hi-Des addressed the problem and came up with a workable solution. They sent me their latest firmware version V 0.0.5.72101, release date 20160316. This solved the OSD image tearing problem. I then asked if they could also update the firmware for the older HV-110. In response, they supplied me with firmware version V 0.0.1.72101, release date 20160316. This fixed the OSD tearing problem in the HV-110, and also made the front panel numeric readout LEDs functional so they now display the actual channel number in use.

The customer support from Hi-Des is excellent. If you do encounter any problems, do not hesitate to contact them via e-mail and request the most current version of firmware.

OSD "S" METER: Both the HV-110 and HV-120 provide the same, identical On Screen Display (OSD) of signal parameters, etc. The typical OSD consists of the Frequency/Bandwidth in upper left corner, station call sign in lower left corner, signal to noise ratio in lower right corner and receive signal power in dBm in upper right corner. This is called the "S" (signal strength) meter in amateur radio terminology. The HV-110 was found to have an extremely accurate OSD-S meter over a range of -10dBm to
-90dBm within 1dB accuracy [AN-18a]. This was NOT found to be true of the HV-120. On the HV-120, the dBm power meter reading was always too high and had very large errors of 7 to 23dB depending upon the particular band. The HV-120's power meter did respond accurately to 1 dB increment steps. Thus the HV-120's OSD S meter is of use only as a relative signal strength indicator, not as an accurate rf power meter.

THERMAL: On my older HV-110, I have had issues with it overheating and malfunctioning by freezing video in any environment hotter than normal room temperature. I solved this by removing both the front and rear panels from the HV-110 and also putting small rubber feet on the bottom surface to allow air to flow under the unit. For the HV-120A testing, I left the front and rear panels on, but did install rubber feet on the bottom. Both the HV-110 and HV-120 seem to run at similar case temperatures, warm, but not burning hot to the touch. If either model is to be used in environments hotter than normal room temperature, I recommend that the front and rear covers be removed and a tiny cooling fan be used.

CONCLUSIONS

The HV-120A is basically the HV-110 with enhanced frequency coverage. It operates the same as the HV-110 and has the same "quirks". I do recommend buying the HV-120A over the HV-110 for it's added frequency coverage and functionality. The price difference, I feel is worth it.

REFERENCES:

2. "DVB-T the Solution for Ham Digital Television", KH6HTV Video AN-17, July, 2014
3. "Notes on Using Hi-Des DVB-T Products with KH6HTV Video -- RF Linear Power Amplifiers", KH6HTV Video AN-18a, Dec. 2015

Note: All KH6HTV Video application notes are available from the web site: www.kh6htv.com