Boulder Amateur Television Club
TV Repeater's REPEATER

November, 2019
4th Edition

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

Future Newsletters: If you have contributions for future newsletters, please send them to me. We love to also include news from other ATV groups.

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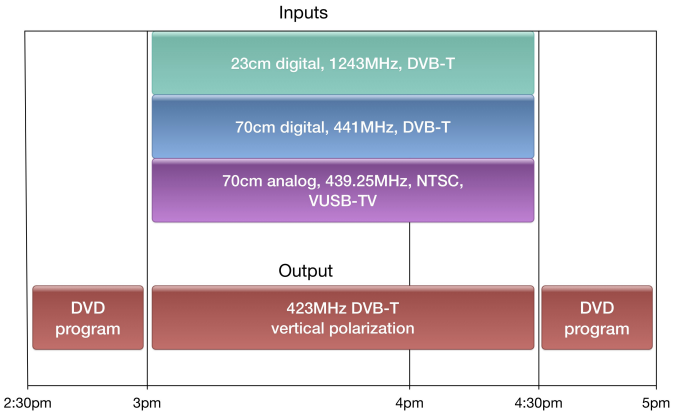


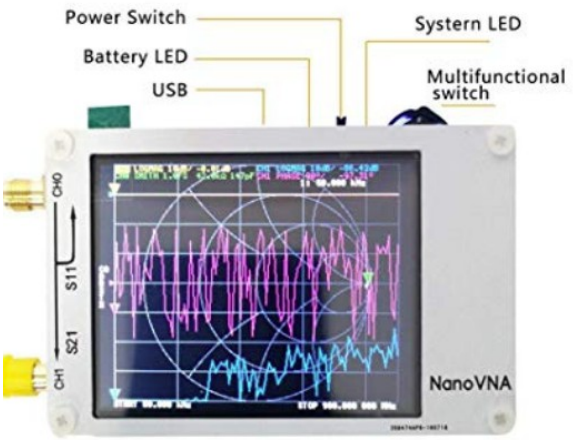
BATC STREAMING: The Thursday afternoon ATV net is streamed on the internet via the BATC server in the U.K. Connect to: https://batc.org.uk/live/ Typically either Don, NOYE, or Jim, KH6HTV, or both are streaming the TV repeater's A/V to the BATC. Click on either N0YE or KH6HTV-TVR.

CQ-DATV: Readers are encouraged to also check out the monthly, free, on-line, electronic magazine called CQ-DATV. https://www.cq-datv.mobi/index.php " The content of this magazine is related to ATV (Amateur Television) and although the site is called DATV (Digital Amateur Television), we will be covering, not only digital ATV, but all aspects of ATV. We have chosen the name of DATV so as to be easily distinguished from ATV which now seems to be a term for All Terrain Vehicles." All past issues are available on the web site. They are available in multiple formats of: mobi, epub, aqw3 & .pdf If you would like to be advised when the next issue of CQ-DATV is available for download, then join the announce mailing list at http://cq-datv.mobi/list.php " CQ-DATV has been picking up several articles from our own local ATV newsletter and giving them world-wide distribution.

------- ELECTION DAY, 5 Nov. ----------

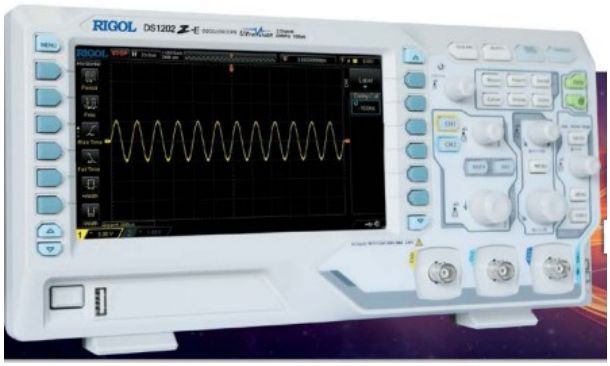
Bill, AB0MY, and wife, Mary made news in the Boulder Daily Camera newspaper. Here they are voting in the recent election.

$40 -- 50 kHz to 900 MHz
VECTOR NETWORK ANALYZER

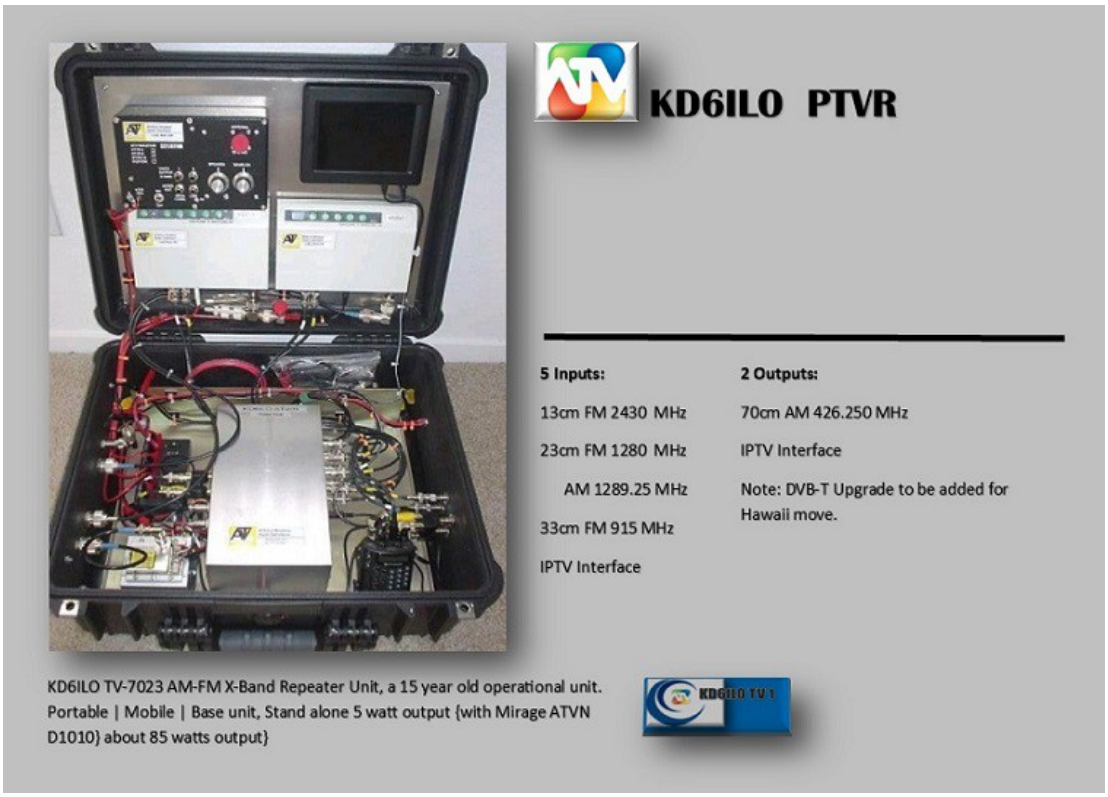


On the Nov. 7th, ATV net, Colin, WA2YUN, showed us his new hand-held Vector Network Analyzer (VNA). He was astonished at the low, low price. He only paid $40. Colin says it will measure both S11 and S21 and would be great as an antenna measurement tool for 70cm ATV antennas. Specs. are 70dB range up to 300 MHz and 40dB to 900MHz. -13dBm rf output. 101 data points. You can export via USB Touchstone (.snp) files from it for use in other simulation software programs. It includes an SMA calibration kit, USB cable and a battery. It is available on Amazon and E-Bay from several vendors. The prices vary with the lowest being about $40. There is a review of it on www.rtl-sdr.com Also there are YouTube videos posted about it. Want still more info -- contact Colin.

NEW 200 MHz Oscilloscope



Looking for a new piece of test equipment for your ham shack? Rigol just announced a 200 MHz, dual-channel scope for the low price of only $370. I paid that much for my Siglent, 70 MHz scope. If this new scope works as well as Rigol's spectrum analyzer, then this is a great buy.



KD6ILO Portable, AM/FM, ATV Repeater

Report from San Diego / Oceanside, California - ATV Activites

Thank you Jim, for a very interesting and informative newsletter. 1st- My work at my C&E labs has picked up as I forecasted last month. So my ATV activities are put on the back burner. But I did have sometime to fire up my 15 year old AM|FM X-Band ATV Repeater and has been placed on my home shop bench. The only adjustments were to the 70cm AM modulator, other then that its working as it should be along with its' Mirage ATVN D1010 PA. The {Singapore}70cm digital upgrade package is still under evaluation and the internal frequency adjustments for Amateur US TV frequency's will be set soon. The package already comes with a built in PA which is adjustable via a GUI interface as well as for frequency set up. Three bands 13cm|23cm|70cm are available with this unit. Their are some extra benefits that go along with this package. more to come.

2nd- We have also upgraded one of the controllers computer with a better processor for handling tasking's as part of its' daily maintenance routine each day. When the system {repeaters} aren't in used the modulators power down to its' lowest output setting. When it receives a signal on an input it will transmit to it's normal set output level. Inputs via RF or IP network adapter connection. We also added a {AREDN}IP phone line extension in to the audio mixer which works out really well for our local AREDN coordination.

Well that's my report for know and I hope everyone has a great week ahead and I'll see you all on Amateur Radio TV. 73 de Mario KD6ILO

KD6ILO Future 2020 Project

DAYTON, OHIO -- ATV ACTIVITES

We have essentially nine active ATVers within normal line of sight distance from the DARA - W8BI ATV repeater. We have another group of ATV hams that I am also active with and as a consequence this other group ends up being DX that comes into the repeater from five other regular ATVers during frequent band enhancements and those guys are located in Mt. Giliad 80 miles, Maringo, 84 miles, Cincinnati, 60 miles, Hebron Ky 62 miles and Powell Ohio about 70 miles. Usually about twice a year or so , there is one other ATVer, W4HTB, in Bowling Green, KY who gets into the repeater at about 230 miles out.

My concept for the repeater has been more in line with using it as a DX window since ATV interest had been taking a popularity nose dive until relatively recently. So the repeater has been very useful for that purpose until interest has started to re-blossom. Most recently, ATV is picking up in the area and I continue to try to fan the flames. There is an HF ATV DX group which meets daily on 75 meters and although my antennas are essentially attached to a mast that is sunk into a five gallon bucket of cement, I have fun trying to work DX. I live in an HOA...drats!!! Since I still work full time, my DX participation has to wait for the weekends.

I installed all of the digital gear at the site and I have upgraded the analog amplifiers and most of the analog equipment. We have been running DVB-T since 2014 at the site. This particular repeater has been active for many years....

Dave, AH2AR

Editor's note: Back in Ohio & the “Midwest” they have a much more humid climate and thus have “tropo” openings for long, multi-hundred miles of ATV-DX.. Tropos don’t

happen out here in the arid western part of the US. But - we do have very tall mountains that they don't have. So we are lucky afterall !

HF ATV-DX NET: The DX group meets at 0730 local Eastern Time or directly after the Christian net on 3.930 MHz every day. Most of the DX stations stream their shack video so you can also see your ATV signal coming into their receivers via their individual streaming pages on BATC. If you go to BATC streaming and look for WB8LGA's streaming page, you can check in on his texting window and he can further direct you to his website. That provides a means to watch everyone's stream on a single page. This is a mid-west, regional activity due to typical 75 meter propagation effects and also ATV propagation.

Dave, AH2AR

PARABOLIC DISH ANTENNAS

Don, N0YE, has submitted an article on measuring the gain of some of his microwave antennas, including parabolic dish antennas. Wikipedia has an excellent tutorial on dish antennas. https://en.wikipedia.org/wiki/Parabolic_antenna The equation for the gain of such an antenna is:

$$G = \frac{4\pi A}{\lambda^2} e_A = \left(\frac{\pi d}{\lambda}\right)^2 e_A$$

Where A is the area, d is the dish diameter, λ is the wavelength, and e_A is the aperature efficiency. e_A determines how well the feed antenna fills the dish and it typically varies from 50 to 70%. G is a numerical value, not in dB. Note: the important concept for a dish is the ratio of diameter to wavelength, squared. Don uses this equation to compare his antenna measurement results.

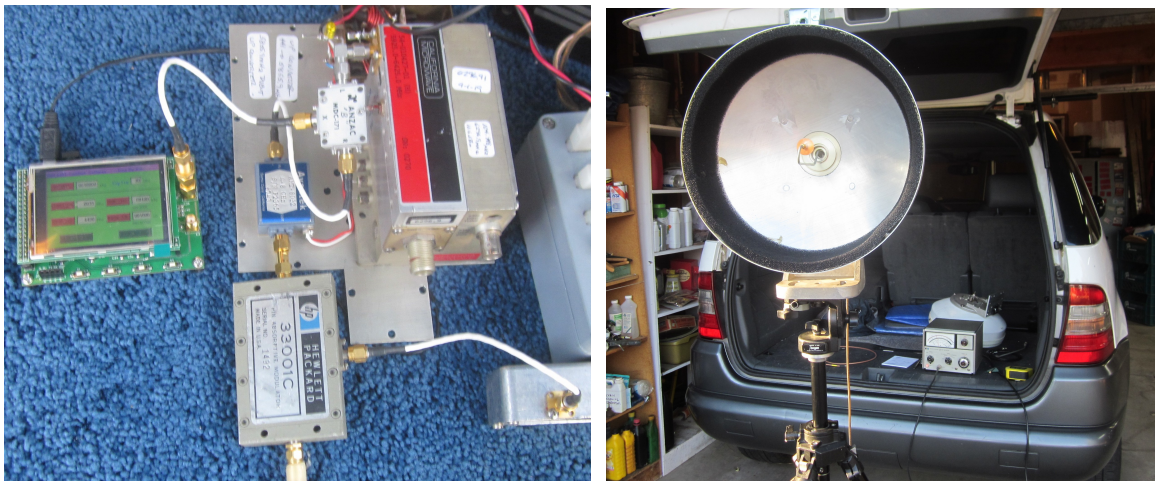
If you are interested in learning more about such antennas, or antennas in general, consult with our local antenna expert, Prof. Ed Joy, K0JOY. Ed is a regular on our ATV weekly nets. This would be a good topic for an in depth discussion on a future ATV net.

Microwave Antenna Tests

Don, N0YE

5.7 GHz ANTENNAS: The test frequency was 5678 MHz. The source antenna was a 13 inch dish with a log periodic antenna constructed on a circuit board and made by Kent Britain, WB5VJB, as the feed. The antenna test range was 70 feet. The source antenna was 10 inches off the ground and the antenna under test were 61 inches off the ground.

The reference antenna for the test is a Radiowaves SP1-2/5 dual band antenna that is 12 inches in diameter. The published gain for the lowest measured frequency of 5750 MHz is 23.2 dBi. The gain for this antenna rose slightly at higher frequencies. Because the tests were run at 5678 MHz, the antenna gain for the test will be assumed to be 23.0 dBi.

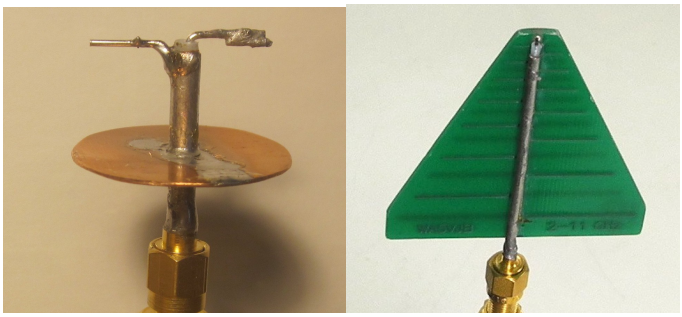


Don, N0YE's, 5.7 GHz source (left photo) consists of ADF-4351 frequency synthesizer, Frequency West brick 6 GHz LO, diode mixer, amplifier & PIN modulator (1kHz square wave). Receive setup (right photo) with antenna under test on tripod, diode detector & HP VSWR meter (1kHz voltmeter).

The antennas tested are in the table below. The table has the antenna tested with the observed gain in dBi. The second column in the table has the measured antenna aperture in square inches. The next column shows the ratio of aperture to the Radiowaves antenna. That ratio then is shown as a number in dB. The final column computes what the tested antenna gain could be by adding the aperture ratio in dB to the gain of the reference antenna.

Dish Antennas: 13" dish with log-periodic feed (left), 13" dish with dipole & disc reflector feed (middle) & 20" dish with log-periodic feed (right)

The 13 inch dish had two different feeds tested. One feed was a home brew (HB) feed that was a driven dipole element with a back splash plate one quarter wave behind the driven element. The second feed was a WA5VJB log periodic antenna. The home



brew feed was surprisingly close to the compted gain for the dish. Although the WA5VJB antenna feed came up a little short of the computed gain for the dish, it is a reasonable feed to use when another antenna may be needed.

The 20 inch dish antenna is a Dish Network 500 dish. This dish worked with two LNBs which says the surface is not a section of a parabola but some other shape that was designed to serve the two LNBs, and is less efficient per surface area than a parabolic surface. The first generation Dish Network dishes were 18 inch dishes with a single LNB and had a surface that is a section of a parabolic surface. This 20 inch dish is a later generation of Dish Network dish. So thus in my opinion this is a dark horse as how to characterize it. The feed for this dish was a WA5VJB log periodic antenna. The gain is good and makes the dish an asset when another antenna is needed.

Antenna	**Gain dBi**	**Aperture Sq. Inches**	**Aperture Ratio**	**Ratio in dB**	**Computed Gain , dBi**
Ref Dish	23.0	113	-	-	-
13 in HB	21.9	133	1.18	0.7	23.7
13 in VJB	20.3	133	1.18	0.7	23.7
20 in dish	23.6	314	2.92	4.6	27.6

10 GHz ANTENNAS: My 10 GHz antennas were compared. on two antenna ranges. The first was at close range of 29 feet separating the source antenna and the antennas under test. The second antenna range was over a distance of 70 feet that was long enough for the source antenna to be in the far field of the antennas under test. The height of the source antenna and the height of the antennas under test were adjusted for each test range for a satisfactory gain measurement. Interestingly these heights h1 and h2, for the source antenna height and test antenna height were computed and did not compare with what actually was found to be needed on each antenna range test.

The test frequency was 10368 MHz. The source antenna was a 17 dBi, waveguide horn. The standard gain, waveguide horn was a Narda 16.5 dBi gain antenna. This was the antenna used as a reference for the other antennas tested. The antennas test results are in the table below.

I have two Dish Network dishes. The 10 GHz dish is 18 inches and has a feed that housed the LNB and was modified to be just the feed by adding an SMA probe into the wave guide. The 20 inch dish is what requires a feed and was used for 5.6 GHz.

All computed gain numbers compare well to the observed gain with the exception of the 13 inch dish. This dish has a home brew feed which is not performing as well as it could/should. The antenna range testing was done in part to get a handle on how well the 13 inch dish and feed perform. The home brew horn antenna was only tested on the shorter range and so the measured gain may not be accurate (below what it may be).

Antenna	Gain dBi	Aperture Sq. Inches	Aperture Ratio	Ratio in dB	Computed Gain
Narda -	6.1	- -		-	
HB Horn	22	33.8	5.54	7.5	24
12 in dish	27.5	113	18.5	12.5	29
13 in dish	24.5	133	21.8	13.5	30
18 in dish	32.5	225 (est)	37	15.5	32

Editor's Note: The pc board, log-periodic antenna, less coax cable, can be purchased for $9 direct from Kent, WA5VJB. For more info, check out his web site for this and other microwave antennas, www.wa5vjb.com

$25 ATV INTRODUCTION

Want to get into Amateur TeleVision (ATV) and not spend many bucks ? How about spending only $30 ? Interested? We can thank the huge popularity these days of drones for making it possible. The drone buzzword to find really inexpensive video gear is FPV, which stands for "First Person View". These days many drone pilots are installing a miniature TV camera onboard their drone and then transmitting the TV picture to a ground receiver so they can watch in real-time what their drone is seeing. Google FPV and you will be amazed at the number of hits you get.

Most of the drone FPV gear today uses the 5.8GHz band with FM-TV modulation. The 5.8GHz, or 5cm, amateur band covers from 5.65 to 5.925 GHz. It should be noted that this is another band shared with unlicensed, ISM transmitters. The ISM band is 150 MHz wide from 5.725 to 5.875 GHz. This is why all the unlicensed drone FPV activity is also found at 5.8 GHz, along with Wi-Fi, etc.

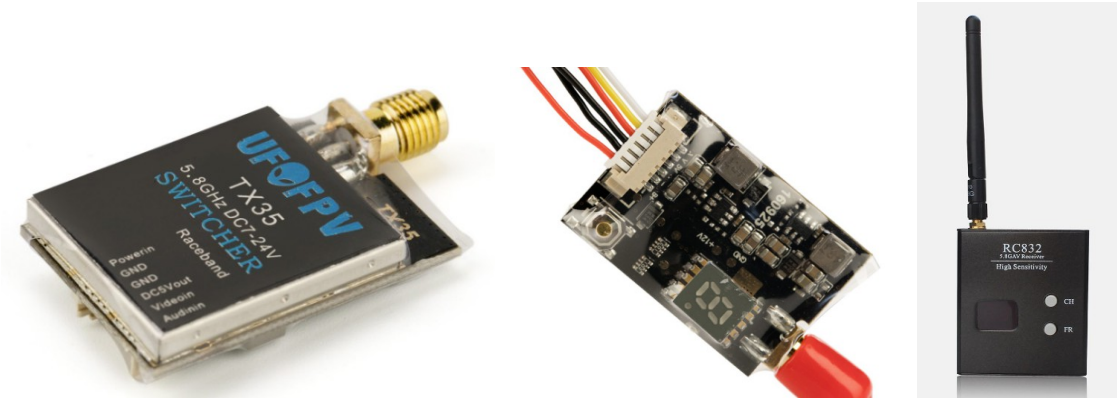
I have recently purchased some inexpensive 5.8GHz FPV transmitters and found that they are using a whole lot of channels extending from 5.645 to 5.945 GHz. They thus cover all of the amateur radio band (5.65-5.925) with one channel below the ham band edge and two channels above the ham band edge. 26 of the 40 channels do fall in the ISM band. It is apparent that the FPV manufacturers are taking advantage of the amateur frequency allocation to extend their range of channels beyond just the ISM band.

The ARRL band plan allows wide-band modes (> 1 MHz) in two, 75 MHz, segments: 5.675 to5.75 GHz and 5.85 to 5.925 GHz. Thus to avoid most of the nasty, 5.8 GHz ISM stuff, we should probably first put our TV operations in the 50 MHz segments of 5.675 to 5.725 GHz and 5.875 to 5.925GHz. We will however still find lots of unlicensed drone operators slopping over into our exclusive portion of the 5.8 GHz band.

Common characteristics of the 5.8 GHz, FM-TV transmitters available are:
1. frequency synthesized with good accuracy.
2. wide-band FM modulation with 8 MHz video bandwidth
3. sound sub-carrier of 6.5 MHz

4. very small size and light weight
5. SMA, reverse polarity connector
6. very wide range of dc power voltage required -- 7 to at least 16Vdc. Obviously they include a switching voltage regulator.

So what problems have I encountered with the various units I have tested ? -- AUDIO ! All units I tested did a great job with video. There was major differences between the units in terms of how they handled audio. All of the units tested did have a sound sub-carrier. One unit however did not put any audio on the SSC even though it had an input wire for audio. Another unit did not have an audio input wire, but did have an on board microphone. I found this to be much less desirable than having a line level audio input. Other units do in fact include a line level audio input. So Buyer Beware ! Shop carefully.



TX-35 5.8 GHz, 300mW, FM-TV Transmitter & RC-832 Receiver

Let's get down to what to buy to put together your $25 ATV kit. My recommendations are:

1. Transmitter: My choice is the model TX-35. It does have a line level audio input. 40 channels. It has programmable power levels of 300mW or 25mW. (I measured 260mW & 10mW.) Current draw was 220mA @ 12Vdc. Price was a very low $8 on Amazon.com Fantastic buy for the money !

2. Receiver: I found the model RC-832 to be a very nice receiver. It tunes all 40 channels. It is in a nice all metal case with an LED display of the channel. It has analog video plus line level stereo output. It requires 12Vdc power at 230ma. It is normally sold as a package deal with a model TS-832 transmitter for about $30. Do NOT buy this package. The TS-832 does not have a line level audio input. It instead has a worthless on-board microphone. The RC-832 alone typically sells for about $17 on Amazon.

With only the TX-35, the RC-832, a DVD player and a conventional home TV receiver/monitor, you can start playing ATV in your own home. If you want to get serious and send pictures to your ham buddies across town, then you will also need to invest in a TV camera and a good antenna. There are wide chooses for a TV camera. All you need is an older analog camera with NTSC, RCA outputs (i.e. Yellow = video, red/white = stereo audio). For an antenna, my favorite for 5.8 GHz is a BBQ grill, parabolic reflector antenna. A good one is the model HG5822EG from L-Com. It has a whopping 23dBi gain. It sells for a low $62. Have Fun on 5.8GHz ATV !