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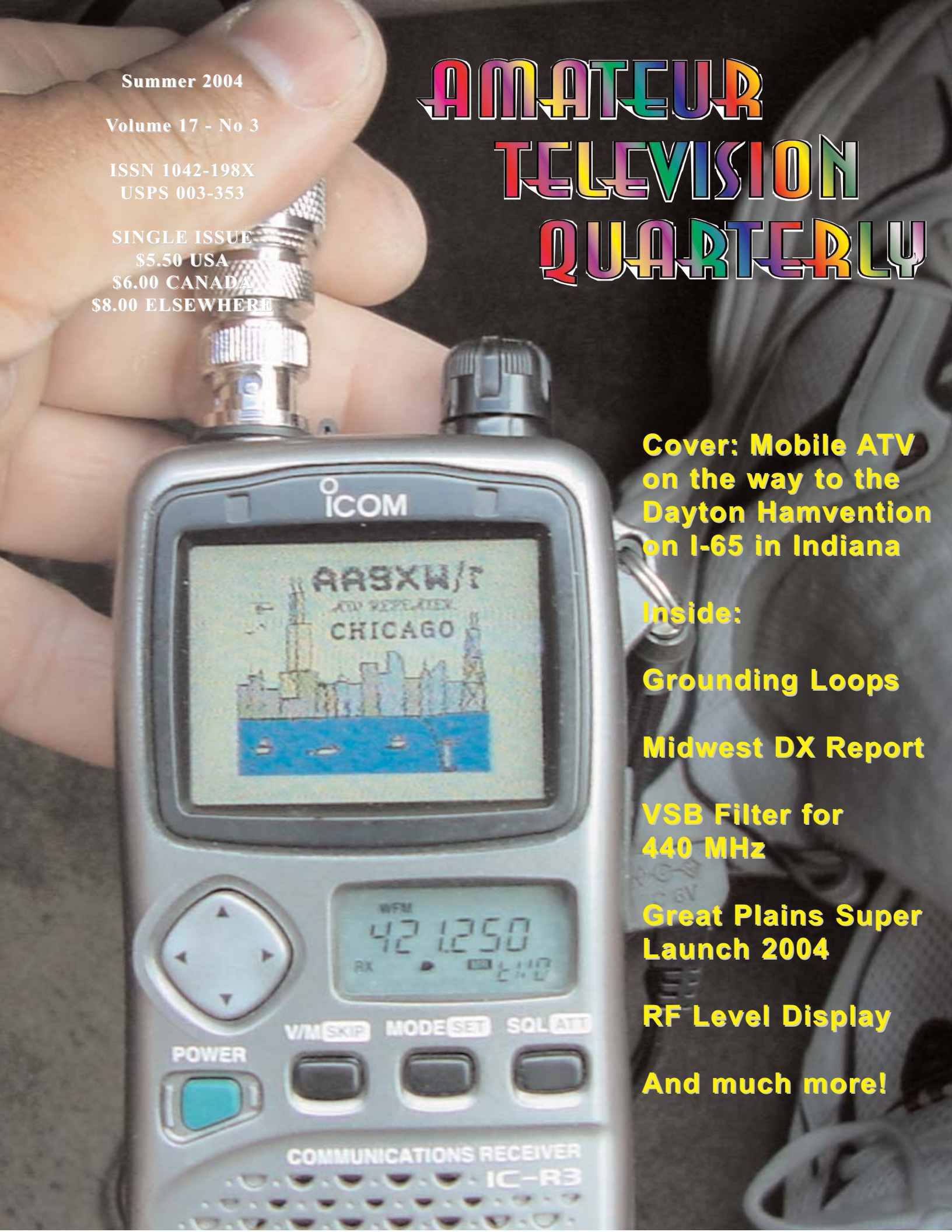

Cover: Mobile ATV on the way to the Dayton Hamvention on I-65 in Indiana

Inside:

Grounding Loops

Midwest DX Report

VSB Filter for 440 MHz

Great Plains Super Launch 2004

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And much more!

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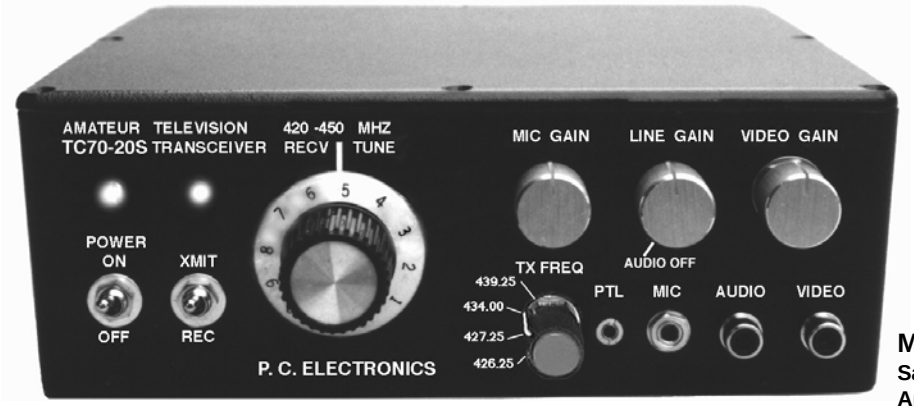

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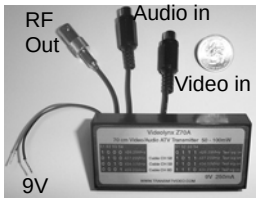

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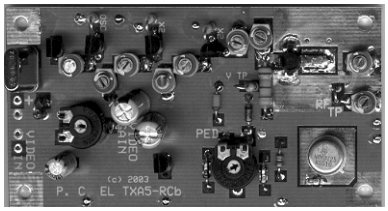

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ATVQ Notes

In the article on Spectrum Emulators from the Spring 2004 edition of ATVQ carried an incorrect address for the author. The correct address is:

Paul Godfrey - G8JBD
3 Lowry Way
Lowestoft
Suffolk
NR32 4LW UK

The cover shot is from when Mike Collis, WA6SVT, Shari, N9SH, and I were driving along I-65 on the way to Dayton. Pictures from the ATN repeater were pretty good from our moving vehicle. Henry, AA9XW, left it in continuous beacon mode for those that wanted to check it out.

Both hands on the wheel, of course, and I never looked at the ATV monitor once.....

Gene Harlan - WB9MMM

ATVQ

DATV News

Just before Christmas 2003 some first DATV units were completed and tested by hams and students lead by Uwe, DJ8DW, at the Wuppertal University and then delivered to purchasers according to the listing. Meanwhile more than 80 sets have reached the “digital elite”. Hans, PA0HKS, performed some contacts with one of the new units in the Netherlands, to Germany and to Belgium, using a prototype up-converter 70/23 cm from Wuppertal and a 30 Watt PA with very linear 2C39 valves.

Earlier the university club station DL0DTV had done an OFDM test (DVB-T) on 23 cm with 4 Watts into a 10 dB omni slot antenna. Receiving unit was a DVB-T Set-Top Box with down converter and loop dipole, pictures were good in spite of strong reflections between the mountains. An additional DATV TX board for OFDM modulation is in preparation, especially advisable for DATV repeater outputs above 1 GHz with multiple reflections in the surrounding area.

ATVQ

(translation Klaus, DL4KCK)

Grounding And Ground Loops

By: Tomi H. Engdahl - Email: tomi.engdahl@iki.fi
Lintuvaarantie 33A4
02650 Espoo, Finland

Ground loop is the annoying phenomenon that often causes humming sounds to audio connections and scrolling horizontal noise bars on video systems, but in worst cases can cause computers to 'crash' or even damage electronic equipment. Hum and buzz (50Hz/60Hz and it's harmonics) occur in unbalanced systems when currents flow in the cable shield connections between different pieces of equipment. Even balanced professional audio system interfaces are not completely isolated from hum and buzz problems.

Ground loops are a mystery to many people. Even college-trained electronic engineers may not know what ground loops actually are. Engineers have typically either concentrated on power distribution (for the electric company) or on equipment that happens to plug in to the power distribution system.

The audio/video and power industries have too often each designed their systems and equipment independently. As a result, there's a degree of incompatibility. Usually what is perfectly adequate in power distribution and operation safety sense is not good enough for AV-systems. Ground loop interference problems are a consequence of this.

This article tries to shed some light on the ground loop phenomenon. I try to provide some technical background on the subject so that you know what is happening and can possibly avoid problems in the future. I also provide some practical tips how to solve ground loop problems when they occur.

Grounding basics

In Britain, people have 'earth' and in Northern America they have 'ground'. They are exactly the same thing, only different terms are used in different countries. The NEC, National Electrical Code defines a ground as: "a conducting connection, whether intentional or accidental between an electrical circuit or equipment and the earth, or to some conducting body that serves in place of the earth."

Earthing or grounding of electrical systems is required for a number of reasons, mainly to ensure the safety of people near the electrical system and to prevent damage to the system itself in the event of a fault. The function of the protective conductor, or earth, is to provide a low resistance path for fault current so that the circuit protective devices operate rapidly to disconnect the supply.

When talking about grounding it is actually two different subjects, earth grounding and equipment grounding. Earth grounding is an intentional connection from a circuit conductor usually the neutral to a ground electrode placed in the earth. Equipment grounding is to ensure that operating equipment within a structure is properly grounded. These two grounding systems are required to be connected to each other through one point connection.

The purpose of a ground besides the protection of people plants and equipment is to provide a safe path for the dissipation of fault currents, lightning strikes, static discharges, EMI and RFI signals and interference. For example lightning, line surges or unintentional contact with higher voltage lines can cause dangerously high voltages to the electrical distribution system wires. Grounding provides an alternative path around the electrical system of your home or workplace and minimizes damage from such.

The main reason why grounding is used in electrical distribution network is the safety: when all metallic parts in electrical equipment are grounded then if the insulation inside the equipment fails there are no dangerous voltages present in the equipment case. Then the live wire touches the grounded case then the circuit is effectively shorted and the fuse will almost immediately blow. When the fuse is blown then the dangerous voltages are away.

One of the major reasons for grounding the low voltage systems supplied by hi-voltage systems is to protect the low voltage 'stuff' from an accidental high voltage. Transformer insulation breakdown, a high-voltage line falling across a low-voltage line are at least two ways that high-voltages could be put onto a low voltage circuit. With the circuit grounded, the high-voltage line will see ground-fault current and trip. Also with grounded low voltage, the maximum voltage seen by the low-voltage circuits under such a situation would be limited. This isn't so much for personnel safety as to avoid burning down the house

The user safety is the primary function of grounding. Grounding systems are designed so that they do provide this necessary safety function. The main design criterion of the electrical system grounding planning is operational safety, user safety, and reliable operation.

Grounding also has other functions besides safety in many electronics systems. Grounding is quite often used to provide common ground reference potential for all equipment in the same area. This works well in many cases, but when things get demanding like in many audio and video systems, the existing building grounding systems might not always provide good enough ground potential for all equipment. Grounding problems

cause ground potential difference and ground loop problems, which are common problems in computer networks and audio/video systems.

Always when operating with grounding issues remember that there is no absolute ground. There is a certain amount of resistance between all grounding points and practically always some current flowing on ground connections. No matter how small, the resistance can always allow an electrical voltage to exist across it when there is any current flowing between those grounding points.

Grounding in mains wiring

Today's modern (US.) mains cable going to grounded equipment consists of three separate wires: black, white, and green. The green wire is always connected to the large ground pin on the plug, and the other (green) end connected to the chassis of the equipment. The black wire is always considered to be the "hot wire," and as such, is always the leg, which is connected to the switch and fuse. The white wire is always the neutral or common wire.

Colors and wiring practices vary somewhat on the old equipment and fixed wire installations. For example in some cases the metal pipe structure where the wires go on some installations can be used as ground conductor.

In Europe the grounded equipment mains cable consists of three separate wires: brown, blue and green wire with yellow stripe. The ground wire is green wire with yellow stripe. Neutral wire is blue. Live wire is brown. Ground wire is always connected to equipment chassis and grounding contactor on the mains plug (there are a wide variety of mains plugs in use in Europe, and how the ground is arranged in them vary).

Grounded and ungrounded equipment

Improper grounding can create a lethal hazard. Correct grounding is essential for correct operation and safety of electrical equipment. Grounding can solve many problems, but it can also cause new ones. One of the most common problems is called "ground loop".

Running a grounding wire to every outlet, the idea there is if the casing of all tools/appliances are grounded by a third prong and the outlet, then a fault in the appliance (such as a hot lead shorting to the case) will short to the grounding conductor and back to the service entrance panel, tripping the breaker. The voltage developed on the case during the short circuit will typically be the half mains voltage or less and it will not last long until the power is cut out, so you won't be seriously injured. This grounded case protection practice is used on most large electrical appliances built into a metal case or that have metal cases. Also the metal parts in the electrical installation in your house (breaker panel, metal conduits etc.) are grounded for safety reasons. Most professional audio/video equipment with internal power supplies constructed into grounded metal cases, and usually the audio/video connector grounds in them are in direct connection to this case ground.

Double insulated tools/appliances are excused from third prong because they are designed in such way that it would require two faults (line to frame, frame to casing) to become dangerous to touch. This is considered very remote. Most home hi-fi and consumer video equipment are designed as double insulated appliances. In this type of appliance the mains power gets fed to the mains power supply that can consist of a traditional transformer or switch mode power supply, and supplies isolated power to the equipment electronics. The equipment electronics and connector ground connections are floating, unless connected to some external ground source. There are also many professional small audio/video equipment powered by small external "wall wart" power supplies and are thus "floating" because the typically doubly insulated mains power supply does not supply any ground to them.

If the equipment has a grounded power connector, then the case ground is connected to mains grounding connector. If the equipment does not have the grounded power connector, that ground is not connected to mains ground (case is floating).

What is a ground loop

A ground loop occurs when there is more than one ground connection path between two pieces of equipment. Ground loop is a condition where an unintended connection to ground is made through an interfering electrical conductor. Generally ground loop connection exists when an electrical system is connected through more than one way to the electrical ground.

When two or more devices are connected to a common ground through different paths, a ground loop occurs. Currents flow through these multiple paths and develop voltages, which can cause noise or 50Hz/60Hz hum in audio or video equipment. In very severe cases equipment can be damaged.

Ground loop is a common problem when connecting multiple audio-visual system components together. Ground loop problems are one of the most common noise problems in audio systems. Typical indication of the ground loop problem is audible 50 Hz or 60 Hz (depends on mains voltage frequency used in your country) noise in sound. In the USA you will hear typically 60 Hz mains frequency noise and its harmonics. Video systems are typically less sensitive to ground loop problems, but still you sometimes see a slow up or down scrolling horizontal bar or several bars that make the image at that area darker or brighter. This is how the ground loop typically shows in a video system.

Most common situation where you meet ground loop problems is when your system includes equipment connected to a grounded electric outlet and antenna network or equipment connected to different grounded outlets around the house.

Audio-frequency ground-loop problems are typically in the low millivolt range, so it does not have to be much interference in grounding system to cause problems in audio systems. Video signals pick up noise in the same way, but typically they are less sensitive to noise pickup, because of the typically lower dynamic range of those signals (low amplitude noise gets nicely masked to video noise and is hard to see).

What causes humming

Audio and video systems need a reference point for their voltages. Generally referred to as common or ground, although it may or may not be actually connected with the earth, this reference remains at "zero volts" while other signal voltages "swing" positive (above) and negative (below) it. The signal grounds of different equipment connected together are interconnected with a grounding wire on the signal cable. Ideally signal ground should be a perfect conductor with no resistance, but in any practical system it is not. There is always some resistance on the wire.

Hum and buzz (50Hz/60Hz and its harmonics) occur in unbalanced systems when currents flow in the cable shield connections between different pieces of equipment. A typical example of this kind of unbalanced systems are normal home audio equipment that use RCA connectors and practically all video systems that use coaxial cables for signal interconnections. The cable shield currents and ground voltage differences between ends of the cable gets summed to the signal going on the cable, thus causing interference. The audio signals in a typical audio cable are just a fraction of volts to few volts. There does not have to be much interference in a grounding system to cause a noticeable signal in audio systems, even a noise with amplitude of only a few millivolts can be usually heard on quiet signals.

Small voltage differences just cause noise to be added to the signals. This can cause a humming noise to audio, interference bars to video signals and transmission errors to computer networks. Higher currents can cause more serious problems like sparking in connections, damages equipment and burned wiring. My own experience on the field is limited to sparking connectors, heating cables and damaged computer serial port cards.

Where the ground currents originate

There are many sources that cause current flowing on the interconnections between equipment. One thing that causes them is the difference of grounding potentials on the different outlets on the house. There voltage differences are typically from few millivolts to several volts depending on the electrical installation and loads on the electrical network. There are various reasons why those differences occur, starting from installations where there is shared neutral+ground wire to situations where there is just some leakage from equipment to electrical installation ground wire, and this causes ground potential differences. There is equipment that leak some mains power live to the grounding wire, for example many computers leak 0.5-1 mA of current to the grounding wire through the capacitors on the power supply filters. The capacitance between line and ground of large heaters and motors, for example, can be much larger than the capacitance in filter capacitors. When you add many pieces of equipment, you easily get 10 mA or more leakage. This current to 0.5 ohm grounding resistance causes 5 mV difference between the grounding point and real ground. If in some place in electrical installation there happens to be a mistake where ground and neutral gets connected to each other unintentionally, there can be amperes of current flowing on the electrical wiring grounding structure, so there can be volts of potential differences.

Also induction can cause voltage differences, either there is voltage induced to a ground wire from nearby high current power cables or noise currents get coupled to the ground loop from nearby magnetic field. Even a very little amount of induced voltage can cause a very large current in a ground conductor loop, because the resistance (and inductance) are very low. These currents can indeed be tens of amps. Current induction can be caused, for example, by cables carrying high currents and from transformers.

Books speak about Common Mode Noise of 1 to 2 Volt in "well grounded" plants and over 20 Volts in "poorly grounded" plants. Books also speak of the current measured on a main service grounding (in a large building) in terms of amps.

When you connect two pieces of equipment on those different potentials together with audio and/or video cable, a current starts flowing trying to lower the potential difference between the equipment. Depending on the nature of the noise source and the resistance of the interconnection cable ground, there can be more or less current and the cable ground can bring the potential differences more near to each other. The potential difference still left between the cable ends gets summed to the signal causing noise. Also the current flowing on the cable shield causes problems, often causing some noise to be induced to the signal wire and the current can also cause noise problems to the equipment

if the grounding practices in it are not carefully designed. Basically lower the resistance of the interconnection cable, less voltage difference gets left between the equipment but higher the current flowing on the cable ground wire.

Small voltage differences just cause noise to be added to the signals. This can cause humming noise to audio, interference bars to video signals and transmission errors to computer networks. Higher currents can cause more serious problems like sparking in connections, damages equipment and burned wiring. My own experience on the field of ground loop damage is limited to few sparking connectors, heating cables and damaged computer serial port cards. I have read about burned signal cables and smoking computers because of the ground differential and large currents caused by them. So be warned about this potential problem and do not do any stupid installations. I have seen systems where there have been hundreds of milliamperes of current flowing on the audio and video cable shields/grounds, and even one ampere of current flowing on ground wire from one electrical distribution panel.

Equipment design issues

Lots of designers count on ground being ground and do not optimize their design to eliminate their sensitivity to ground noise. If you are a product designer then remember to take care that ground loop current does not cause problems in your equipment by designing a proper grounding scheme inside the equipment. Star grounding and all connectors tied to solid well conducting metal case will work.

A balanced input will solve the problem with voltage drop across the screen of a cable (by converting it to common mode), but will not in and of itself solve problems with current circulating in the chassis of the equipment where the case is connected to the internal single ended audio electronics reference rail (0V, but that is a confusing label) at more then a single point. Now in well-designed gear this is a non-issue as care is taken to keep noise of the reference line for internal single ended signal paths, but it would appear that not all the gear out there is designed by competent engineers (or that the designers have other priorities).

Hum current on the ground wire of unbalanced connection will have two effects: common mode and current effects. The common mode voltage that is left between the equipment gets summed as noise to the signal. The current flowing on the cable ground can cause considerable hum problems or not, depending on the equipment design.

Professional audio world uses balanced interconnections that are less sensitive to ground loop noise. Hum current on the ground wire of balanced connection will have two effects: common mode voltage and current effects. An ideal balanced input is designed to eliminate the common mode noise completely, real life implementations can typically attenuate this around 60-90 dB, which is enough that typical ground loop voltages are not a problem in most uses. Ground wire currents on the balanced interconnection should not be a problem in an ideal system, but in real life there is some poorly designed equipment that considerably suffer from the ground currents on signal cables. In a well-designed equipment the XLR connector pin1 ground is wired to the equipment ground directly with a thick wire. In poorly designed equipment, the pin 1 can be just wired to the circuit board signal grounding traces, and go from there to cause problems on those parts of the equipment where the signal is in unbalanced format (typically in the amplifying stages just after the input amplifier state). The problematic currents are stopped typically by using a “ground lift” switch or cutting the wire going to XLR connector pin 1.

Unfortunately, many, if not most audiophiles have equipment, which either has a two prong plug, or has a three prong plug which induces unacceptable hum on the available unbalanced connection. A comprehensive choice of equipment with balanced interconnects does not really exist for consumer applications. Tuners, turntables, and cassette decks simply are not made that way. Most amplifiers made for the audiophile market do not have balanced inputs. In many real-life audio/video systems you nowadays use a mixture of balanced and unbalanced audio interfaces, unbalanced video interfaces and a mixture of grounded and ungrounded equipment. This applies nowadays to many home entertainment systems, on-site video production equipment or fixed audio/video installations.

Ways to avoid ground loop problems

Ground loop problems can be avoided and solved. Because ground loop problems are typically hard to debug and deal with, you usually solve lots of last minute hassle by carefully designing the system you are setting up.

Use single power feed everywhere you can

If your system power requirements allow, take power only from one electrical power outlet. This will avoid the ground potential difference problem, which can exist if power is taken from multiple power outlets. If the distance and electrical code permits it is a good idea to run a power extension cords from a single power feed point to all subsystems connected to your audio system instead of using the local power sources.

Use dedicated power feed for your audio system. Wire all sound sources, musical instruments, effects and your mixing desk to same grounded dedicated audio power feed. Do not connect any other equipment than audio/video equipment to this power feed. This saves you from many humming problems. It is a good idea to mark clearly which extension cords are part of your audio power feed so that you don’t accidentally connect any other equipment to them.

Star Grounding: One Path to Ground

This system removes the possibility of a potential difference between mains grounds or the connection of mains grounds being duplicated in an Audio system. With star grounding systems the centre that is usually chosen is either the main mixing console or the multi-core snake or patch bay that is usually plugged or hardwired into it. The reason for this choice is that most audio systems only have one main mixing console and the vast majority of devices are connected to it. Conformity with this grounding system will usually ensure that your system, no matter how large, will remain hum free.

A simple solution in the small audio/video installation is to plug all equipment to one grounded extension cord and then plug this cord to one grounded outlet. This will keep many problems away, because this a creates star-like grounding scheme for the equipment.

Prefer balanced audio connections

Balanced interconnects diminish or eliminate the problem caused by unbalanced interconnects and multiple grounds. Balanced connections are much less sensitive to pick up interferences and humming. If you still get humming with basic balanced wiring, there is much more to do to correct it than with unbalanced connections. Use those XLR connections instead of normal RCA cables if you have this option available in your equipment.

Most professional audio devices are connected via balanced cables to minimize pickup of stray electrical noise. Consumer audio devices use unbalanced cables and are very prone to picking up noise, especially at low signal levels from devices such as microphones. Balanced circuits have an inherent ability to only pass audio signals and reject unwanted noise.

Balanced refers to the fact that there are two symmetrical signal lines and one ground, while unbalanced uses just one signal line in reference to ground. Normally, XLR connectors are used in most balanced devices while unbalanced consumer gear normally use mini-plug or RCA connectors.

Isolate the ground wires which go to equipment connected to separate power feed or grounding system

If you must connect equipment, which is powered from another power source than your audio mixing desk, then you must make sure that they don't cause ground loop problems. The safest choice is to use audio isolation transformer in every connection you need to equipment connected outside your dedicated audio power feed.

In audio/video transmitter application it is a very good idea to isolate the transmitter itself from the rest of the studio system to avoid the noise. Isolating the transmitter from the studio system is a good idea because the radio/TV transmitters are connected to antenna grounding system (can be on somewhat different potential compared to house electrical ground) and are often powered from separate power feed.

Avoid unwanted ground connections

There are other things than the power connections, which can be an unwanted grounding connection to your audio system. Audio connectors which have a metal shell, which is in contact with the cable shield can cause unwanted grounding if they touch any grounded metal in the building or some other grounded equipment. Some applies also to microphones and snake cable connection boxes. So if there is chance that your exposed audio wiring ground can touch any building ground then put some insulation between your wiring and that ground.

Avoid putting equipment racks over any metallic parts in the floor because it is possible that they are grounded for some reason. If you have to place equipment on such a place, then put some kind of carpet between the metal parts in the floor and your equipment rack to provide necessary isolation.

The recommended practice in the professional audio community is not to ground the shells of XLR connectors. The reason is XLR shell can come easily in contact with metal railings or something else grounded on the field causing a ground loop problem. If your shells are not grounded, nothing harmful will happen when a connector shell touches something. But if you have, for some reason, grounded the XLR connector shell to audio ground, you will get humming to your system. Sorting out those all of the ground paths/loops can drive you crazy. It is best to leave the shells not connected so you don't add intermittent problems to your audio systems.

Avoid magnetic noise pickup

Audio equipment and wiring can very easily pick up humming from magnetic fields. So avoid putting any sources of such magnetic interference near your system. This applies to power transformers, video monitors, computer monitors, electric motors, fluorescent lights and any mains wiring that carries large currents.

Coiled cables can easily induce magnetic field around them and pick up magnetic fields. If your power cables are tightly coiled, they can cause large magnetic fields and heat too much up if loaded very much. Coiled audio cables can easily pick up interferences. If you have spare cables you need to put somewhere do not coil them just to a single coil, but instead put them on number eight shape to ground (this shape greatly reduces the magnetic interference problems).

Use correct gain structure in your system

By using the correct signal levels throughout the system will minimize the humming, noise, and distortion. Gain controls in PA power amplifier will be typically set between half-way and fully up. Amplifier gain controls set at a lower position require

input signals to be set to a higher level to obtain suitable power levels. Particularly with unbalanced input lines, the hotter your signal is at the input of an amplifier, the more noise propagation you will have into your amplifiers. If you have set the amplifier gain set too low, your system may become such that you reach the maximum gain travel of a fader, at your source device, before obtaining expected power within your amplifiers.

Signal isolation transformers are your friend in audio systems

If you have a mixed balanced and unbalanced system, as you unfortunately often have, do yourself a favor and use isolation transformers in every connection between balanced and unbalanced system. When unbalanced lines cannot be transformer isolated, use special cable assemblies to solve the humming problems.

Audio isolation transformers are very powerful tools for solving unexpected ground loop related humming problems. When you have some extra audio isolation transformers always available the problems can be easily solved whenever they pop up.

Do not break the safety ground connections!

Logically you could think, you could eliminate ground loops by disconnecting the power-cord ground pins on all your gear. Some people might try to break the ground connection by cutting the grounding pin in the connector, using cheater plug, cutting the ground wire in equipment, tapeing over the grounding connector etc.

Do not do this. Removing the ground connection isn't the right thing to do. It is against electrical safety regulations and potentially very dangerous. Removing the ground connection can defeat the actions of your noise filter or spike protectors inside the equipment. If the ground connection is cut then a fault in the insulation inside equipment can cause dangerous voltages to the equipment case instead of burning a fuse. Removing the ground connection from the equipment is dangerous, against electronic safety regulations, and you risk damaging your equipment. Do not do it. Running without a power ground will not automatically electrocute you, but removing the ground connection will make the probability that someone gets electrocuted very much higher.

Never use a three wire to two-wire "cheater" mains connection adapter on any piece of audio gear where a human can possibly come into contact with it. It might eliminate the hum, but there's a much safer way to do the same thing. The lowly cheater plug has solved a lot of hum problems for many people, but it removes a level of protection against insulation failure. There are manufacturers of three-prong products that state in their instructions that it is permissible to use a cheater plug. Others specifically disallow it. Those manufacturers who allow the use of cheater plugs have their products certified to a two prong, double insulated standard. With this kind of special equipment "cheater plug" is OK, for everything else, it is definitely not.

The third prong has one purpose: to counter insulation failure. Two prong equipment takes special care in mounting the transformer, so that a short of the primary to the transformer frame won't put a potential on exposed chassis in case of failure.

Ground loops in video systems

Video lines are also sensitive to ground loop problem type noise, but usually considerably less sensitive than unbalanced audio connections. But the basic problems are the same. As the source and destination of a video signal can be at differing ac or dc earth potentials, earth loop currents flow and cause longitudinal hum to be introduced into the video signal.

Video hum is low frequency (50 or 60 Hz mains frequency or it's harmonics) noise from the ground lines, which has influenced the video signal, causing degradation of the displayed signal. Video hum is usually observed as bars rolling vertically through the video image, video hum may also cause video distortion or even tearing of the picture in severe cases. Video hum may be a problem in any system where video sources and display devices are connected to different A/C power sources with varying grounding potentials.

Typically the humming can be seen as slowly vertically moving horizontal bars in normal TV video signals. The mains frequency (50 Hz or 60 Hz) noise on video signal can cause typically stationary or moving horizontal humming bars to appear on the video signal (as shown on the picture above). If you have light dimmers nearby those humming bars can easily become quite severe and easily visible.

Ground loops can also cause other kind of problems. The "herring bone" interference on video line is caused by a ground loop (that includes your coax shield) acting as an AM radio antenna. Any large loop of wire makes a good AM antenna. These antennas are especially adept at picking up AM broadcasts if most of the loop is vertical.

Ground loops can also cause one signal to interfere with another, because every cable should ideally return through the corresponding shield conductor, but there's an alternative path through the other shield conductor that causes undesirable voltage differences to nearby cables.

Solving video signal ground loop problems

The best idea when setting up the video system is to think through the system grounding practices to avoid ground loop problems. If you use one power source and start good grounding practices, you have to very rarely worry about ground loop problems on video systems. If your video system includes a central video production position and few separate remote cameras,

it is a good practice to pull a long extension cord from the central position to the remote camera together with the video able. In this way the cameras get the same reliable power and grounding as the rest of the systems, so no problems would be expected. Avoid powering the video cameras from any electrical outlet that happens to be near the camera position, because this practice is like asking for ground loop problems, unless you know for sure that the camera power supply is "floating" and does not make any connection from camera to electrical outlet ground.

When you can't decide how grounding is arranged and problems exist, then video signal isolation is the tool to solve the problem. Isolating video signal is more complicated than isolating audio or antenna signals, because the DC level of the video signal is important and video signals have very high frequency spectrum (normal composite video can have bandwidth from 50 Hz to 6 MHz). Isolating a video signal needs typically active technology that involves electro-optical isolation or differential amplifier with a floating ground on the input connector. Both technologies are usable in real world situations. Differential input with floating ground works nicely for small ground potential differences and this approach is used in some professional video equipment, like some video projectors. The differential amplifier circuitry, based typically on high-speed operational amplifiers, only amplifies the difference between the two input signals, here the video coaxial cable connector center connection and outer shield. The coaxial cable shield is left floating (not connected to equipment ground), so that there will be no ground-currents floating on the cable shield, causing potential difference between cable ends. If your ground potential difference is a maximum of few volts, this can work well. If ground potential difference is higher than this, it does not work.

Electro-optical isolation is used in professional video isolation amplifiers. Those devices amplify the video signal, feed it to a special linear high-speed optoisolator and then feeds it to the output drivers. Professional isolation amplifiers can provide isolation of several hundred volts or more easily. You rarely need this high isolation unless you have video feed extending from one house to another.

There are also special wideband isolation transformers that can isolate video signals. A transformer that can nicely transfer the whole video frequency spectrum without much distortion is very hard to produce so there are not many of them on the market. Some of the isolation transformers are only designed for CCTV application, where more signal distortion is accepted than in the broadcast industry. Whatever transformer you use, all have the same limitation: they cannot pass the DC component of the video signal. For most equipment this is not a problem, but on some cases the loss of DC component can cause problems to the video system operation.

Ground loop elimination does not always ask for a complete isolation of the grounds. There are passive hum suppressor transformers that will very effectively remove the hum from the video signal, but do not affect the video signal otherwise. Those special transformers act like a common mode coils, which stop the annoying ground loop currents on the shield of the coaxial cable, but provide a straight path for the signal inside the cable. This type of device is capable of passing the signals from DC to tens of MHz without problems. The hum suppressor transformer both reduces the current flowing on the cable shield and compensated the voltage differences that would otherwise be between cable ends and eventually get to the signal. The transformer/coil consists of many (tens to hundreds) turns of 75-ohm miniature video coaxial cable wound on a suitable transformer core. The aim is to have a coil that has high enough inductance to keep the cable shield current low and still withstand the voltages/currents it gets exposed to in typical applications without saturation. This kind of hum reduction coil works by mutual inductance. The coax cable is wound around a transformer core so that both the inner and shield of the cable become inductors. The tight coupling ensures that any voltages/currents flowing on the cable shield, caused by variations in earth potential differences, are transformed into the inner conductor. This type of transformer is typically constructed to a specially selected toroid transformer core. This type of hum suppression transformer has found it's way to the professional video application (rental companies) and computer video applications (computer to video projector connections). The transformers of this type are usually called "hum bug transformers", "hum-bucking transformers", "anti-hum video transformers" or "hum suppressor transformers". Typical performance figures are 30-40 dB hum level reduction up to 5-10V volt voltage differences.

The choke (humbugging transformer) is primarily used in broadcast TV because it passes the DC component of the signal. It is used in studio, and in remote ENG. The isolation transformer is primarily used in CCTV: security, manufacturing, avionics, display, etc.

Antenna connections are typical problem in home AV-systems

Most components in typical audio and video systems are not grounded. In the most common receivers and VCRs the ground of the antenna input is connected to the equipment metal case, that is connected to the equipment audio and video input/output connector ground. This means that normally ungrounded equipment becomes grounded through the antenna network when it is connected to the antenna outlet in the house. In a normal system where all parts are ungrounded, there are not any problems, because there is only one ground connection, thus, no ground loops.

But if you intend to connect a grounded PC or any grounded professional audio/video equipment to this kind of home audio/video system, you form a ground loop that goes from the mains outlet ground through the equipment to the antenna outlet. Typically this causes lots of humming noise.

Typical ground loop humming problem occurs when you connect your computer sound card to a stereo receiver that is connected to a wall antenna plug. The computer is connected to a

grounded power outlet, which causes the sound card audio ground to be connected to mains ground. The receiver is connected to antenna ground because it is wired to the antenna plug in the wall. The mains ground and antenna are tied together (at least should have for safety reasons) somewhere else in the house. Combining more than one “properly grounded” system to your audio/video system is known to cause more or less noise problems. The “properly grounded” for antenna network and electrical wiring means that they are safe and those systems work on their own. They do not guarantee a noise-free operation.

Typically antenna and mains grounds have some voltage difference in them and the AC voltage between them can be heard as the humming noise in all unbalanced connections. In systems where you use unbalanced interconnections, like typical RCA audio cables, you have to accept the fact that their noise shielding against this kind of grounding potential differences is very poor. The humming problem needs to be solved within your audio system when they occur. The only acceptable method for testing is to remove and disconnect everything. Then reinstall the equipment and connection piece by piece. Stop when the hum becomes audible, and fix the problem in the last piece of equipment that was installed.

Usually the problem is solved either by disconnecting the PC from the home audio/video system or disconnecting the antenna connection to wall outlet. In this case you need to put a suitable isolator between either of those connections. If you have only audio connections from PC to your rest of the system, putting a small audio isolation transformer here solves the problem nicely. Another right place to cut the ground here is to buy antenna signal isolation to the wire that goes to cable TV outlet. This cuts the ground connection to the antenna system, but still passes the antenna RF signal through nicely (the isolator causes usually some antenna signal attenuation that is not usually a problem).

Images:

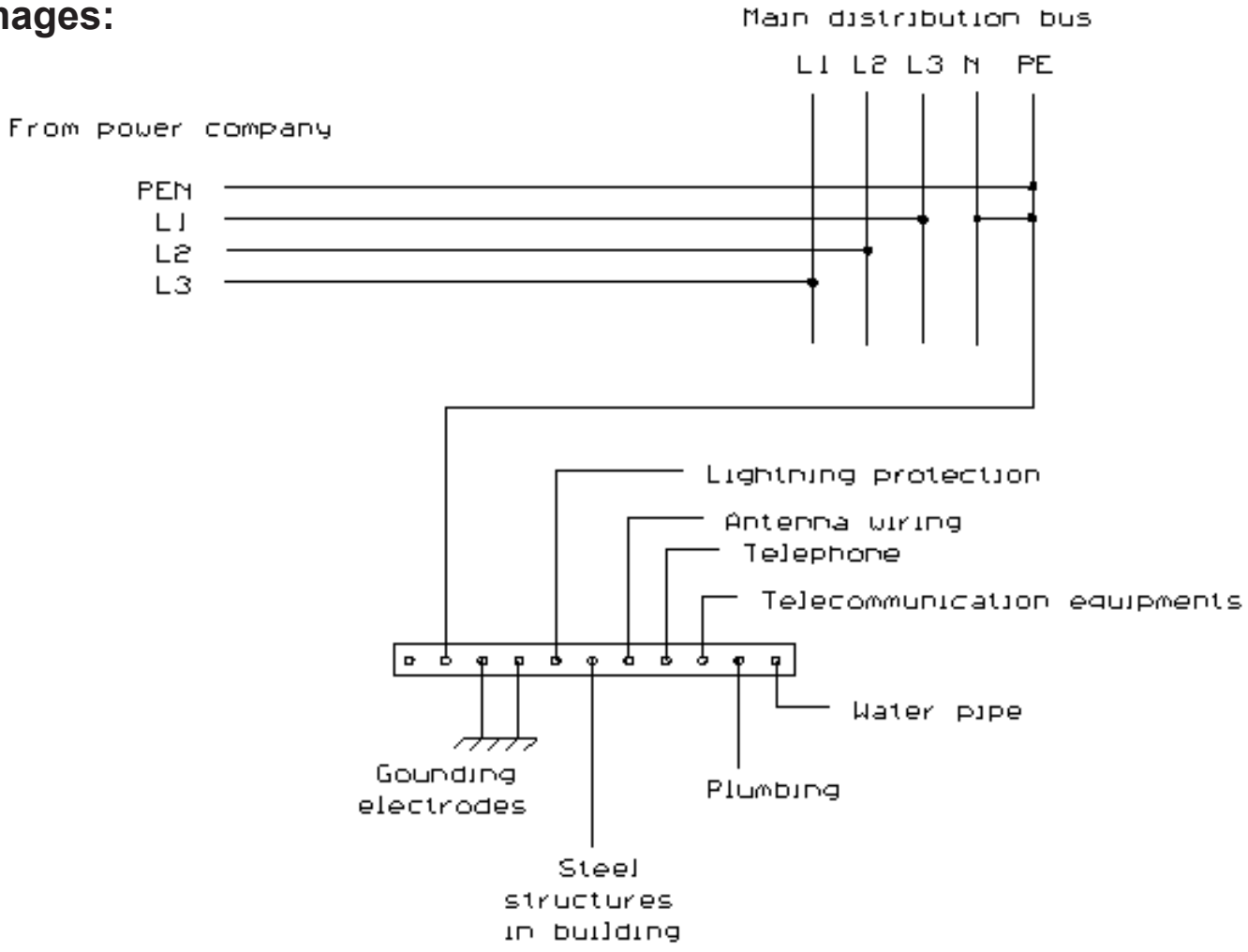

Image 1: This is a description of a typical grounding and electrical distribution system in a large building that uses three-phase power. The power from the power company comes from the power company distribution transformer with three phase wires and one shared neutral/ground wire. This is just one example to give the idea. The wiring practices used in different applications vary somewhat from country to country. For example the power to a typical home in USA comes with two live wires and one neutral/ground wire.

When you have the antenna ground connection removed, you can freely have as many audio and video connections from your PC to your home audio/video system as you want.

Knowledge helps avoiding problems

Hopefully this article has given you some understanding on the grounding and ground loop idea. With the right knowledge you can avoid the ground loop problems and solve them in the cases you meet them. With a good system planning you can avoid many problems. And keeping the right tools in the toolbox helps to solve the problems when they appear.

Unfortunately there are no simple “works for all” solutions to ground loop problems. To solve these kind of problems effectively you need to know what causes them and know the possible solving techniques. Then you go to analyze your system (draw a schematic of interconnection and do measurements if needed), plan the potential solutions and try them. This is a well-tried process that has proven to give good results. I have used them when I have worked with ground loop problems solving on auditoriums, home theatre systems, live audio and video systems, web broadcasting systems, on-location TV broadcasting system and video projection systems on concerts.

You can find more information in this topic from my ground loop document located at:
http://www.epanorama.net/documents/groundloop/index.html

ATVQ

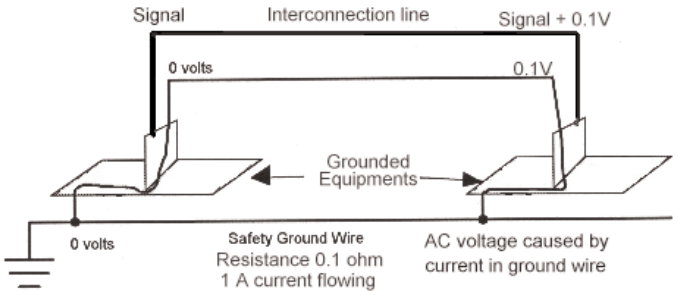

Image 2: This is a typical ground loop situation. Here the current on the safety ground wire causes potential difference between two different grounded equipments. The potential difference gets summed as noise to the unbalanced interface (audio or video) signal and causes humming noise to it. Part of the grounding current flows through the signal wire ground and the equipment wiring usually causing more or less problems in the equipment operation (usually causes noise as well). The loop formed by wires and equipment can also pick up interference from nearby magnetic fields and radio transmitters.

Image 5: A look inside a commercial "video hum bug transformers" I had to open to change the BNC connector that was broken on a field use. This device consists of a toroid shape transformer core and around 50 turns of very thin 75-ohm video coaxial cable wrapped around it. You can make your own working similar device by taking he core from a 100-400W toroidal mains power transformer and winding 30-50 turns of thin 75-ohm coaxial cable around it. This will work well but is somewhat larger and heavier than the commercial devices like this. The price range of this kind of commercial device is 100-200 US dollars.

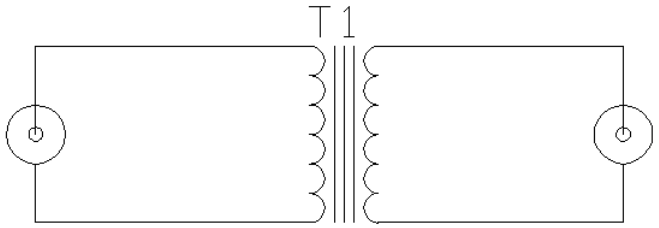

Image 3: This picture describes the wiring inside an RCA audio isolator. Use a good quality 1:1 ratio audio transformer as T1 to build this circuit. Suitable impedance rating for the transformer coils is few kilo-ohms. This kind of isolators are quite cheaply (20-30 US dollars) available from car hi-fi shops.

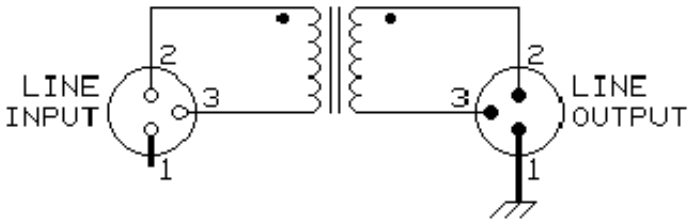

Image 4: This is an isolator for a balanced lines that use XLR connector. This circuit solves the ground loop problems that can sometimes occur in the balanced line. In addition to this the circuit can be used for balanced-unbalanced interconnection by connecting the unbalanced audio signal between input pins 2 and 3, and getting the balanced signal from the line output. The transformer used in this circuit is a 1:1 ratio good quality audio transformer with 600 ohm coil impedances. This kind of devices are available as ready made devices from professional equipment sources.

Annual Banquet

The Central Illinois/St. Louis Area Amateur Television Club will hold their 19th annual banquet on November 21, 2004 at the Ariston Restaurant in Litchfield, Illinois.

The banquet starts at 4PM with a get acquainted hour and dinner served at 5PM. Following the meal, awards will be presented including the club's annual ATV Operator of the Year plaque. A large prize drawing will follow.

There will be a small area for swap and for sale items. For further information contact Scott Millick K9SM at 217 324-2412, smillick@wamusa.com or 222 N. Jackson St., Litchfield, Il 62056.

ATVQ

FD 2004 from Grosse Ile, MI

These are the only two I got off the videotape.

These are pictures from a Microcam CS188 camera (one of two that I won at the Dayton Friday night ATV get-together) at 60 feet high on Saturday June 26th at about 5 p.m. from Centenial Farms on Grosse Ile, MI in the center of the Detroit River.

The first one shows the top of the main rec center on the island, then the next building is one of two horse barns, then the storage shed and then the tree line about 400 yards away along with some of the 2m Satellite beam.

The second photo shows just the treeline as we were rotating the beams during contacts along with one of the 70cm satellite beams. The other one was about another four feet further out and was being used for ATV transmissions.

We had reports of images being received as far as ten miles away. All equipment was from P.C. Electronics except the camera which was donated as door prizes from ATV Research the past two years at Dayton Friday night get-togethers.

James French - W8ISS
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ATVQ

New ATV Mode?

By: Rick Peterson, WA6NUT Email: arandess@sbceo.org
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Lompoc, CA 93436

The attached news item pertains to MSTV, the third ATV mode (besides FSTV and SSTV).

I don't know of any "on-the-air" work by U.S. amateurs using the DRM modes. One U.S. amateur, KA2HZO, checked with the ARRL on whether DRM would be a legal mode for use by U.S. amateurs -- he received the impression that the DRM bandwidth (4.5 kHz minimum, with wider bandwidths available) exceeds the allowed limit for U.S. amateurs on HF.

EUROPEAN AMATEURS FIRST TO QSO VIA DRM VIDEO MODE ON HF

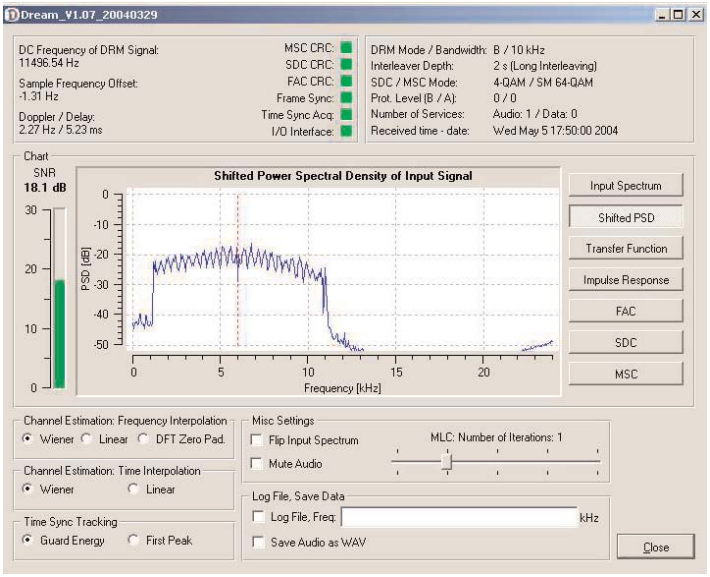
On May 25, 2004, Roland Brustle, DL3NDR made the first amateur transmission using the new Digital Radio Mondiale (DRM) mode on 14270 kHz. He was joined by EA2ARU, PE1RMQ, IW0HK, and HB9TLK for the exchange of Medium Scan TV and text. DRM is a wideband (5-20 kHz, selectable) COFDM mode employing several hundred closely-spaced carriers to reduce the effects of multipath delay on HF. The Medium Scan TV image resolution is 352 x 288 JPEG, full color. Frame rate is about 1 frame/sec.

The DRM mode is also used by European shortwave broadcasters primarily for the transmission of high fidelity music and speech.

The DRM system uses a soundcard-based software transmitter and receiver with multiple carriers centered at 12 kHz. Mixers are used to convert the transmitted soundcard output signal up to RF, and convert the received RF signal down to the 12 kHz soundcard IF input. HB9TLK's website

http://www.qsl.net/hb9tlk/drm

shows how he modified his FT 847 transceiver for interfacing to the 12 kHz soundcard input and output.



DReaM Screen

The DRM receiver and transmitter software (and required .dll file) are available as "Compiled DREAM Decoder Software V1.07" from the SAT-

Service Schneider website:

http://home.t-online.de/home/sat-service/sat/index.htm

DRM .wav files for testing the receiver are found at the DReaM website:

http://www.tu-darmstadt.de/fb/et/uet/fguet/mitarbeiter/vf/DRM/DRM.html

The DReaM receiver can be tested by playing the .wav files from Windows Media Player to the DReaM receiver via the "Virtual Audio Cable" (VAC) from:

http://www.nrcde.ru/music/software/eng/vac.html

Another useful utility program, for transmitting webcam video with theDReaM software, is the Dorgem video capture software from:

http://dorgem.sourceforge.net/

More information on setting up the DReaM, VAC, and Dorgem software is found at the "public forum" link at the DReaM website referenced above.

Another Medium Scan TV (MSTV) system (1.9 frames/sec, 60 lines monochrome), developed by Con Wassilieff, ZL2AFP, has been in use since 2002. This soundcard-based software permits live webcam video to be sent and received in real time on HF, within a 3 kHz bandwidth. The ZL2AFP software is available at:

http://www.archive.org

At the "Wayback Machine" prompt, type:

http://users.pandora.be/ON1AIJ/index.htm

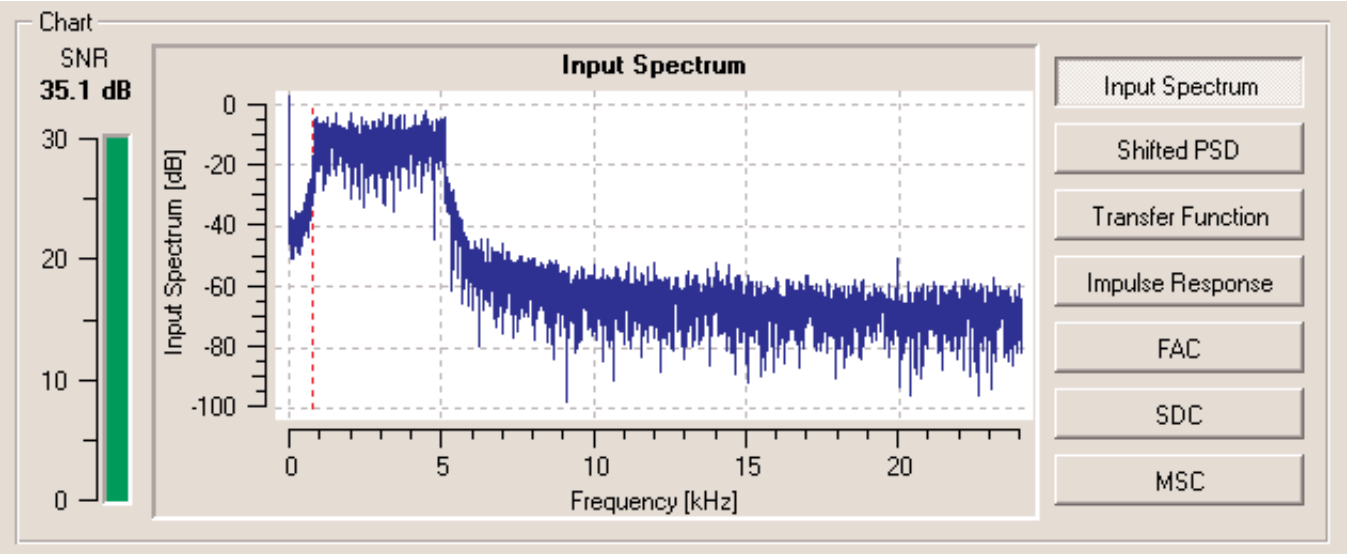
(note that this version of ZL2AFP's software does not run in Windows XP).

Con is currently developing a multicarrier MSTV system which, like DRM, gives improved performance under multipath conditions on HF.

FIRST AMATEUR QSO VIA NEW NARROWBAND DRM VIDEO MODE

Attached is another very recent development on the MSTV front.

This version of DRM features a bandwidth about the same as SSTV, thus should be allowable for U.S. amateurs on HF. It seems to require no modification to the SSB HF transceiver, just the addition of a soundcard interface, like SSTV.



HamDream Screen

Depending on the frame rate achievable with HamDream, it might become the predominant MSTV mode in the future.

On June 6, 2004 the first transmission using a narrowband version of DRM, called HamDream, was made between two Brazilian amateurs, PY4ZBZ and PY4BL. The transmission, on 40 meters, included a test pattern from PY4ZBZ using the DRM Multimedia (data) mode. The contact was made over a distance of 70 kM (42 miles).

The wideband version of DRM (Digital Radio Mondiale) requires 5-20 kHz bandwidth (selectable), and is used by European shortwave broadcasters for the transmission of high fidelity music and speech.

The Brazilian amateurs' version of DRM requires only 2.1 kHz bandwidth, compatible with the bandwidth of HF SSB transceivers. Unlike previous DRM receivers, the HamDream software receiver input is at baseband (demodulated AF output of the SSB transceiver to the PC's soundcard), so that no down-conversion from the SSB receiver IF to 12 kHz is required.

Details of the contact using the HamDream mode are found at PY4ZBZ's website:

http://planeta.terra.com.br/lazer/py4zbz

best viewed from Altavista using automatic translation by Babelfish.

The frame rate for the Multimedia video was not given on the PY4ZBZ website, but it is likely less than the 1 frame/sec available with the wideband DRM mode.

Availability of the HamDream software was not announced on the website.

FIRST DX CONTACT VIA HAMDREAM NARROWBAND DRM MODE

On June 21, 2004, a contact was made between HB9TLK (Switzerland) and PY4BL (Brazil) on 14255 kHz using the narrowband DRM (Digital Radio Mondiale) mode known as HamDream. With only S3 to S4 signal levels, only callsign data was exchanged and displayed via this mode. Although the "MOT Slideshow" video mode was used, the low signal levels did not permit the display of actual video (the system has provisions for displaying callsigns and other data even if video cannot be displayed).

The HamDream bandwidth is only 2.1 kHz (about the same as SSTV), compared to the 5-20 kHz bandwidth of the DRM version used by European shortwave broadcasters.

Details of this contact were added June 21 to the PY4ZBZ website:

http://planeta.terra.com.br/lazer/py4zbz

best viewed in Altavista using automatic translation by Babelfish.

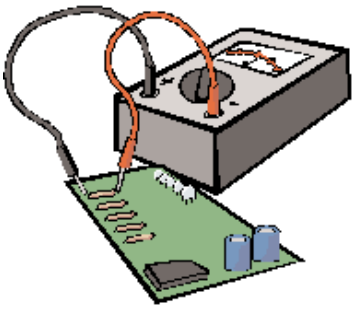
Also, on June 21, the HamDream software became available for downloading from the PY4ZBZ website. A soundcard interface is required for HamDream operation with an HF SSB transceiver.

I've been monitoring the various Internet websites and forums for developments in DRM video. About the time I think I've reported the final development, another one shows up! Lots of good stuff happening out there!

I had a chance to try out the HamDream "video" mode for the first time this morning. The JPEG images look good, but they're very slow (55 sec) compared to the wideband DRM mode (1-2 sec). So it looks like the HamDream "video" is more like a fast SSTV, probably more robust in multipath than SSTV. HamDream does not seem to qualify as MSTV -- definitely not a realtime mode.

The HamDream program is a modification, by HB9TLK, of the DReaM program.

ATVQ



Sparks from the Bench

by Ron L. Sparks - AG5RS - Email: atvq@sparkles.com
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Katy, TX 77492

Dark Subjects
A Regular Featured Column!

I started trying to compose this column and cannot tell whether I am swimming with sharks or simply went off the deep end. Last time I said there was a lot more information to digest to get from lighting to the resulting camera image. I really did understate that!

It turns out that we can get from light measurements to useful video images, but you will need to hang on along the way as the path is a bit like riding a roller coaster – fun, but winding and full of fast and slow spots. At this point a little map-like overview is in order. In the last column we looked at sources of light, their measurement, and how they illuminate an object. In that process the types of light were broken into three components. Scientifically they are the Total Flux, Illuminance, and Luminance and for clarity (and sanity) I renamed them to intensity, illuminance, and visibility.

The first two terms were covered in detail and if you do not have a copy of the column, you should write to ATVQ and order a copy. So, assuming you have that information digested, you are ready to tackle the last component – visibility. Once that is done you will have the tools to look at a light source, do some calculations, and determine if it will be adequate for your camera.

Then, hopefully, in a future column we can look at types of cameras, how they work, and make some comparisons. By that point your toolbox will have the information to allow these comparisons to have reasonable scientific basis. You remember "reasonable scientific basis", it is the exact opposite of "marketing department specifications".

Why Lambert's Foot?

Looking at an object and how it is lit is an even more dazzling array of units than the measurements of intensity and illuminance. For example, you will find measurements in candelas per square "anything", phots, steradians, lamberts, nits, apostilbs and several others. That brings up a big question, since the units you will come across the most often are millicandela, candlepower, lumens, lux, and foot-candles why use these "weird" units? It has to do with the nature of light. The common units you see are measures of intensity and illuminance. But, unless you are an astronomer or professional light bulb photographer the light you want to get an image from does not go directly from the source into the camera.

The key point is that the image is formed from light rays that have been reflected off of an object and back through a lens to the camera. That is why I prefer to call these measures of visibility. They have as much to do with how we (or film or a CCD) sees as they do with how much light falls on them.

That means that to be precise about creating an image in the receiver (camera or eye) we need to take into account the color of the light, the color of the object, how reflective the object is, how it scatters light, how sensitive the receiver is to various colors, how sensitive it is at various levels, how much light is absorbed by the lens, and a whole host of other things. Well, unless you are a lighting engineer or a professional photographer or camera operator being precise is just not going to happen. That is not necessarily a bad thing, but you should know the basics so you can sense where the major pitfalls are.

This brings us to Johann Heinrich Lambert 1, an 18th century physicist who advanced the science of optics and light substantially. He created a law of reflectance which is the foundation for work concerning the light that we or our cameras see. Remember in the last column I mentioned a standard gray card? Well, I must first admit that my memory was off a bit and when I dug mine out it is actually an 18% gray card (not 50% as I previously said). The reason for the 18% has to do with Lambert's law and the way we see things. If you take a "typical" scene (whatever that is!) and average every spot in the scene into one number, it turns out that number is about 18% – theoretically. As they say about gas mileage, "Your mileage may vary."

But, as discussed, the gray card serves a number of valuable purposes. One is that it is a reasonably uniform reflecting surface, that is to say it is close to a true Lambert surface. The second use is that it is a common calibration point for light meters that you and I can possibly afford without having to get a bank loan.

Now imagine for a moment that that card reflected 100% of the light that hit it. If so it would be a perfect Lambertian surface. In that case, if you illuminated it with one foot-candle of light it would reflect exactly one foot-lambert of light. If you look back at the chart from the last column you will see that one foot-candle is lumen/ft2. So we are getting close to being able to convert the lumen rating on a light bulb into how well it will be seen by our cameras.

Getting an Eye Full

The human eye, even unadjusted, can usually see normally in a minimum of 0.1 foot-lamberts. Therefore, a typical scene with an average of 18% gray could be seen clearly if the light level were lit uniformly with 0.56 foot-candles of light. Interestingly, that is the approximate number of foot-candles of illumination

that the IESNA2 recommends for parking garages and general path illumination. Something tells me that the correlation between those numbers is not a coincidence.

Things get a bit more complex when you discuss cameras instead of eyes. For one, cameras have interchangeable lenses. For another, they have different sizes, types, and form factor for their sensors. There goes the roller coaster, just when you think you are getting close to the goal it lurches another direction. But before we leave this path, it is fair to mention the "old way" of measuring camera sensitivity.

In the "wild west" days of marketing hype, before standards were created, you would often see a camera rating like 3 lux or 1 lux or even 0.01 lux. The even the most conscientious manufacturers would generally take light source, and adjust its intensity until the camera did not pick it up. As you can see from the 18% card, that immediately meant that you had to multiply that sensitivity by 5.5 (or 1/18%) to even get close to what a typical scene needed to be lit with. And even that assumed you did not want to see the details in the image. If you wanted accurate color rendering you probably needed to multiply by another 10 on top everything else. Thankfully, the "Marshall" came to town in the form of the CEA/EIA3 and created a standard, number 639, to create some order on the frontier.

Cameras Have Film?

In 1884 George Eastman created paper backed film and in 1888 Thomas Edison invented the Kinetograph (a motion picture camera) which was developed to production by his assistant. For the next 120 years film was the dominant way to create moving images. The theory and practice of how to do that clearly, efficiently, and economically has become a mature science. Because of that a side trip into the world of film cameras is in order. Do not worry, the trip will more than pay for itself in savings on equipment. Because, you see, as a science matures its components become more of a commodity item and the price drops, often dramatically.

For example, light meters with famous names like Gossen, Seconic, Weston, and others are often available on e-Bay for under $50. Considering that these sold for $1,800 (inflation adjusted) a few years ago they are now great buys. So why are they so reasonably priced? At the risk of missing a good deal on them, I will let you in on the secret. Virtually no one knows how to use the readings without becoming confused and cannot understand how to convert their measurements to video. But, we are closing in on ending that confusion. Let's look at three parts of their use.

You already know the first part. Intensity readings in foot-candles or lux can be read directly from these meters with an "incident light" attachment. This is simply a small frosted white hemisphere that is attached or moves over the sensor. When in place the meter can read the illumination directly. So watch for this attachment on meters you buy. Also look at them closely to see that there is a chart or scale to allow this reading to be measured in foot-candles (often abbreviated fc) or lux.

The second part is the 18% gray card. The meters are calibrated to match that card so if you get one you can use the techniques I described last time and use them to get your camera lighting done well. And, you can use them to compare cameras.

The third and final part, how to convert their readings into values for your video camera will be covered in a future column, so as they say, "stay tuned".

Why film when I do video?

Since film photography is such a mature arena, many techniques and heuristics (rules of thumb) have been developed that will help us at every turn with our video projects. For example, if I have an understanding of how to calculate various light levels and light types I can properly measure it with one of the aforementioned light meters. Then by using the same formulas the film people do, we can easily calculate what kind of camera, lenses, and filters are needed for any situation we want to televise. That means no more blurry tower cam shots that are useless at night, no more SSTV or ATV pictures that look like they were shot by a 10 year old with a disposable camera from a cereal box, and no more spending (wasting?) money on cameras with unrealistic or unneeded specifications.

One thing you will notice about film photography as compared to modern video photography is it is easier to get critical information about the product you are buying than it is in our ATV world. For example, the lens f-stop is just as critical to us and yet is almost never specified in cameras with fixed lenses. Believe me, a pinhole camera with an f/16 equivalent lens will never, ever; perform as well as the camera with an optical glass f/1.2 lens. Otherwise, Nikon, Zeiss, Canon, and a host of other manufacturers would simply not exist.

Another even more difficult to find rating is the dynamic range of the video camera. Most film emulsion has a 9 f-stop range and the end product can handle a 7 f-stop change reasonably well. But what is the dynamic range of your video camera? And, more importantly, when was the last time you saw a specification sheet for a low end camera that even mentioned dynamic range?

By going back to our film brethren, we can get some useful information on this critical point. As you will learn next time, one f-stop is one doubling of light intensity. Or to put it in ham terms a 3 dB change. If you do the math then that 7 stop range is 21 dB which works out to a range of about 125 to 1. The full sensitivity of the emulsion is, by the same math, about 500 to 1. Now take those numbers and convert them to the closest binary equivalents of 128 and 512 and you will see they represent a 7 bit and 9 bit resolution, respectively.

This is our first piece of "cross over" information. For your video camera to approach the range that you expect from watching film movies you must have at least a 9 bit digitizer on the light sensor. I would expect that in reality that needs to be 10-12 bits in order to allow for differences in sensitivity and things like quantization errors.

A second useful piece of information from film references is that a "typical" scene contains about 4 stops of range from black to white. That works out to about 32 to 1, so simple cameras can often work when there is simple lighting. Simple lighting is a single source, generally behind the camera. When you add fill light, like from another window on the side of the room, it does not add to the range – it multiplies it. For example, if you have a 32 to 1 scene lit mainly by one window behind the camera and the light coming from the side window is 1/4th as bright then the range of the scene jumps to 4 * 32 = 128 to 1. This is about the maximum for many cameras.

That's a Wrap

Whew, that was a ride. Let's recap what we covered this time. First, visibility (luminance) is light that is reflected off of something into our eye or camera. Its brightness and contrast depend on the reflecting subject as much, or more than, the light that is shining on it (flux and luminance). Second, that reflected light must go through space, some kind of lens, and then be measured by the sensing element (whether CCD or retina). Because of that path there are more losses and various color sensitivity changes. Third, we now know how to use a light meter and gray card to check both the intensity and visibility of the scene we want to capture. And last we figured out that there are some useful things about film photography that we can use to fill in the gaps in data on our video equipment.

My goal for next time is to get a copy of the EIA standard and use it, the gray card, and a photographic light meter to measure and compare all the cameras I can get my hands on. I will also begin to explain why you cannot use a cheap web-cam as a direct replacement for a standard video camera.

In the mean time, you should go "scrounging" at your local photo shop, pawn shop, or whatever and get yourself a good light meter and gray card. Also, get an inexpensive dimmer and hook it to a halogen lamp with a PAR type bulb. Once you do, start experimenting with your video equipment and begin coming up with ideas on how to improve your pictures.

Until then, remember a picture is worth a thousand words but an in-focus picture of the culprit's license plate is priceless.

References

1. **Johann Heinrich Lambert** (August 26, 1728 - September 25, 1777), was a mathematician, physicist and astronomer. He was born in Mülhausen (now Mulhouse, Alsace, France) and died in Berlin, Prussia (now Germany).
2. Illuminating Engineering Society of North America
3. Consumer Electronics Association/Electronics Industry Association, CEA-639 Revision: 03, Consumer Camcorder Or Video Camera Low Light Performance, *Sept,2003*
4. George Eastman (1854-1932) and Thomas Alva Edison (1847-1931), Edison's assistant on Kinematography was William Kennedy Laurie Dickson

ATN SUMMER NEWSLETTER 2004

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NEW ATN CALLSIGNS:
W9ATN for ATN-IL and K9ATN for ATN-IN

ATV at DAYTON:
Many ATN members were there this year from almost all of our chapters. Don our webmaster was taking photos for the website. Gary W6KVC & Mike WA6SVT gave an ATV presentation at the Friday night ATV Dinner. We met with ATVers from ATV groups nationwide. It was great! We hope to have a bigger ATN presence this next year!

WINTER MEETING:
We had a late start. Our president was unable to make the meeting at the last moment and Mike, WA6SVT, opened the meeting. We had awards for several members who have provided major help over the years. We also showed the new membership certificate (awards and certificate mailed several days later to the members).

We had trustees and members from several ATN chapters but due to the rain local attendance was down about 20% from last year. Roland, KC6JPG, and Gary, W6KVC, provided the camera work and on the air communications to the members who could not attend the meeting. Donations above the membership dues were up this year helping ATN finish some projects ahead of schedule, Thank you! Several members had a great dinner after the meeting at a local restaurant.

ATN WEBSITE:
Don, KE6BXT, has done a great job this year with the website and making several updates including Dayton 2004. Log on to and check it out!

ATN-AZ NEWS:

WHITE TANK MT:
The repeater is working well and the new feedline for the 1253 MHz output should be installed at the end of the summer or early fall when the weather cools down.

MT. LEMMON:
The antenna assignments are not done yet on the new 160' tower

and ATN may be helping install a cable tray to allow clients (and us) to install the antennas. Harold, K7AED, has the repeater transmitter almost done. The 440.225 MHz voice repeater has been finished and under test with the link to White Tank at a test location in Western Arizona.

ATN-CA NEWS:
Thanks to Jim, K6CCC, for running the Monday night Mt. Wilson ATN net, Roland, KC6JPG, and Dave, KA6DPS, for running the Tuesday night linked system ATN Net. Thanks to the members who have shared a video tape presentation after roll call making a fun net night evening.

SANTIAGO:
The new lower loss feedline will be installed sometime this summer. Dave, KA6DPS, donated funding for a new commercial grade 434 MHz TV demodulator. This should give us some improvement in performance if we can resolve some QRM. The QRM turns out to be a spread spectrum digital Air National Guard base station at March Field. Gary, W6KVC, and Norm, KD6OMV, both found the signal on separate "T" hunt missions after Mike, WA6SVT, gave a general area location from using a yagi antenna and spectrum analyzer from the repeater site. Gary, W6KVC, has contacted the Air National Guard and they are willing to help find a solution to the QRM. Norm, KD6OMV, Gene, K6BNN, and Mike, WA6SVT, installed a 6' receive dish to replace a conifer dish to improve the link from Santa Barbara. We obtained an 8 dB improvement.

We need some members to volunteer for help to paint the inside of the site building. If we can get about four persons, we can get it done in one day. Please contact Mike, WA6SVT.

OAT MT:
Allen, W6IST, Joe, K6TBA, Norm, KD6OMV and Mike, WA6SVT, have moved the repeater to the new site at the top of Oat Mt. Coverage has greatly improved in Simi Valley and other areas. Allan is building a 150 watt amplifier to replace the 15 year old 20 watt amplifier.

BLUERIDGE MT:
The repeater has moved into the new building and the tower camera and 146.43 MHz antenna still need to be mounted. Hangers have been donated to replace the tie wire holding the heliax cables. Any volunteers? We also need to take down some of our remaining antennas and feedline from the old site.

MT. WILSON:
The repeater was down for a few weeks to facilitate major construction at the site to add DTV and new analog broadcast transmitters and a full new electrical service to the building.

Brian, KE6IYC (our newest member and Doug's replacement at Mt. Wilson), and Mike, WA6SVT, reinstalled the rack in another attic location. We added a new ID system and Mike, WA6SVT, donated a 1241.25 MHz VSB filter for the repeater. The new call for the repeater is W6ATN. Mike purchased a new VOR-3 board and donated a VOR-2 board. He is installing it into a new chassis to make a multi port controller that will have 434 MHz in, system link into the rest of ATN, connections so Brian can participate in ATV from the site's living room and aux input for tower cam and or NASA SELECT input.

SANTA BARBARA:
Last Month Rod, WB9KMO, at Santa Barbara and Mike, WA6SVT, and the Santiago crew fine tuned both the new 6' new dish at Santiago and the 10' Santa Barbara dish to peak performance that made a real improvement in the link.

Mt. Palomar (Palomar ARC)
Art, KC6UQH, is working on new link equipment to replace the VFO controlled HF Technology receivers at the Valley Center site and Mt. Palomar.

ATN-IL NEWS:
Rockford:
Gene, WB9MMM, is finalizing the repeater in preparation for installation at the repeater site. He has resolved the problem of the 421.25 MHz transmitter from getting into the 1253 MHz receiver. Repackaging the receiver and adding RF bypassing and RF beads did the job. Currently the repeater is under testing at Gene's QTH. Gene purchased a 150 watt amplifier for the transmitter.

ATN-IN NEWS:
CROWN POINT:
Henry, AA9XW, has obtained a club license K9ATN. Henry has been very busy the past two months with his wife Silvia who is having very serious complications from major surgery. We hope she will pull though and be home soon. Gene, Shari, or ATVQ and Mike, WA6SVT, tested mobile coverage of the repeater while traveling though Chicago and Indiana on the way to the Dayton Hamvention.

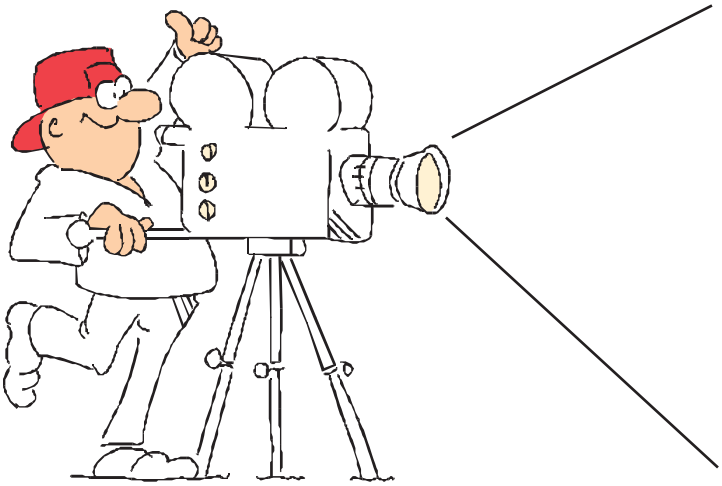
Coverage started south of Downtown Chicago with a P2 picture using a R3 handheld receiver and a big wheel antenna on the roof of the car. P5 within 15 miles of the repeater.

ATN-NV NEWS:
Mt. POTOSI:
Later this summer Geoff, KB7BY, and Mike, WA6SVT, plan to repair the link dish at Mt. Potosi and tune up the system. We plan to also check out a location for a link antenna to Arizona.

ATN-NM NEWS:
Ben's Bluff:
Late summer, Earl will be installing a new 65 ft tower to replace the 30 ft. tower. He also plans to add a tower camera.

THANK YOU:
The ATN Trustees and management want to thank all of the members who donated items, designed and built items, helped at the sites. It is your efforts that greatly help make ATN the network that it is. ATN is the world's largest & successful ATV repeater club thanks to your help and support of the membership.

ATVQ



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ATV'ers are hams that build projects more than other hams. They have a varied background ranging from technicial to engineer, and just might see a need for your product in their regular job as well as in their hobby. I hope to hear from you soon.

Please call TODAY!

Gene Harlan - WB9MMM - Editor/Publisher

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DEADLINES

COVER DATE	COPY DEADLINE	TO Printer	MAILING DATE
WINTER	January 1	January 15	Febuary 1
SPRING	April 1	April 15	May 1
SUMMER	July 1	July 15	August 1
FALL	October 1	October 15	November 1

While we will try to adhere as close as possible to the above dates, we reserve the right to adjust as needed.

If material is going to be late, please call to check if it will meet our schedule. We will try to accommodate everyone as best as we can.

Camera ready art or negative film right reading down are acceptable.

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Complete set of all 8 ATVQ CD's - $90.00 plus $8.00 shipping (USA) ....._____

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Amateur Television Contest 2004

Contest period 00:00z 06/01/04 to 00:00z 09/01/04

Contest goal: To raise activity and promote *long haul* contacts on ATV.

Participants must hold at least a Technician class license and be within the boundaries of North America, Alaska or Hawaii.

In case of multiple Ham occupants, they may share equipment during the contest so long as the intent is not merely to manufacture points. All occupants who enter must submit their own log.

Schedules: The use of schedules is allowed, and can be made by any means available. The use of 144.340 mhz national ATV calling frequency is also allowed and encouraged.

REPEATER CONTACTS DO NOT COUNT. Distance calculations will be between both stations in the QSO with no relay allowed.

Exchange: Callsign with at least P-1 video on any amateur band 70cm and above.

MOBILE or **PORTABLE** stations must exchange their location at the time of contact as determined by portable GPS or other verifiable means.

VIEWER: Station does not have to exchange any video but must be a licensed amateur and confirm at least a P-1 reception report to the transmitting station via 2 meters or another amateur band.

CLASSES: There will be 4 classes for participants:

HOME: Primary location of residence with Fixed Antenna structure. Minimum distance for repeat contacts (75 Miles)

PORTABLE: Station can be set up just for the contest and may not operate from any other location during the contest period. Minimum distance for repeat contacts (50 Miles)

MOBILE: Station can operate stopped or while moving but all antennas must be affixed to the mobile unit and capable of transmit while in motion. Minimum distance for repeat contacts (25 Miles)

VIEWER: Station must be able to receive video at P-1 signal level and relay report to the transmitting station. Minimum distance for repeat contacts with this class is determined by the transmitting stations type or class.

Scoring System: Each valid contact will be awarded points for the mileage between the two stations on an ever-increasing difficulty per frequency basis as follows:

70cm = 2 points per mile

33cm = 4 points per mile

23cm = 6 points per mile

13cm and above gets 10 points per mile!

A station can be worked for points only once unless they are a minimum distance apart as specified by the class of entry. (See CLASSES) and then they may be worked once in a calendar month through the contest period.

The distance between stations will be calculated by the Maidenhead Grid and sub grid identifier coordinates listed on QRZ.com and rounded down to the nearest mile. Every effort should be made by entrants to verify or update their information before the contest starts. If you do not have Internet to look up a stations coordinates please ask the other station, if they do not know then leave the mileage column blank and it will be determined by the verifier. No changes can be made to coordinates once the contest starts unless you move.

Distance will be calculated with the (Bearing and Distance) DOS program by W9IP that is used by the ARRL for distance records.

LOG's: All logs must be in a standard format as specified below:

STATION WORKED RPT REC RPT SENT UTC DATE FREQUENCY GRID SQ DISTANCE POINTS

Your log information should also include your Name, Address, your Maidenhead Grid and sub grid identifier coordinates, and a list of equipment used. Sample Log is below and a full page Log sheets will be available on www.hampubs.com .

Logs can be submitted by email or regular mail and must be received by September 15th to be eligible for contest Awards. Send the logs to:

ATVQ Contest - 5931 Alma Dr. - Rockford, IL 61108 - or to: **ATVQ@hampubs.com**

AWARDS:

All Scores will be published in ATVQ and certificates will be awarded for the top three scores in each class. The highest overall score of the contest (The one who covers the most points on ATV) will receive the OVERALL WINNER PLAQUE

CALL			GRID SQ.			CLASS		
STATION WORKED	REPORT SENT	REPORT RECEIVED	UTC	DATE	FREQUENCY	Grid Sq.	MILES	POINTS
TOTAL MILES				TOTAL POINTS				
NUMBER OF DIFFERENT STATES WORKED								

Overland DX Record Challenged

By: Bob Delaney - KA9UVY - Email KA9UVY@hotmail.com
10630 N. Delaney Lane
Mt. Vernon, IL 62864
DX Hotline 618-242-7063

While I was looking for ATV DX operators to sked with for the summer I was fortunate to meet up with Rick, K9KK of Norman, Oklahoma. We ran a few skeds and did quite a bit of talking about DX. One morning while I was receiving his video carrier at only S-5 on 439.250 I made an encouraging comment to him something like: I believe we can make it if we keep trying and just get some Tropo.

What he said back is the reason for writing this: I know we can make it I worked W9ZIH in Northern Illinois and he is further!

Now let me tell you that kind of got me to thinking RECORD?? Rick and I are not near the previously claimed Overland ATV Record of 628 Miles as recognized in ATVQ Vol 8 #1 Winter 1995. K5YWL in Harrison AR to K8AEH of Columbus OH. There also seems to be some confusion regarding the Overland record since 73 Magazine of March 1995 claimed the record was established between WB0ZJP, Dave Williams, of O'Fallon MO and KA3FZF, Jim Dallas, of Monroeville, PA at 614 miles.

I decided to compute the distances of all of the contacts with the Bearing and Distance program by W9IP that is used by the ARRL for distance records. The trick was to find the Grid and sub grids of all involved. Keeping in mind all of these contacts were a great achievement and should be recognized as such, here is what I found.

KA3FZF, Monroeville, PA (now K3FZF) > WB0ZJP, O'Fallon, MO. (now SK) = 592 mi

K8AEH, Renoldsburg, OH.> K5YWL, Harrison, AR = 629 mi

K9KK, Norman, OK . W9ZIH, Malta,IL = 643 mi

The first 2 contacts took place in the big band opening of December of 1994 and challenged but did not beat the 643 mile exchange between K9KK and W9ZIH which took place in the summer of 1990.

What seems funny about the whole thing is that the stations involved did not seem to think that the contact was anything that terrific or recordbreaking.

Ron, W9ZIH, and Rick, K9KK, were just running skeds on 40 meters after Rick had relocated to Oklahoma and trying ATV just for grins. They exchanged at least P-3 to P-4 video on that morning in 1990 and Rick even took some photos of Ron pounding in on ATV at a whopping 643 miles as shown below.

Ron, failed to take any pictures of Rick but after a phone call from me he described at least P-3 signals were received from Rick in Northern Illinois on that morning. All QSL and log info on the contact have been lost but the pictures and the memories remain clear in the minds of these two record setting ATV DX'ers.

I feel it important to note that many of the operators involved in the contacts mentioned in this article have become inactive, have moved and some are now silent keys. Every attempt has been made to be as accurate on distance measurement as possible. The grid and sub grid info was obtained using WinAPRS and locating the street address of each individual at the time of the contacts. The grid info for each station used for computing distance is as follows:

KA3FZF(K3FZF) FN00ck
WB0ZJP EM48pt
K9KK EM15en
W9ZIH EN51nv
K5YWL EM36id
K8AEH EM89ow

I would expect an error of less than 5 miles so unless someone steps forward with information of maybe a 650 mile or better overland ATV contact the distance to beat will be the 643 miles a record that still stands after 24 years!

Maybe we aren't trying hard enough!

ATVQ

Midwest ATV DX Report

By: Bob Delaney - KA9UVY - Email KA9UVY@hotmail.com
10630 N. Delaney Lane
Mt. Vernon, IL 62864
DX Hotline 618-242-7063

Now on with the reports:

04/01/04
01:15z KA9EGM, Jim, of Centralia IL reports he saw WA9EUN, Plano, IL on 434 Mhz at P-1 signal level.

04/07/04
00:16z W9ZIH, Ron of Malta, IL was received by KA9UVY at up to P-2 signal level on 439.250.

04/1604
14:20z KC0HFL, Bob, in Withcita, KS reports seeing the KC5NQ ATV repeater in Dallas, TX coming in P-5 at a distance of 340 mi.

04/18/04
10:00z Tropo finally developed here in the Midwest and followed Hepburns map very well. Many UHF TV stations were seen here in Southern Illinois from NW Arkansas in an arc South to Biloxi, Ms.

04/18/04
12:20z N9XHU in Springfield IL worked W4HTB in Bowling Green, KY at a P-2 signal level. This contact at 263 mi. was coordinated on 144.340.

05/05/04
12:00-15:00z Tropo developed here in Southern Illinois as predicted by Hepburn. Many UHF broadcast stations from Oklahoma City north to Kansas City were P-4 and P-5. Unfortunately My CQ's failed to raise a soul, and no reports of ATV contacts during this opening have been received. :-(

05/28/04
13:30z KA9UVY managed to see Mike, KD0FW from the Kansas City Mo. area at P-2 signal level.

05/28/04
13:50z KB9LII, Mike, of Centralia IL worked his first DX this morning exchanging P-2 video with N9XHU near 100 miles.

05/29/04
11:50-12:00z KB9WLM, Larry, of Canton, IL reports working W9NTP, Waldron, IN and K9KLM, Bernie, of Westport, IN signal were at P-4 level at a distance of just under 250 miles.

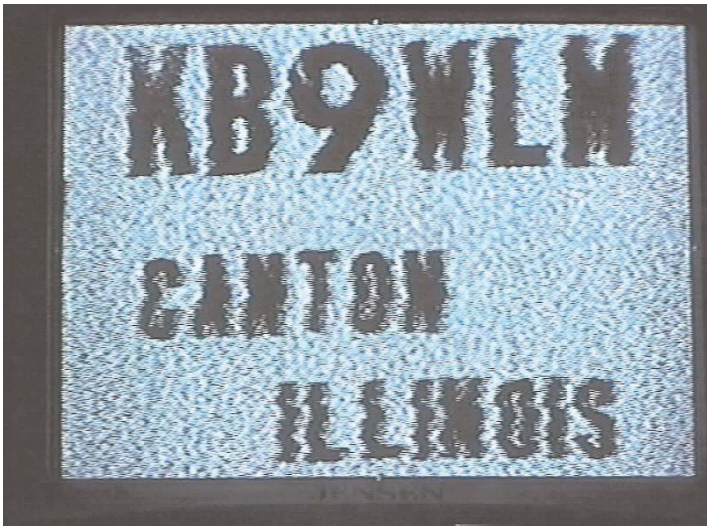
06/04/04
12:00z-13:00z A nice inversion developed this morning providing many P-3 contacts from Southern Illinois to West Central Illinois. AA9MY of Pekin, IL, KB9WLM of Canton, IL, and N9XHU of Springfiled, IL worked Southern Illinois stations: KA9EGM, KB9LII, and WA9IZV.
Best DX was WA9IZV, Len of Fairfield IL and KB9WLM of Canton at 174 Miles at P-3.

06/29/04
01:15z W9ZIH, Ron in Malta Il. came in at P-1 to P-2 level during a sked attempt. I did not manage a 2-way due to amp failure on my end :-(

So far early summer has not brought much in the way of Tropo but the unseasonably cool WX has produced many nice temperature inversions in the late mornings. Signals in the 100 - 175 mile range can be very enhanced by these inversions. Take a look at this picture I grabbed of WD0FCH, Earl, in St. Louis, Mo. on the morning of 6/20. Earl was running only 6 watts average and made a P-4 color signal here at 91 miles! This picture really doesn't do Earl justice since it's a 2nd generation capture.

Also a picture of KB9WLM, Larry, in Canton, Il at 169 miles distance taken on 06/04 during a morning temp inversion (next page).

Just a reminder to all of the DX Operators out there to please send in your reports if you work something of interest. Try if at all possible to capture a picture of the station you work and send it along to me.



This column will only continue if there is interest and participation from all of us who enjoy ATV DXing.

Your feedback is always welcome and appreciated !

DX Tip: Getting the antennas properly aimed

One of the problems with working DX on ATV is the challenge of getting your antenna properly aimed toward the station you are trying to work. Long boom UHF yagis and more importantly multiple arrays of them have very sharp patterns and therefore require precision alignment for a video exchange to take place. There are many antenna bearing programs out there that are used for this purpose but who really can say that both stations have properly aligned their antennas when installed ? Also how accurate is your rotator system? Another problem is both stations must be able to give exact coordinates for such a program to be completely accurate.
The best way to start especially if you are coordinating on 2 meters is to simply peak the 2 meter FM signal this of course is most effective if both your 2 meter beam and UHF yagi are aligned together and on the same mast.

This is only the beginning and if you are coordinating by other means then a little geographic knowledge goes a long way.

The ATV station with the most ERP should transmit first and the best way to find an ATV signal is not with the TV at all but with a narrow bandwidth Receiver. A 440 FM receiver that will tune the desired ATV frequency will be much more effective finding the video carrier than your downconverter and TV and a SSB receiver can find even weaker carriers. Now not everyone has a SSB rig that they can use or even an FM rig so they might use a scanner. Since most scanners don't offer an s-meter you would have to try and peak for least noise in the carrier. An even better method would be to use your sensitive downconverters front end and IF output frequency. This would keep you from having to change the antenna line over to your ATV gear when you're ready to watch for the video or transmit back. You can install a simple TV splitter in the downconverter output and run one line to your TV and one to a narrowband receiver capable of tuning your IF output frequency. The only drawback to this type of installation is the drift of the local oscillator in your downconverter. If you want rock steady IF output I would recomend the new PC Electronics synthesizer board. I use this type of setup here and it gives me not only a way to peak the antenna but also gives you an on-carrier audio RX and if the station you are trying to work is using on-carrier audio you can have a full duplex QSO while waiting for the video to come up out of the noise!

ATVQ

Correction for Winter 2004 Article ATV Channel Filters

In building the 1.2 GHz filter with the 10 MHz bandwidth, we found that there was an incorrect measurement listed. The "B" dimension for 10 MHz was listed as 1 23/32" and should have been just 23/32". We are in the process of remaking the top and bottom on our filter so we can test.

Gene - WB9MMM

ATVQ

B/W	6 MHz	7 MHz	10 MHz	17 MHz
A	13/16	11/16	11/16	5/8
B	3/4	13/16	23/32	1 7/32
C	1 7/16	1 3/8	1 3/8	1 9/32
D	1 1/2	1 7/16	1 7/16	1 5/16

70 cm VSB Bandpass Filters

by Mike Collis - WA6SVT Email: WA6SVT@aol.com
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In the Winter 2004 issue of ATVQ we explored 23 cm VSB and FM Channel Filters. This issue of the "Q" we will explore a filter of the same type design for 70 cm due to requests from several ATVers.

This filter is in the interdigital family, the rod connections are alternated between the top and bottom bar stock as compared to an inline filter were the rods are connected on one side of the filter and tuning is on the other side. The filter is made from the same materials that are described in detail in the earlier article. The main difference is the length of the rods, spacing of the rods, the spacing between the ¾" x1/4" bar stock (see measurement list for lengths and spacing. Only 6 MHz VSB filter information is given for 70 cm as FM video is not a good idea here.

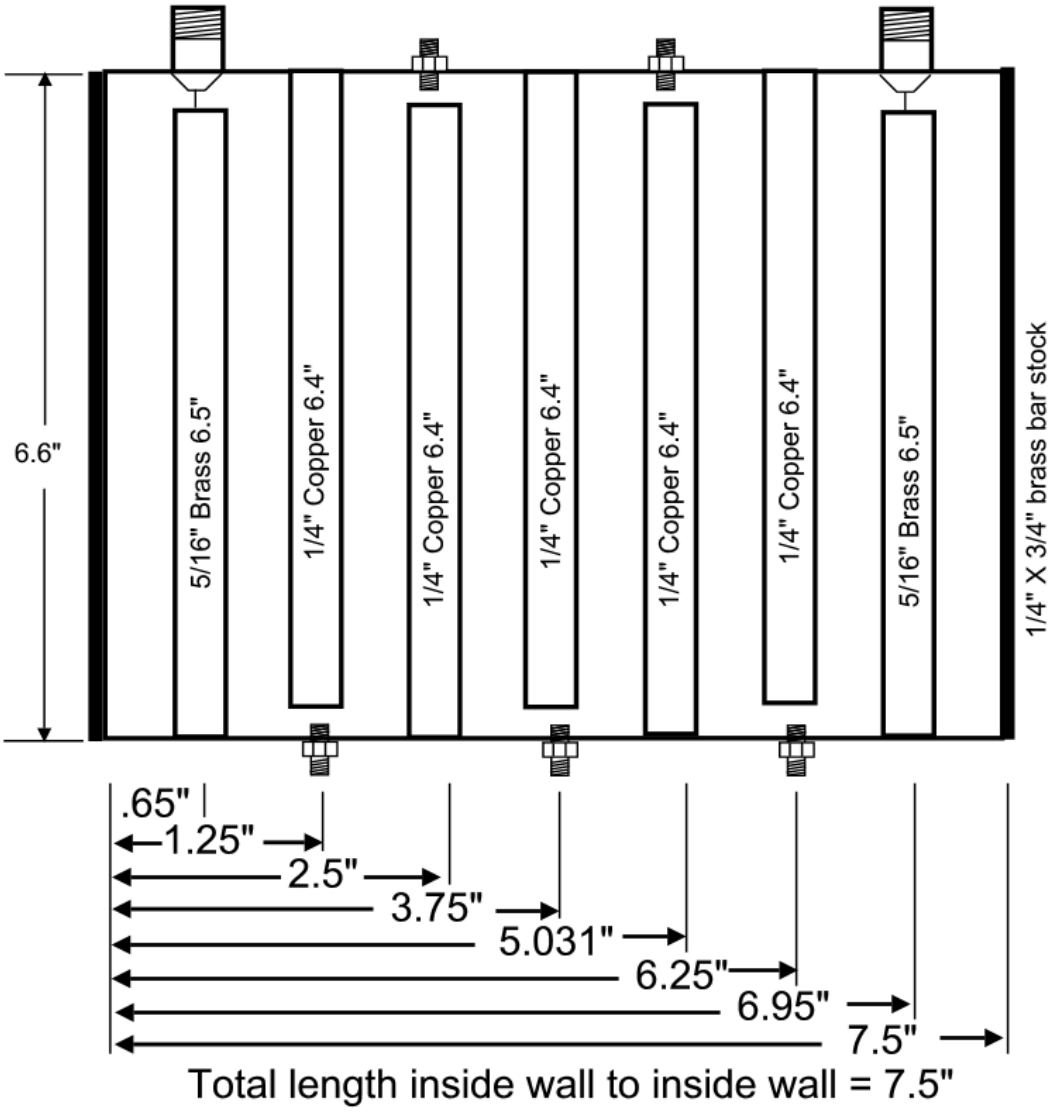
Construction techniques and alignment of the filter is the same as in the earlier article.

Insertion loss is about 1.5 dB for a silver plated filter or a filter with copper rods and top and bottom lid about 1.6 dB. An all brass filter is about 2.2 dB. The size of the filter makes its use inside a receiver chassis viable.

Here is the measurements for the filter parts.

The same materials as the 1.2 GHz filters (Winter 2004).

1. Inside to inside of the box height is 6.6"
2. Left inside wall to right inside of the box width is 7.5"
3. Left inside wall to input rod center is 0.65" (A)
4. Left inside wall to 1st resonator rod center is 1.25" (A+B)
5. Left inside wall to 2nd resonator rod center is 2.5" (A+B+C)
6. Left inside wall to 3rd resonator rod center is 3.75"
7. Left inside wall to 4th resonator rod center is 5.031"
8. Left inside wall to 5th resonator rod center is 6.25"
9. Left inside wall to output coupler rod is 6.95"
10. Resonator rods are 1/4" brass, copper rods or hobby tubing 6.4" long
11. In & out coupling rods are 5/16" brass, copper rods or hobby tubing 6.5" long



Loss is about 2 dB for brass and 1.3 dB copper. bandwidth is 6 MHz

This filter should tune 421.25 MHz, 426.25 MHz 427.25 MHz, 434 MHz (filter design frequency), and 439.25 MHz. I personally have used this filter on 426.26 MHz by retuning.

Great Plains Super Launch 2004

By: Zack Clobes, W0ZC - Email: zclobes@swbell.net
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Hutchinson, KS 67502

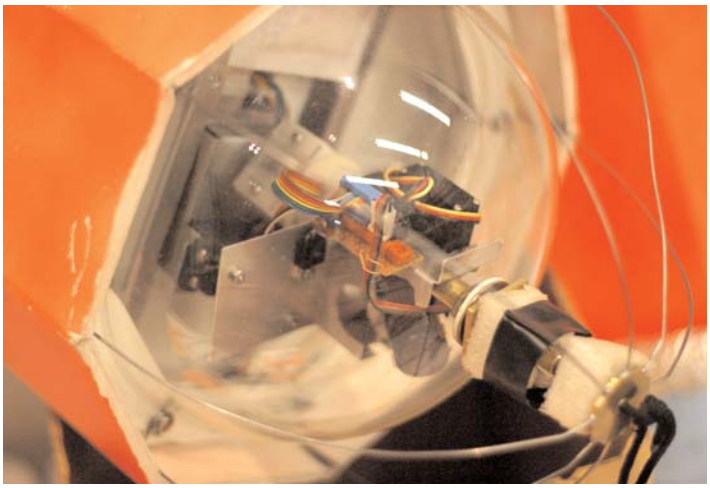
A group of nearly 50 high altitude balloon enthusiasts gathered in Hutchinson, Kansas over the Fourth of July weekend to swap war stories, show off their toys, and of course, fly balloons. People from as far away as Idaho and Alabama made the pilgrimage to Kansas for the fourth annual Great Plains Super Launch.

Most of the attendees began to gather in town on Thursday evening, and many met for dinner to begin their weekend story-swapping-fest. Friday morning and afternoon was consumed by a series of presentations ranging in topics from university-funded launches to cosmic rays to FAA reporting and alerting procedures. Friday was rounded out (no pun intended) at an all-you-can-eat Chinese buffet where the groups finalized their plans for in the morning's launch.

Saturday morning began bright and early – by 6:00am for most groups. Due to the forecast wind calculations putting a number of the capsule's touchdown points within a few miles of Mid-Continent Airport in Wichita, the launch was moved 25 miles north to a backup site at the McPherson Airport.

When I arrived on the field at 7:30am, several groups were already there beginning to unload their payloads and assess the wind situation. The ramp of the airport quickly exploded into a flurry of activity. Tarps were being laid out, parachutes and load lines extended, and capsules being packed up. A total of nine K and T sized helium tanks were divvied up amongst the participants and it wasn't long before someone had tapped a bottle and filled the air with the familiar hiss of high pressure gas being vented into a balloon.

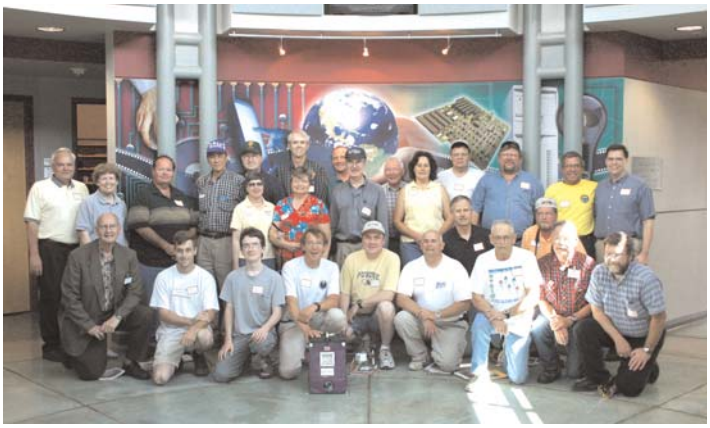
Meanwhile, my grandfather, George Clobes, arrived with his ATV receiving station that he has pieced together over the past few years as Project: Traveler has



Bottom of EOSS's compass-stabilized ATV capsule. The camera can be seen towards the bottom of the frame.

experimented with various flight configurations. His current station consists of a 21 element Yagi loosely mounted about 15 feet in the air on a portable base, a PC-Electronics variable frequency 70cm down-converter, and an automotive-type 12V TV/VCR combo. The antenna is mounted in such a way that, through a series of ropes and bamboo poles, the antenna can be maneuvered to any direction, almost any elevation, and can even be flipped between horizontal and vertical polarization.

George has had pretty good success receiving ATV video feeds from the Project: Traveler's "Little Wheel" antenna, and was hoping to test it out with Bill Brown, WB8ELK and EOSS's ATV downlinks. Unfortunately due to a busy work schedule, Bill was forced to give up his ATV plans. The EOSS group from Colorado had their ATV transmitter being fed from a B&W video camera on board their craft. The camera was actually



Group photo from the conference. The conference was held at the Shears Technology Center at the Hutchinson Community College.

The ramp at the McPherson airport starting to heat up Saturday morning.

George Clobes assembling his ATV receiving station in the parking lot of the McPherson airport.

mounted to an electronic compass stabilization system, whereby the camera, by use of a stepper motor, was constantly being adjusted to always point west.

Back on the ramp, most of the balloons were filled and ready to go. I could tell that several of the groups were getting antsy, so I gave the word to begin moving the capsules into position away from the hangers. My capsule, Project: Traveler 2004c was equipped with a Mini-DV (digital) camcorder which was facing down, so we moved upwind of the rest of the groups to capture their liftoffs on video.

By use of an aircraft-band radio, we announced our intentions on the local Common Traffic Advisory Frequency (CTAF) and started by launching the Project: Traveler payload. A few seconds later, the other five groups were releasing their capsules and soon the sky was filled with little white dots.

Unfortunately, EOSS hit a snag while launching and the BNC connector for the ATV transmitter came unplugged. Being the only ATV transmitter in the sky that morning, George wound up going home early after collecting essentially zero footage.

Despite EOSS's antenna problem, all of the payloads were sending good APRS position reports as they departed the airport, and except for one and a half minor outages, all payloads were tracked all the way to the ground. All payloads, with the exception of one triple-balloon flight, landed within a few miles of Newton, Kansas, and were recovered within an hour or two. Don Pfister, KA0JLF, and the HABITAT group from Kansas City was the responsible party for the triple balloon payload which landed a few miles north of Hutchinson, rather than tracking south like everyone else.

Shortly after the recovery, almost everyone made it back to Newton to grab a bite to eat at a local truck stop, before heading home. There were some interesting stories that surfaced like the one unlucky soul who needed to stop by WalMart before he came to eat because he was soaked in mud. Mark Conner, N9XTN's NSTAR capsule quit transmitting APRS data at

George Clobes, and son Don Clobes after erecting the ATV receiving antenna.

The McPherson airport crawling with life.

Preparing for launch.

And they're off!

Jon Riley, AJ0NR retrieving the Project: Traveler payload from a tree.

27,000 feet on its way down. They were able to talk the local farmer into driving them through their field on his truck and wound up stumbling across the package. Jon Riley, AJ0NR from Project: Traveler got to show off his tree climbing skills after our payload landed nearly 30 feet in a tree.

Soon the excitement was over, and all of the new and old friends I'd just spent the past 36 hours with were returning home to their "real" life. A total of 31 people from eight states were accounted for at the symposium on Friday. The following groups/individuals flew on Saturday:

Bill Brown, WB8ELK from Huntsville, AL
Edge Of Space Sciences from Denver, CO
High Altitude Basic Investigation Testing
And Tracking from Kansas City, KS
Harry Mueller, KC5TRB from Tulsa, OK
NSTAR from Omaha, NE
Paul Verhage, KD4STH from Boise, ID
Project: Traveler from Hutchinson, KS

73 and Happy Flying

Zack Clobes, W0ZC
Project: Traveler

ATVQ

ATV Mobile

Scott, N9GLL had to show me how he does Mobile ATV when we saw each other at the Fox River Radio League Hamfest on July 11th. Bruce, KA9H, who did the welding I understand, went out to the parking lot with us. The welded assembly fits on a regular ball mount trailer hitch and seems quite sturdy. Then again, I was not riding in the car behind! I'll never forget the first mobile antenna I made that swung back and forth and almost hit other passing cars, but that is another story..... ATVQ

The Mount and attachment

If You Move

Please send us your NEW ADDRESS! We pay 70 cents for each returned ATVQ. And we are usually nice and send another copy to your new address which costs us $1.29. Please help us from having to do this. Thanks!

HABITAT SkyLab at GPSL 2004

Don Pfister - KA0JLF - Email: ka0jlf@earthlink.net
5200 W. 79th St.
Prairie Village, KS 66208

HABITAT SkyLab attended its 3rd GPSL (Great Plains Super Launch) and flew a balloon package July 3, 2004. Several High Altitude Balloon groups from across the country flew balloons. Groups I know of were from Nebraska, Oklahoma, Idaho, Colorado, Tennessee, and Kansas, I think there were 8 in total.

HABITAT SkyLab took a different approach this year, expanding on what we did at GPSL 2002, flying a three-balloon configuration. We had a choice of two objectives; 1) either a high altitude attempt (for GPSL), or 2) a duration event. Note: Parallax put up a Basic Stamp II for the highest altitude at GPSL 2004. Parallax and Nuts & Volts magazine were sponsors for GPSL 2004. Those that attended the symposium received issues of some of the magazines (sister publication of Nuts & Volts).


3 balloon configuation

My Theory:

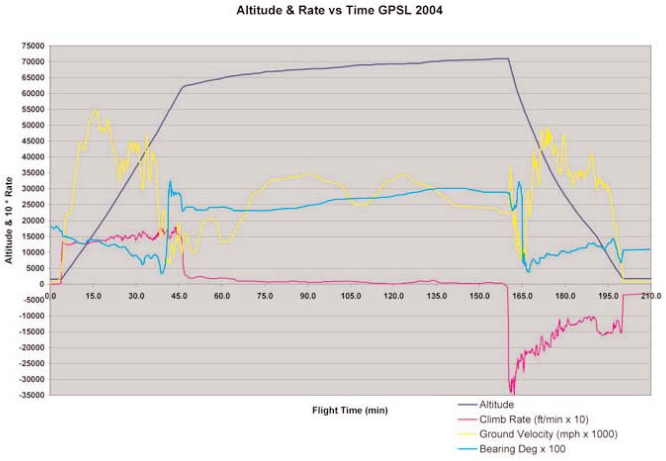
I have always thought we could make a latex balloon float. While we did not maintain the same altitude, the rate of climb was low enough to consider it a 'floating' flight, even if we did climb an additional 10,000 feet. This has been done to some extent by some other group, not the least of which was by Pete and his group in Salina, KS. They got stuck in a 175-mph jet-stream between 116,000 and 117,000 feet. Their package rode that jet for about 5 hours and 800 miles, landing 5 states away. After some other groups did nearly the same thing it has been accepted Latex weather balloons can be made to float.

While I won't get too deep into specifics, it has been my thought; we need additional lift to 'punch' through that kind of jet stream. My thinking has been if we had a 'booster' stage to give us the lift to get through the high winds, we could then, climb slowly to maximum altitude. I think our flight has shown this has true possibilities. Additionally, we could use the 'booster' stage as a 'mother ship' and put heavier equipment on it, leaving our 'capsule' minimum weight. One planned approach would be to put an ATV repeater on the 'mother ship' and a low power ATV on the capsule. The capsule would only have to have enough power to reach the 'mother ship' in orbit so to speak. Then the repeater with more power could re-transmit the ATV to the ground stations.

The Evidence:

As it turned out our flight was option #2. Our flight lasted over 3 hours. We spent in the order of 2 hours between 61,000 and 71,000 feet. Most of the time with at least one of our chase crews watching the balloon with our naked eyes. Our balloon covered almost 100 miles and landed 18 miles from the launch site. This gave us both the longest flight, and I believe the closest landing to launch.

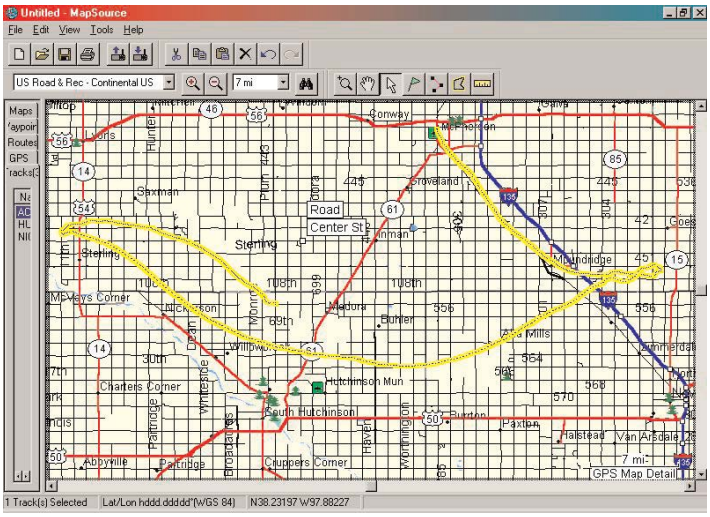
Our initial ascent rate was 1250 fpm, increasing to 1550 fpm at 62366 feet, 46 minutes into the flight, also when our first balloon burst. Our final balloon burst at 71,211 feet, 161 minutes into the flight. Maximum fall rate was 3290 fpm. At 164 minutes into the flight, 62,000 feet, our fall rate decreased to 2400 fpm. Fall rate declined steadily to 1065 fpm at 18,000 feet at 187 minutes into the flight. At 11,300 feet our fall rate suddenly increased to 1500 fpm, 187 minutes into the flight. At 200 minutes into the flight we touched down at 1300 fpm.



Additional points:

With our slow ascent rate, we noticed, at least on July 3, 2004, there was considerable difference in wind speeds in very narrow

bands. Normally we climb right through these and never notice the changes. (It just occurs to me, I remember those 'bumps' while flying small planes. I really noticed it when riding in the back of a tandem Ultra light looking for Paul Verhages lost capsule several years ago.)



Nick's map made from Nick's Rino data.

Our Payload:

This flight we flew 4 capsules:

1) Primary data capsule, made up of a Pocket Tracker, Garmin GPS engine, and a amplified GPS antenna.
2) Secondary data capsule, made up of a Garmin Rino, GPS and radio.
3) Camcorder package
4) SSTV package

All but the camcorder package worked as expected or better. The camcorder problem was my fault, I'm afraid, although I don't completely know what went wrong. The camcorder DC power adapter was made to plug into a car cigarette lighter. The battery pack we flew was a 15V pack. We had tested using only 12V of the pack. When we were preparing the capsule I had the guys hook up to the 15V. My thinking was; a car's electrical system can be 15V, so why take a chance of the testing causing the voltage to drop too low. It seems the camcorder, or its adapter had trouble with the extra voltage. Additionally, either the adapter didn't get plugged in completely or the camcorder though it was on battery power and turned itself off after about 5 to 10 minutes. I have used this camcorder to record various programs for the full 2.5 hours of my tape. However, I think these recordings were made with the AC power adapter.

We did not fly the ATV, again, because we used the camera on the camcorder (in VCR mode). When we tried to fly the ATV about a month ago, we experienced some problems and again left it on the ground. This is an area we plan to address in the next weeks before our next flight. We will put the overlay board and video switcher on the ATV for the next flight. Another factor in the decision not to fly the ATV, no one came equipped to view the ATV, much less, record it. At only 90 mw, we didn't think we could make it to the KC ATV group's repeater. We didn't think about the closer Wichita, KS ATV repeater, and hadn't made any arrangements with them.

Guy, AB0DP, in Wichita, did capture all of our SSTV pictures and has them on line at **http://fmsstv.net/sp/index.html**. He also captured SSTV pictures from Mark N9XTN, NSTAR, in Nebraska. All the pictures and some information on them are available for viewing. Mark had a camera problem and all of his pictures are just his callsign overlaid on a blank screen.

On descent, our 2M tracking system antenna was pulled off its BNC connector. However, the secondary tracking package worked flawlessly. In fact, using the second Rino the team walked right to the capsules, about 1/3 of a mile off the road, in a very rough cow pasture. They directed me, and the second group, in when we arrived. It was a very hot and humid day, they had failed to take water with them, I carried water to all four of them on my trek to the capsules. We got several good pictures.

Jerome, W0JRT, (with RDF antenna - clear plastic boom) and Drew, N0XU, at recovery site.

Future plans:

We plan several more test flights. Our next launch probably Aug. 1, 2004, or at least in August. We want to test equipment again. We are working on capsules to correct some problems they could solve. New equipment has been ordered and should be arriving soon. More equipment will be ordered to add more capabilities and improved data collection.

In addition to the ATV, we plan to improve on the SSTV. There is work being done to add a simulation of the new Echo Sat from AMSAT. With PSK on SSB (10M?) up to the balloon, and all the PSK channels downlinked on a single FM channel (440). The plan is to put two PSK data channels on the edges of our downlinked channel, so people will be able to see our band width and join us.

The HABITAT SkyLab Group:

We have formed a group on Yahoo Groups, to provide better communications among our members and interested parties. We have increased to about 32 members. We have lots of activity among the group. Several members are either heading a group, or working on projects by themselves. Much improvement has already happened and I look to the efforts continuing.

We have two new hams so far in July, 2004. Dean KC0SSI was issued his license on July 1, 2004, just in time for GPSL 2004. He is already working on his General. Chris passed his test on July 10, 2004 and should be getting his license in a couple of days.

This adds to our list of hams that have gotten their license either directly or indirectly from the efforts of HABITAT SkyLab. They are Charlie KC0OWB, while Dawn KD5SFW, Cris N0XZB, and Ron N0ZTE are also family and have helped with the balloons. We hope to continue generating interest in not only the ballooning but also ham radio.

Here is our group of 12 that made it to GPSL. We had 3 balloons, so when the photographer said to point to the balloon we had to use 3 fingers. <grin>

ATVQ

**All 12 members that made it to GPSL 2004.
Left to Right: Dean, KC0SSI (issued 7/1/04); Andy, W0AFQ; Larry, WB0UXI; Nick (no call - yet?); front to back, Cris, N0XZB; Don, KA0JLF; Jerome, W0JRT; Mary, KC0NYQ; Steve, KA5YFC; Drew, N0XU; Charlie, KC0OWB; and Chris, KC0SUH (passed Tech. test 7/10/04).**

RF Level Video Inserter (Michael Faas, DL7TF)

This is a small extra device for insertion of an RF level meter display into a test pattern at ATV repeaters. Core part is a UAA190 IC, which was used years ago in many TV sets in order to show the channel search scanning voltage. We at DB0KK in Berlin had always wished to have an S-meter display on the repeater output, but our older 13 cm FM-ATV receiver was not suitable. Now we have a new set with an rf level measuring output up to 12 V DC.

For a full swing display from left to right screen edges we need about 5 V DC, so check your receiver before starting to build our device. The UAA190 IC may be a scarce article, the other IC are no problem. Our practical realization goes as following: on the 2 m calling frequency a control tone activates the ATV repeater test pattern, and now you can send your ATV carrier (without video modulation, which would change the output screen to the input otherwise). The length of the rf level display helps to find a maximum beam heading or a polarization optimum.

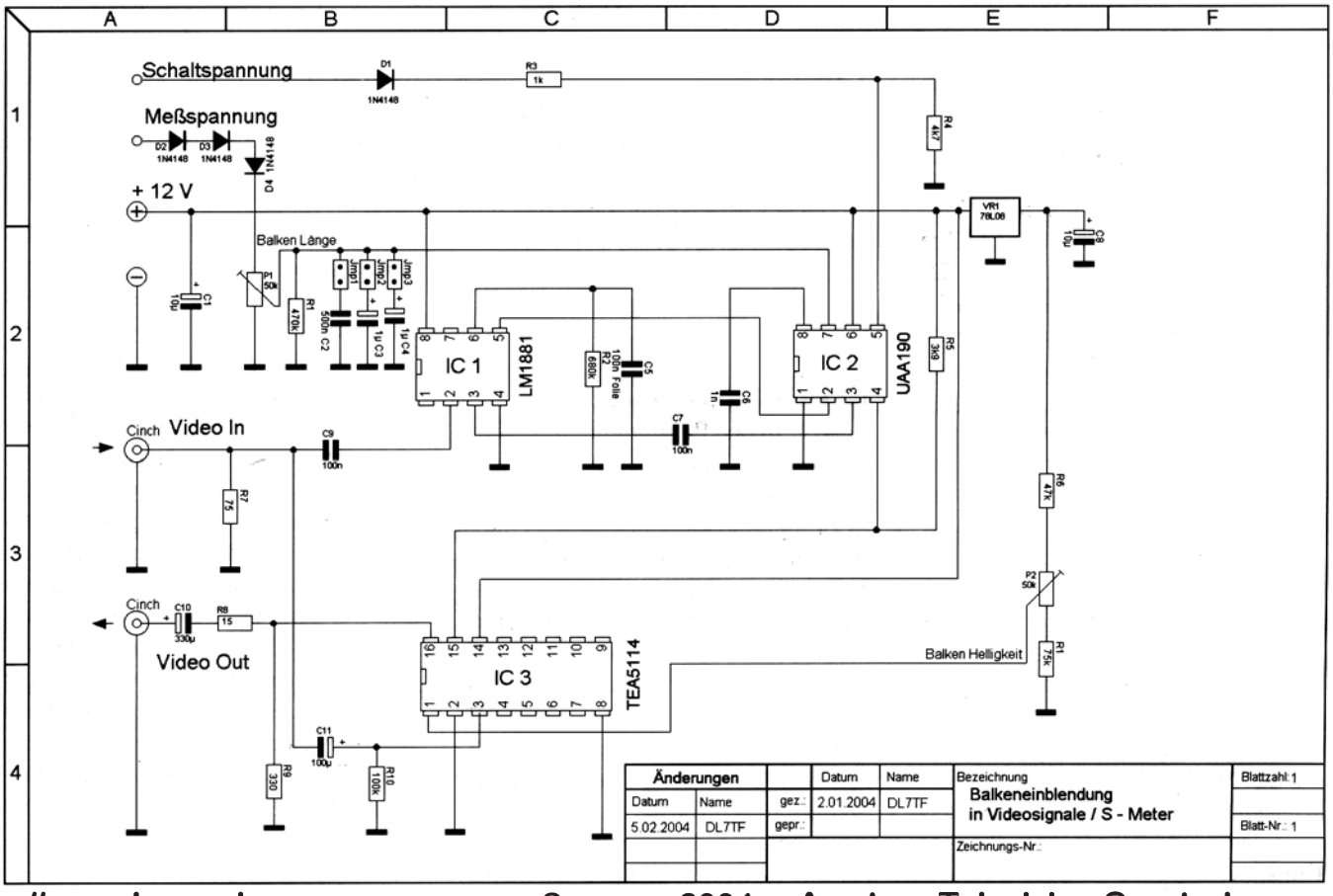
Circuitry

There are three silicon diodes in a row at the signal input "Messpannung": they eliminate a basic indication induced by random noise without a signal. A positive voltage (i.e. coming from a DTMF decoder) at the input "Schaltspannung" activates the device which is simple enough for a breadboard assembly. Only the video inputs at IC1 and IC3 are sensitive for rf, so a shielded housing is advisable nevertheless. Trimmer P1 "Balken Laenge" determines maximum length of the bar display with a given measuring voltage. Three jumpers with C2, C3 and C4 are for testing purposes only, one capacitor should be sufficient to calm down a jittering bar with weak signals. The second trimmer P2 "Balken Helligkeit" adjusts the bar brightness from black to lighter grey.

(translation Klaus, DL4KCK)

ATVQ

Hier ein Beispiel, wie die S-Meteranzeige im Testbild integriert werden kann. Im oberem Bild ist deutlich die vorhandene Rauschspannung bei fehlendem Eingangssignal zu erkennen. Zum Zeitpunkt der Aufnahme waren die Dioden im Eingang noch nicht vorhanden.



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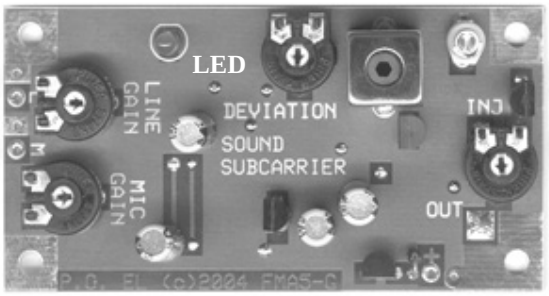
Tel: **(626) 447-4565** m-th 8am-5:30pm pst (UTC - 8) Tom (W6ORG) & Mary Ann (WB6YSS)
24 hr FAX order line (626) 447-0489 Email: Tom6ORG@hamtv.com
Web site: http://www.hamtv.com

ELECTRONICS

NEW FMA5-G Sound Subcarrier board with AGC



The prior versions of the FMA5 Sound Subcarrier boards all used what is called a soft limiter. When audio peaks exceeded the set deviation, back to back diodes conducted and instantaneously changed the voltage gain in the op amp from 100 down to as low as 5 depending on how hard they were hit. Only the positive and negative peaks got the reduced gain which resulted in a rounding of the wave form or "soft limiting" versus hard limiting if they were flattened instead. If the gain is cranked up too high, or the speaker has a tendency to vary how loud they speak, the result is audio distortion. There was no way to know if you were over deviating into distortion unless the ham on the other end said something.

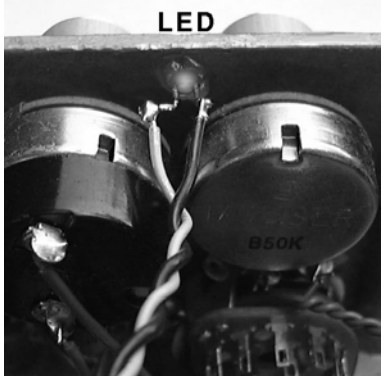
The new FMA5-G has automatic gain control or AGC which changes the gain of the whole waveform. The circuit has a full wave detector that proportionally varies the gain by means of the variable resistance characteristics of a FET and therefore does not distort like the soft limiter. A full wave detector is necessary because voice characteristic wave forms are not symmetrical. Attack and decay times are set to optimize voice characteristics like broadcast wireless mics and the LED indicator can tell the user when the gain controls are set too high or they are shouting. The AGC/LED is indepenent of the deviation 20 kHz to 50 kHz set range.

The new board is 1 for 1 replaceable with older boards; same size, mounting and connections. 4.5 MHz is standard for NTSC AM ATV, but the board can be reset up to 6.8 MHz for PAL or FM ATV transmitters.

Audio Over Modulation LED TC70 Transceiver Installation

The supplied LED actually serves two purposes; besides blinking off when you hit the mic or line audio too hard, it will indicates that you have the sound subcarrier turned on in transmit.

The logical place to mount the LED is right between the MIC GAIN and LINE GAIN lettering above their respective pots. There is room to drill a .125 diameter hole centered on a line across the top of the lettering (about .2 inches from the top edge of the chassis). Take care in drilling the hole so as to miss hitting the pots. Shake out all drilling chips and debur the hole.



Bend the leads at right right angles in opposite directions as shown in the photo about 1/4 inch from the LED. Hook and solder a twisted pair of different colored wires to the leads. To ID, we put a black wire to the lead on the side of the LED with the flat since the cathode goes to the ground LED solder pad on the FMA5-G board. Enter the wires from the top side of the FMA5-G and solder on the bottom. Turn on the transmitter, if the light does not light, make sure the line audio pot / subcarrier power switch is turned on and reverse the LED leads if necessary. If all is working correctly, put some glue or epoxy around the rim of the LED and reinsert into the hole and you are ready to modulate. Speak in a normal voice and increase the audio gain until the LED blinks, then back off just a little.

ATVQ TO PAY FOR ARTICLES! CONTRIBUTORS GUIDE

Payment for Technical Articles

ATVQ will pay for certain articles that it publishes. I will outline the policy here, but it will be subject to change as needed to make sure that ATVQ continues to be an ongoing publication. ATVQ will pay $25.00 for technical articles that are published and are a minimum of 2 pages. While this is not a great amount, I hope it will encourage more technical type articles to be written. Exceptions will be articles that are written by a manufacturer/seller of equipment that is being written about. While I do not want to discourage this type of article, the article itself is an advertisement of the product. Articles from clubs will be encouraged, and I would expect they would like to share their information with the ATVQ readership. Information gathered from the Internet will not be paid for and is mostly small filler items.

Ideas

Do you have an idea for an article that you've said to yourself that you wanted to write, but never did. Feel free to check with us to see if it is of interest, or write and send it in. No guarantees that it will get published, but if you don't try, you will never know. I'll be looking to see what you can do!

Preferred method of receiving articles is from **Microsoft Word**, however **Wordperfect** is OK too. Next preference would be **ASKII text**, followed by **typewritten** or **hand written** (clearly). Diagrams or pictures (B&W or Color) can be sent in hard copy, or if you scan them in, save to PCX or JPG formats (actually I can read about anything). If you send a computer disk, make sure it is PC (not MAC) format.

When sending in articles in Microsoft Word, please SAVE with FASTSAVE OFF and save in Word 6 format. Also, articles written in any word processor, consider what will happen when it is re-formatted to fit the style that I might put it in. An example would be setting up tables or adding figures into the article. They can be very hard to strip out. If possible, put the tables, figures, each in a file by itself. This will help me to be able to import into the magazine format.

Articles can be sent to:
ATVQ, 5931 Alma Dr., Rockford, IL 61108

or to our email address: **atvq@hampubs.com**
Also note our web page address: **http://www.hampubs.com**

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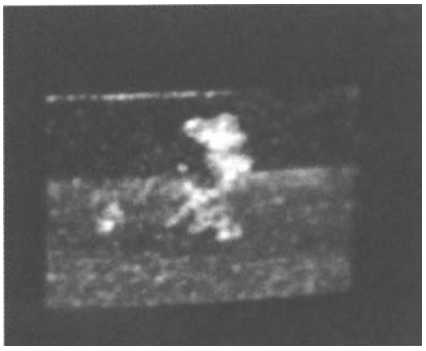
Apollo 11...

Manfred, DL2OU, wrote responding to the recent article in TV-AMATEUR 131, page 31:

On that memorable evening of the moon landing (1969) there were also DK1RY and DL2OU present in the "institute for space research" in Bochum. I took some photographs from the TV monitor screens. After that Professor Kaminski (DJ5YM - the first westerner to hear "Sputnik" satellite signals in October 1957) had to confiscate that film in order to check it with his NASA copyright conditions. Most of the negatives I received back after some weeks, hi. I will search for that filmstrip and mail some digitized pictures to you.

Well, afterwards it was a bigger thing than we ever thought, think alone of the skeptics claiming that the whole moon landing was faked in a film studio (see **www.moon-truth.com**)! We know better that the signals originated from the moon surface. I remember the declarations by OM Fuetterer that it needed parametric amplifiers at the feed (of the 20 m dish), as the signals from the moon were very faint - no sign of GasFets that time!



I found it exciting that it was FM-TV, and I considered the implications for TV amateurs - it was still the big time of AM-TV then. This is a fine christmas story in view of the chronological and historic dimensions, worth to remember.

Manfred Fuetterer, DC6FM, wrote:
On 20th of July 1969 the landing module of the "Apollo 11" mission reached the moon surface. Like DL2OU I remember this evening in the institute very well. We received the TV signal from the "Eagle" lander, a moon vehicle was activated only with "Apollo 15" in July 1971. That "moon mobile" TV signals we received in very fine quality, sorry to say that we have no photographic or video documents from that event. Luckily Manfred, DL2OU, was able to submit his original picture, showing on the left monitor a snow-free TV transmission from NASA via satellite and the local "WDR" broadcast station - on the right monitor our directly received video from the moon lander, snowy in spite of the 20 m dish. Thanks for your kindly request, I am fine, watching the ATV development - especially in the digital branch.

(translation Klaus, DL4KCK)

ATVQ

NASA TV Free On Dish Network

Do I understand correctly? I can use "unactivated" equipment to watch NASA TV on Dish Network? I don't watch much TV at all, but I do like NASA TV. Frank - KG6JVE

That is correct. NASA TV and some shopping channels are available for no charge on Dish. I've seen the same thing too. And it seems like I saw some dish literature somewhere that pointed that out. I don't think they can charge for NASA since it's a government TV channel.

Jon Ogden - NA9D **na9d-2@speakeasy.net**

Yes, I recently turned off my Dish Network service and NASA Select continues to work. Most everything else on the program guide is red (and unavailable).

Louis A. Mamakos - WA3YMH - louie@TransSys.com

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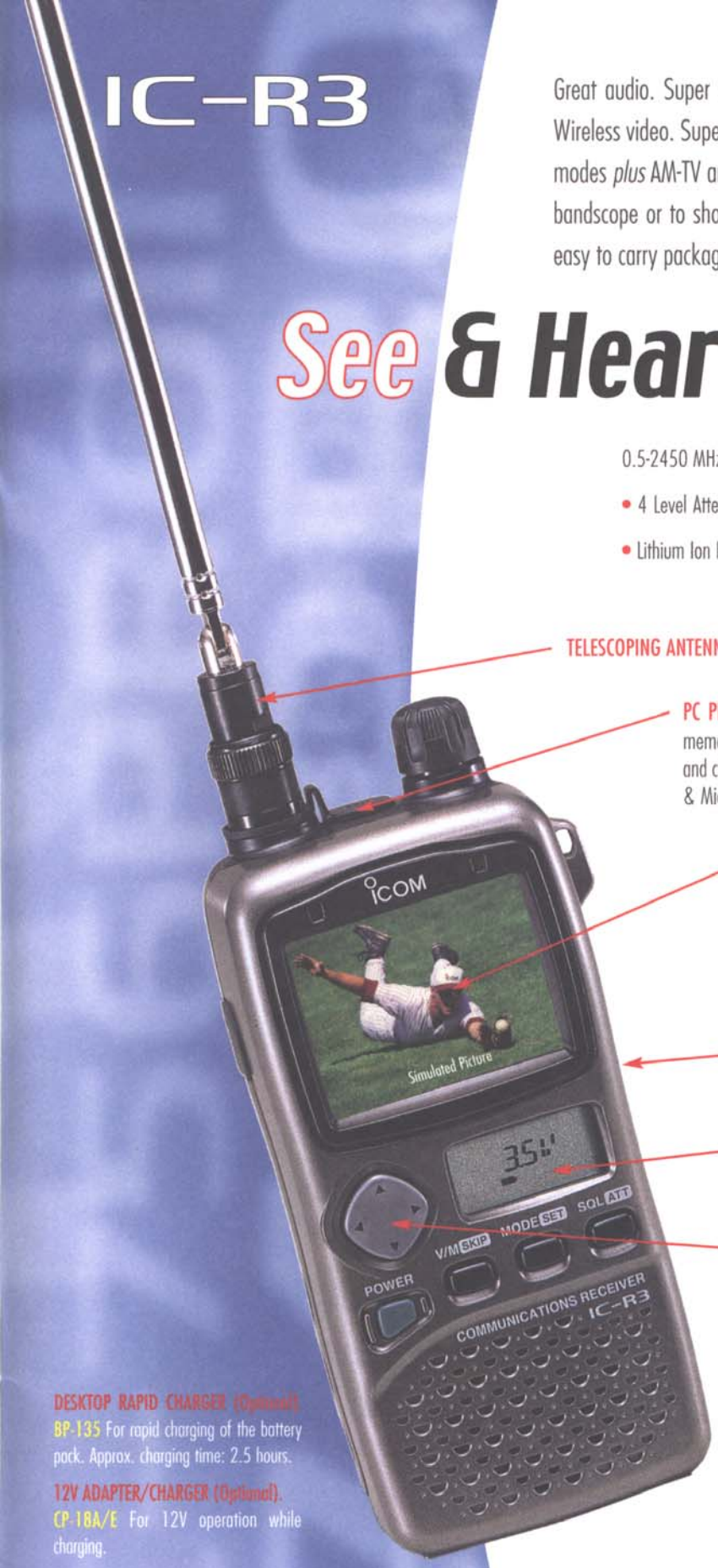

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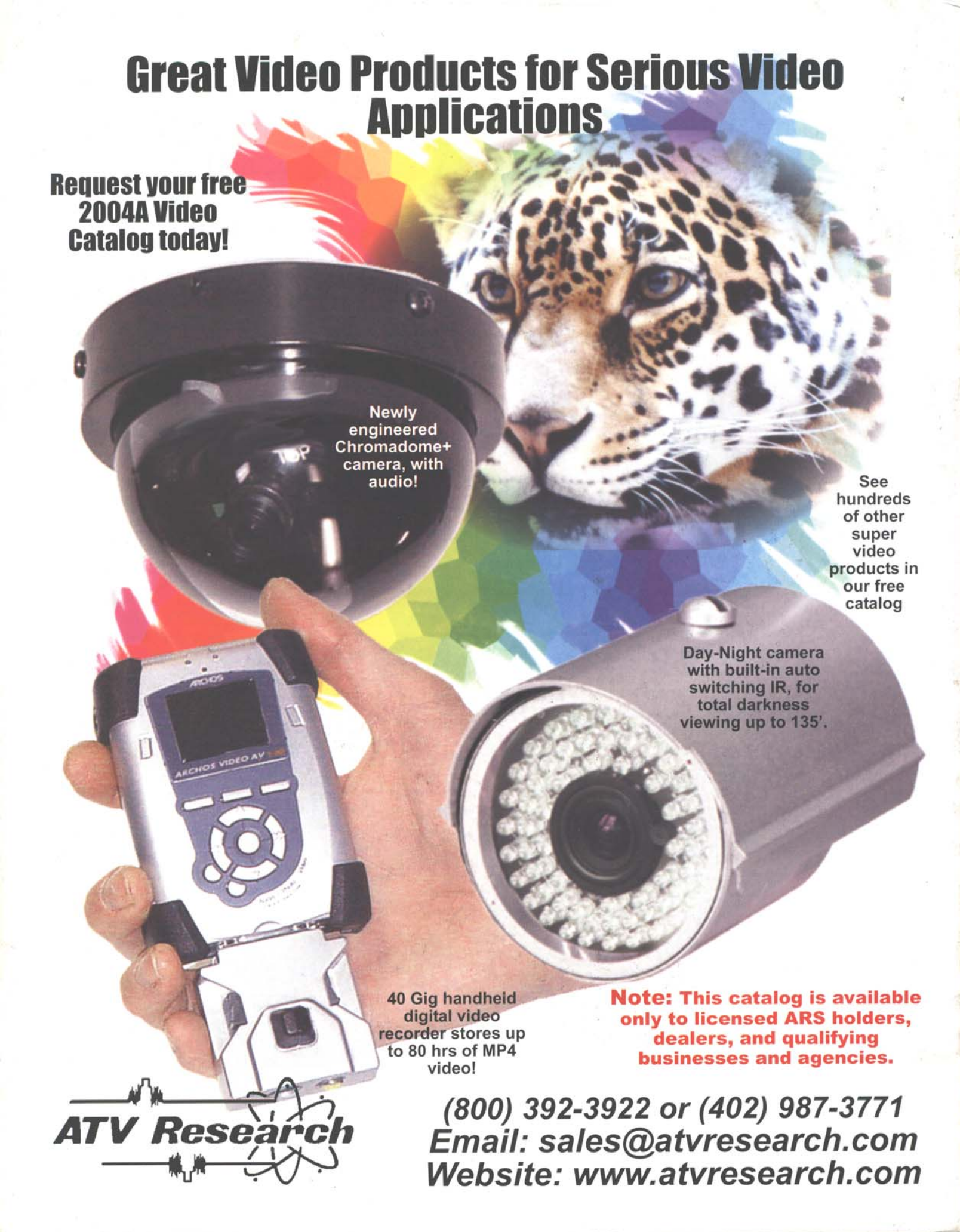

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