

Amateur Television Journal

July, 2026

2ed edition, issue # 214

BATVC web site: www.kh6htv.com

ATN web site: www.atn-tv.com



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

New App. Note

Following on from AN-75 which discussed antique TV mode AM, this new AN-77 discuss the other antique mode of FM-TV. Some hams still love using FM-TV, so it is still quite relevant. This notes explores the history of FM-TV, the theory, how to implement it, and what equipment is still available today to do FM-TV on our higher microwave bands. It is now available in .pdf format to be down-loaded from: www.kh6htv.com



Application Note

AN-77

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Amateur Analog FM Television

Upcoming PR Events for ATV:

There will be two Colorado ARES events in July promoting the use of ATV for public safety events. They will provide Public Relations PR exposure for ATV, and in particular digital ATV (DATV). The presenters will be Allen Bishop, K0ARK, and Jim Andrews, KH6HTV, of the Boulder, Colorado ARES group called BCARES. Allen is the chairman and E.C. for BCARES. Allen will lead off with a discussion of the uses of ATV for public safety with lots of examples. Jim will then follow with the technical details of DATV and how to implement it.

The first event will be a 2 hour, on-line, Zoom meeting hosted by the Colorado ARES section E.C. Perry Lundquist, W6AUN. It will be held on Saturday morning, July 18th from 9 to 11 am (MDT). While the zoom meeting is intended primarily for Colorado ARES groups, Perry has said he also welcomes other interested ARES groups to join in. If interested, contact Perry at perry.w6aun@gmail.com for a zoom invitation and details to log-in.

The second event will be an in-person, live talk and ATV demonstration by Allen and Jim for the Douglas & Elbert County ARES group (R1D5). It will be on Thursday evening, July 23ed, starting at 7 pm. The location will be in Highlands Ranch, Colorado at the Sheriff's substation, 9250 Zotos Dr.

CQ-TV 292 – Summer 2026

Visit to W0BTV

Mike G0MJW



I have been to Boulder, Colorado in the US many times for work, but never until now had the chance to meet the local amateurs.

This year it worked out as I had a Saturday morning free before my flight home and Jim, KH6HTV, very generously offered to arrange a visit to a local diner to meet a few of the Boulder ATV enthusiasts for breakfast. Many of us receive Jim's monthly ATV Journal via email. If you don't, it is certainly worth subscribing.

It was great to meet the locals and very interesting hearing what they do and how. There is quite a bit of activity, no doubt encouraged by the local repeater group and the strong interest in emergency communications.

The climate in this part of Colorado is milder than you might think, but there can be thunderstorms, snow, floods and in the dry season, devastating fires, so supporting emergency response with on the scene video has real benefits.

Boulder is in the front range of the Rocky Mountains. To the west, the high peaks, to the east vast flat prairies. Consequently, their local DATV repeater, W0BTV which is hosted at the NCAR Mesa laboratory, DM79JX and about 500ft above central Boulder, has excellent coverage over the town, as well as Denver, Loveland, Fort Collins and Aurora.



► W0BTV Antennas on NCAR building

The transmitters are on 423 MHz and 5.905 GHz 6 MHz DVB-T, QPSK. The input is on 1243 MHz with secondary receivers on 441 MHz and 10.380 GHz. The repeater is managed by Jim and the Boulder Amateur Television Club. It is streamed on the BATC streamer.

Their nets are on Thursdays, 3pm local time which is 10pm UK time.



► W0BTV test card and coverage

After breakfast, Jim generously invited me to see his shack and the many things he was working on. Jim produces a range of DATV amplifiers, DATV transmitters and receivers, down-converters, filters, duplexers and repeaters.

Practically all you need for a DATV station. He has recently completed a deployable TV repeater for emergency communications use. These projects are all written up in Jim's ATV journal <https://kh6htv.com/newsletter/>

► Jim – KH6HTV in his shack



CQ-TV 292 – Summer 2026

A highlight was to be able to operate Jim's station and work several of the locals via DATV who I had met at breakfast. I was able to show them what we do in the UK and also introduce them to QO100 via the YouTube recordings. Our BATC net at 8pm is at lunchtime in Colorado, so we might have a few new viewers and perhaps we can stream them in.

The full HD quality and the low latency of the DVB-T signals through VVOBTBTV proved a marked contrast to working 333ks over QO100.

Accessing the repeater needed just a few watts into a vertical on 70cm or a panel for 23cm. The RX was another 70cm vertical. Other stations were working 10 GHz and 6cm. The low latency permitted real time talkback on 2m. All very different from our UK experience.

The US 70cm allocation spans 420-450 MHz, so there is plenty of space for the 6 MHz transmissions and I am sure plenty of spare capacity within the multiplex for metadata.



While we don't have access to such a wide allocation on 70cm, we do on higher bands, so maybe this is something we might try on 23cms and up.

I would like to thank Jim and the members of the Boulder ATV group for a most enjoyable visit. 🙌

reprinted with permission from the BATC

Remember the WaveCom ?

How many of our old analog ATV hams from the "Good Ole Days" remember our using the WaveCom A/V Sender for doing FM-TV on the 2.4 GHz band ?

As a compliment to the above AN-77 on FM-TV, this is an item of interest that still might show up at swap-fests. I happened on a freebie box of them at a local swap-fest 2-3 years ago. It contained several various, but compatible brands, including Radio Shack, Emerson, etc. I got both transmitters and companion receivers.



So, I decided to test them to see what standards they were using. What I discovered is they do NOT use pre-emphasis / de-emphasis, but have a flat frequency response. The transmitter I measured showed a flat response to beyond 7 MHz. The frequency deviation measured 4.4 MHz. It had stereo audio sound sub-carriers at 6.0 and 6.5 MHz. They were set to -24 dBc. It did give good quality video and audio.

These transmitters were frequency synthesized on four (4) channels, which can not be changed. They were: 2411, 2434, 2453 & 2473 MHz. Note not all brands used the same ID of either a channel number or channel letter to ID which is which. Also note: only 2411 & 2434 are in the 13 cm ham band (2.30 - 2.31GHz & 2.39 - 2.45 GHz). The 2453 & 2473 are in the US Federal Govt. allocations for FIXED, MOBILE & Radio Location services. Thus we should not use those two frequencies.

To meet FCC specs. these transmitters were quite low powered. Hams soon discovered you could dig into them and disconnect the built-in rotatable patch antenna. Instead bring out the rf to an SMA for driving a higher powered amplifier and external antenna for long distance DXing. Also do the same modification to the companion receivers. We also found that the basic transmitter design was capable of a lot more power than it put out. We found a resistive attenuator was added to the rf output design to meet the stringent FCC specs. On the units I have modified I typically was able to get 50mW (+17dBm) of rf power.

So, if you happen to see any of these at your next ham radio swap-fest snap them up. Still worth having for your ATV inventory.

73 de Jim Andrews, KH6HTV, Boulder, Colorado

DVD of Past Issues:

The *ATV Journal* first appeared eight years ago in July, 2018. It was originally called the "*Boulder TV Repeater's REPEATER*". It was first intended as strictly a local newsletter for the Boulder, Colorado ATV group of about 20 ATV hams. The distribution list soon started to grow to ATV hams beyond Boulder, plus started to include ATV news from elsewhere. After the demise of the *ATV Quarterly*, print magazine and the free, on-line, electronic magazine, *CQ-DATV*, it became the "de-facto" ATV newsletter for the USA. It also attracted an international ATV following and included ATV news from overseas. At the urging of some key USA ATV hams, we changed the title of the newsletter in 2024 to *ATV Journal* to reflect this more national / international aspect. The newsletter is published at least monthly and often times more than twice a month, depending upon material available. The newsletter is free and distributed as a .pdf attachment to emails sent to subscribers.

Archive: By now the number of issues published has exceeded 200+. All previous issues are archived on my web site: <https://kh6htv.com/newsletter/> In 2023, our newsletter was also added to the *INTERNET ARCHIVE*. It is found in the "Digital Library of Amateur Radio & Communications" section. <https://archive.org/details/dllarc>

DVD: There has been some interest expressed in having a permanent collection available on disc. Therefore, if you the reader are interested in receiving a DVD disc with all previous issues of the newsletter, I would be willing to burn you a disc and mail it to you free of charge (USA only). I will also include on the disc my collection of KH6HTV application notes. Send your request to my email.

73 de Jim, KH6HTV, Boulder, Colorado

ATV International QSO Party: We have once again received word from Peter Cossins, VK3BFG, that he is organizing another international ATV QSO party. He says "The annual DATV QSO Party is planned for our Saturday August 29 (your Friday night 28th.)". He would like to invite any ATV repeater groups interested to also participate in the party. If your group is interested, contact Peter directly at pcossins@bigpond.com

MARMOTSat launched with DVB-S2 29.410 MHz Beacon:

MARMOTSat carrying a 10m band DVB-S2 Digital Video Beacon on 29.410 MHz was deployed from the Space X Transporter 17 mission on July 7.

IARU Coordination info https://iaru.amsat-uk.org/formal_detail.php?serialnum=1038

Frequencies of satellites deployed by Transporter 17

<https://community.libre.space/t/transporter-17-rideshare-vsfb-slc-4e-2026-07-07-07-10-utc/14950>

news bulletin from amateurradio73@outlook.com

Early ATV in Denver: *Recently while browsing old issues of the ATV Quarterly, I found some info about ATV activity in Denver in 1990. This is from July, 1990, Vol. 3-3.*

The Denver group has a repeater on top of 7400' Lookout mountain. Input is on 426.25 with an output on 1253.25 Mhz. An additional input on 1277.25 MHz will be active soon. Look for the Denver group on their calling frequency of 14.34 MHz. An activity night is held every Mon night at 8 pm. Also they have a weekly net on the 147.2 repeater every Thurs night.

On April 1st members of the Western Vision Network (WVN) helped out with coverage of the Super Cities Walk for MS. Several ATV portable and mobile stations were set up along the route to provide live television coverage back to mission control. Headquarters was in the stadium press box. All pictures from the various checkpoints were P-5, including some mobile shots from the rover station. The walk-a-thon officials were quite pleased with the coverage. (p.s. a much longer article about WVN and it's founding and repeater details was found on pages 92-93).

Note: ATV activity in Boulder also got re-activated about this same time. There was no co-ordination between the two groups because the TV signal from Lookout mountain in Golden did not penetrate into the Boulder Valley. Likewise our signals didn't cover much of Denver. We encountered bad vibes from them actually when we also used the 144.34 MHz simplex frequency for our ATV chatter. Thus we moved our 2 meter voice frequency up to 144.37 MHz at that time. To this day, we still use 144.37. The WVN no longer exists. I don't really recall when they went off the air. Sometime in the 90s as I vaguely recall. -- Jim, KH6HTV

10 GHz LNB Control Signals:

Switching the Local Oscillator (LO) and polarization on an LNB (Low Noise Block - Down Converter) adjusts how it processes incoming satellite frequencies down to a signal your receiver can handle. You manage these using voltage levels for polarization and a 22 kHz tone for the LO.

Polarization Switching: Polarization refers to the orientation of the electromagnetic waves sent by the satellite. The LNB switches between different antenna probes inside its housing based on the DC voltage sent up the coaxial cable by the receiver:

Vertical / Right-Hand Circular (RHC): Selected using 13V DC (12.5V to 14.5V).

Horizontal / Left-Hand Circular (LHC): Selected using 18V DC (15.5V to 18V).

Local Oscillator (LO) Switching: The LO frequency is the base frequency the LNB's internal oscillator uses to "down-convert" high GHz satellite signals to a lower, IF frequency range.

Low Band: Uses a standard LO (such as 9.750 GHz for standard Universal Ku-band).

High Band: Selected by injecting a 22 kHz tone into the coaxial line, which shifts the LO (e.g., to 10.600 GHz for Universal Ku-band)

The **Bullseye** BE01 10 kHz **LNB** is an ultra-high-precision, factory-calibrated Ku-band LNB. Widely used for amateur radio (especially the QO-100 satellite) and general Ku-band reception, it utilizes a digitally controlled carrier offset and a 2 PPM TCXO to prevent signal drift.

Joe, K2EVK, reports that the BullsEye is once again available on E-Bay from China. It is presently listed for \$30 plus \$5 shipping. Joe has supplied us with the key specs.



While the input frequency listed is for the Ku satellite bands, we hams have found they still work well for our 3 cm band (10-10.5 GHz). The gain is specified to be in the range of 50 to 66 dB over the satellite bands. For my (kh6htv) particular unit, I measured the gain to be 42 dB at our Boulder, 3 cm, ATV frequency of 10.380 GHz.

Boulder ATVer, Chris, K0CJG, reported on our ATV net the results of his measurements on a BullsEye of it's phase noise. We hope to have a written report from Chris soon.

Key Technical Specifications

Feature / Specification [1, 2, 3, 4, 5, 6, 7]	Value / Details
Input Frequency	10.489 GHz - 12.750 GHz
L.O. (Local Oscillator) Frequency	Low Band: 9.75 GHz High Band: 10.6 GHz
Output Frequency	Low Band: 739 MHz - 1950 MHz High Band: 1100 MHz - 2150 MHz
Frequency Stability	± 10 kHz at +23°C ± 30 kHz (-20°C to +60°C)
Factory Calibration	Better than ± 1 kHz utilizing GPS-locked spectrum analyzers
Noise Figure	0.5 dB typical
Conversion Gain	50 - 66 dB
Oscillator Type	PLL with 2 PPM TCXO
Reference Output	25 MHz output available on secondary F-connector (Red)
Mounting	Standard 40 mm feedhorn collar

The BullsEye has the industry standard mount of a 40mm feed-horn collar. Thus it is an easy retro-fit to surplus satellite dish antennas for use on our 10 GHz ham band. The BullsEye can also be used as a stand alone antenna without a dish reflector. Boulder ATV ham, Steve, WA0TQG, has calibrated the gain of the circular waveguide LNB horn at +14.6 dBi.

ANTENNA GAIN vs. BEAM-WIDTH

Antenna Gain: This formula is used to calculate the gain of a parabolic dish antenna,
(from *www.everythingrf.com*)

$$\text{Gain (in dB)} = 10 * \log_{10} (D / \lambda)^2$$

Where λ is the wavelength and D is the physical diameter/aperture of the antenna. To convert antenna gain in dB to dBi, add 2.15.

Examples for 3 cm (10 GHz) parabolic dish antennas:

6" dia. => 16 dBi, 1 ft. => 22 dBi, 2 ft => 28 dBi, 3 ft. => 32 dBi

Antenna Beam-Width is generally defined by the Half-Power Beam-width (HPBW), which is the angular width where the radiated power drops by -3 dB (50%) from its peak. The fundamental rule of thumb is that beam-width and antenna gain are inversely proportional: as gain increases, the beam gets narrower.

The 3 dB Beam-width Rule:

For a standard directional antenna (like a parabolic dish or horn), the empirical rule of thumb to approximate beam-width (θ) in degrees is:

$$\theta \approx 60 \lambda / D$$

For the above antenna examples: 6" dia. $\approx 12^\circ$ 1 ft. $\approx 6^\circ$, 2 ft. $\approx 3^\circ$, 3 ft. $\approx 2^\circ$

Key Rules of Thumb for Design & Deployment

1. The 20 dB Rule: A highly directional antenna that features a 20 dB gain will typically have a beam-width of roughly 20° .
2. The "Doubling" Effect: Doubling the size of an antenna's aperture (or doubling the frequency) cuts its beam-width in half and quadruples its gain.
3. Null-to-Null vs. HPBW: The beam-width at the first null (where signal drops to zero) is often roughly double the -3 dB (half-power) beam-width.

How About Yagi Antennas - Gain vs. Beam-Width ? Consulting catalogs of M-Squared and Directive Systems for typical Yagi antennas, I found some rough guide lines to go by.

11 dBi (50°), 13 dBi (40°), 15 dBi (30°), 17 dBi (24°), & 20 dBi (16°)

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10 GHz ATV News from Belgium

We just received our July issue of the **ATV NEWS** from Frans Van de Velde, ON4VVV. This issue is devoted to 3cm (10 GHz) ATV. Check out these photos of some impressive dish antennas.



To minimize signal loss, the connection between the 3cm PA and the antenna is made using a flexible waveguide. The 1m diameter mesh dish used provides a theoretical gain of 38dB with an opening angle of 1 degree at -1dB. This implies that the direction is very critical

JUNE IARU ATV CONTEST :

To my great delight, there were more ON participants than ever before during the ATV contest, thanks to newcomers Olivier ON4KTO and Dirk ON7CHV , among others; Danny ON7RD also made an attempt on 3cm. That is all very nice.

I was able to make the very first connection on 3cm with the new antenna installation with ON4BHM; that is only a distance of 15km and therefore not really convincing yet, but anyway, a confirmation that it at least works.

Guido ON1AFB and Joel ON6JM drove to the Kemmelberg specifically for the ATV contest



The top (full) 95cm dish with elevation adjustment is RX for 3cm; below it on the left is the 1m dish for TX 3cm, below that a 1.2m dish for TX at 23 + 13cm, and to the right of that a 2m dish for RX or TX at 6 + 13 + 23cm.



Guido ON1AFB, Joel ON6JM and Rudy ON6PY

and set up a /P rig on the "Belvedere Tower" to participate, but primarily to receive my 3cm signal. Despite the obstacles on the rf path, they could clearly see my signal on the waterfall after a distance of 78 km, but due to circumstances, they fell just a "dee bit" short of a picture. Thank you, Joel and Guido, for the courageous attempt and all the work. During the contest, despite the disappointment with the Kemmelberg, I still managed to make three 3cm connections, the furthest being to Corné ON7MOR at 67km. A week later, which had not succeeded during an attempt in the contest, I could also be received by Jack PA0BOJ at a distance of 112 km.

Antenna Alignment Trick: Frans also passes along a good alignment technique for dealing with such high gain, narrow beam-width antennas. He suggests that one first transmit a single frequency CW strong carrier signal. At the receiving end use a spectrum analyzer rather than the digital TV receiver. This will give a much stronger received signal to then align both antennas to optimize the received signal strength.

DVB-S vs. DVB-T: Also in this issue of ATV NEWS, Frans writes the following:

DVB-S2: I have conducted extensive comparative tests between DVB-S and DVB-S2, which showed that with a MiniTiouner, you need on average about 1dB lower Signal-to-Noise Ratio to decode a DVB-S2 signal. That is of course not much, but it is sufficient to determine whether or not you receive a picture during an ATV contest.

DVB-T: For the past week, we have had a DVB-T receiver installed on ON0TVO. It was made and donated by Wim ON8DSW (thank you, Wim). It is set to 436MHz with a bandwidth of 1000kHz and allows us to compare the comfort and signal strength with our DVB-S2 receiver, which is equipped with a variable SR of 125, 250, 500, and 1000ks/s. Both devices receive an identical signal and quality from the same antenna.

Initial tests clearly show that DVB-T requires up to approximately 6dB less signal for a perfect picture. This still needs to be tested further, but the first impression is that a DVB-T signal is less susceptible to interference and, at least with a setting featuring a strong FEC of 1/2, a large Guard Interval of 1/4, and QPSK modulation, suffers less from multipath and thus also less from "candy cane" effects. A disadvantage, however, is that it takes slightly longer for an image to be displayed.

All of this is a clear sign that we all need to experiment more with DVB-T. To be continued...

W0BTV Details: **Inputs:** 23 cm Primary (CCARC co-ordinated) + 70 cm & 3 cm secondary all digital using European Broadcast TV standard, DVB-T with standard 6 MHz wide TV channels. Frequencies listed are the center frequency of the TV channel.
23 cm = 1243 MHz (primary), 70 cm = 441 MHz & 3 cm = 10.380 GHz
Outputs: 70 cm Primary (CCARC co-ordinated), Channel 57 -- 423 MHz with 6 MHz BW, DVB-T
Also, secondary analog, NTSC, FM-TV output on 5.905 GHz (24/7 microwave beacon).
Operational details in AN-51d Technical details in AN-53d. Available at:
<https://kh6htv.com/application-notes/>

W0BTV ATV Net: We hold a social ATV net on Thursday afternoon at 3 pm local Mountain time (22:00 UTC). The net typically runs for 1 to 1 1/2 hours. ATV nets are streamed live using the British Amateur TV Club's server, via: <https://batc.org.uk/live/> Select *ab0my or n0ye*. We use the Boulder ARES (BCARES) 2 meter FM voice repeater for intercom. 146.760 MHz (-600 kHz, 100 Hz PL tone required to access).

Newsletter Details: This newsletter was started in 2018 and originally published under the title "*Boulder Amateur Television Club - TV Repeater's REPEATER*" Starting with issue #166, July, 2024, we have changed the title to "*Amateur Television Journal*." This reflects the fact that it has grown from being simply a local club's newsletter to become the "de-facto" ATV newsletter for the USA and overseas hams. This is a free ATV newsletter distributed electronically via e-mail to ATV hams. The distribution list has now grown to over 800+, both in the USA and overseas. News and articles from other ATV groups are welcomed. Permission is granted to re-distribute it and also to re-print articles, as long as you acknowledge the source. All past issues are archived at: <https://kh6htv.com/newsletter/>

ATV HAM ADS -- *Free* advertising space is offered here to ATV hams, ham clubs or ARES groups. List here amateur radio & TV gear

For Sale - or - Want to Buy

Upcoming Colorado Hamfests

Pike's Peak RAA MEGAFEST

Saturday, July 25

8:00am - 1:00pm

Lewis Palmer High School

Tables - \$20 Admission - \$5

<https://ppraa.org/megafest>

Rocky Mtn HAM SUMMER SWAPFEST

Sunday, August 23

9:00am - 1:00pm

Adams County Fairgrounds

Tables - \$13 in advance Admission - \$6

<https://www.rmham.org/the-summer-swapfest-2026/>