EBU R116-2005



The use of DV compression with a sampling raster of 4:2:0 for professional acquisition

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# EBU Technical Recommendation R116 – 2005

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# Recommendation on the use of DV compression with a sampling raster of 4:2:0 for professional acquisition

The EBU recommends the following constraints concerning the use of consumer DV camcorders:

- 1. The use of consumer style camcorders in broadcasters' operation should be limited to those instances where considerations of size, weight and disposability prevail over considerations of picture and sound quality;
- 2. For material that has been captured with consumer style camcorders, postproduction manipulation should be avoided so far as possible, except for any necessary simple editing;
- 3. If television programme material acquired by using consumer style camcorders must necessarily be subjected to intensive postproduction operations, it should be transferred onto a professional platform, e.g. 50 Mbit/s with a sampling raster of 4:2:2, before further treatment.
- 4. Concatenating DV-home (4:2:0) and DV-based (4:1:1) compression in professional acquisition should definitely be avoided as this results in loss of both horizontal and vertical chrominance resolution.
- Appendix 1 provides operational considerations related to the use of DV compression with a sampling raster of 4:2:0 in a professional environment.
- Appendix 2 puts DV consumer compression in context with DV-based compression and lists a bibliography of EBU documentation concerning the use of compression within video production.

# Appendix 1

# Considerations on the use of DV compression with a sampling raster of 4:2:0 for professional acquisition

# **Current Scenario**

DV compression (IEC 61834) based on a sampling raster of 4:2:0 for 625/50 systems ("DV-home" for short) is implemented in a variety of video equipment intended for consumer, professional and broadcast use, e.g. miniDV, DV and DVCAM equipment. Furthermore, the DV-home compression can be handled by a great number of different editing software ranging from very low cost to broadcast products.

Currently a large amount of this equipment is in operation in professional acquisition. Broadcasters are now commonly using material acquired using DV-home (whether they want to or not). There is increasing concern about this use of consumer or semi-professional camcorders for the acquisition of television programme material for which they have not been intended. Simply put, if such use were to spread indiscriminately over all genres of broadcast programmes, it could result in a general lowering of broadcast picture quality even for programme genres for which one would desire the best picture and sound quality that professional studio operation could provide.

Perhaps the biggest attraction of consumer DV cameras is their small size, weight and purchase price. They allow shooting in situations that would be impractical with a professional camera and crew on account of lack of, or poor access to space at the location, for safety reasons (e.g. shooting amongst a crowd in a public space), cost implications due to the production timescale (following a contributor around for three months), or plain and simple lack of budget.

The main area of use is the observational documentary: not necessarily unobserved or covert, but rather unobtrusive and less threatening. Many interviewees in their normal environment can be seriously distracted by the presence of a full production team and a professional, large camera.

A new category of professional – the video journalist, or "VJ", has come into being through the use of DV consumer equipment for professional acquisition. Undeniably, the low cost of the cameras makes them very attractive to production budgets, as does the possibility that the programme-maker will be able to operate the camera himself/herself. While this has budgetary advantages it begs all sorts of questions about the technical and editorial quality of what is captured and what training is required for 'Self-Operation' shooting.

The use of this equipment has brought video acquisition to a much wider range of person than would otherwise be the case. Many contributors now have no formal production training and learn "on the job", following a set of simple do's and don'ts (such as limiting their use of zoom and panning).

For all that, the EBU is aware that broadcasters, independent television programme producers and freelancers are already using such camcorders for applications such as hard news coverage, for documentaries and even for dramas and serials.

Even though this represents current practice, EBU members must be aware that the use of DV consumer equipment brings not only benefits but also some risks to the broadcaster. The general impact on professional acquisition brought about by the use of DV consumer equipment employing DV compression with a sampling raster of 4:2:0 is discussed below.

# Impact of DV consumer equipment on professional acquisition

#### Benefits

Consumer style DV equipment enables a general reduction of cost per programme minute because of its economical conditions.

The general picture quality of DV-home (4:2:0) was evaluated and compared to that of DV-based (4:1:1) in the EBU tests on DVCAM. The conclusion was that the average picture quality was judged equivalent for DV-home and DV-based compressions.

The low cost of consumer style DV equipment is highly demanded for equipment in some areas of broadcast

#### acquisition.

The small size and weight of consumer DV cameras allows the operator to shoot in situations that would be impractical with a professional camera and crew.

Experience already proofed that seldom are there serious problems due to the material having been captured on DV at 4:2:0 rather than, say, self-operation Digital Betacam capture.

#### Risks

For material captured in a self-operation style there are often technical and editorial quality issues. These, in the main, are the result of inadequate technical and general production training, without which the necessary skills will be lacking.

If the use of consumer DV equipment is permitted in a professional environment the usual concerns about professional robustness must be relaxed considerably.

#### **Editorial issues**

Issues such as inappropriate or inadequate lighting, poor sound, mis-framing of the shots and so on, are frequently seen on transmitted programmes.

Editors are constantly complaining about rushes that have been shot without any knowledge of the way that a sequence is constructed - the need for multiple angles and shot sizes, an establishing shot and general views, as well as numerous cutaways.

#### **Technical Issues**

The quality of the optical part is limited. For instance, zooming-in typically darkens the shot and disturbs white balance.

The smaller CCD (typically one-third inch or less) found on small DV cameras makes the depth-of-field larger and more difficult to control.

Signal processing in consumer 'handycam' is simplified/limited to preserve battery life and shows up in highlights and strongly coloured areas of the picture. The use of a professional DVCAM gives better results due to better signal processing within the camera.

The restricted chroma resolution and compression of the tape format can cause problems with chroma keying if that is needed.

The aspect ratio of consumer DV camera chips is 4:3 and if the broadcaster has adopted 16:9 as the norm then the material needs to be aspect ratio converted before it can be inter-cut with other sources.

# Conclusions

In general, the DV-home compression cannot itself be identified as the sole reason for the problems associated with the use of consumer DV equipment in professional acquisition.

Other issues such as the grade of the optical parts, quality of the mechanics and of the electrical processing as well as the ergonomics of the consumer cameras are the main sources of concern.

An evolution of consumer DV equipment towards professional acquisition would require:

- improved lens operational controls
- larger CCD sensors (possibly 16:9)
- professional rather than consumer electronics and mechanics
- higher resolution viewfinders and LCD screens to improve focus assessment
- better mechanical balance and viewfinder location
- better protection against RFI.

#### Impact of HDV on professional acquisition

The EBU is monitoring developments currently taking place with HDV and it will issue recommendations in due time.

# Appendix 2



**DV Compression** 

# Figure 1: Relationship between DV compression (DV-home) 4:2:0 and DV-based compression 4:1:1, in context to the digital VTR formats concerned

# Bibliography

EBU documents concerning compression within video production

EBU Technical Statement D80-1996 - Compression in Television Programme Production

Recommends a single open compression algorithm for mainstream programme production, which is operating at 50 Mbit/s and I-frame only.

EBU Technical Statement D82-1998 - M-JPEG in Future Networked Television Production

Recommends DV-based compression and 422P@ML MPEG-2 based compression, but not M-JPEG for future TV production.

EBU Technical Statement D84-1999 - Use of 50 Mbit/s MPEG compression in television programme production

Operating requirements of a television production environment may entail constraints in the detailed specifications of MPEG bit streams, particularly when recording MPEG bit streams on tape.

**EBU Technical Statement D85-1999** - Constraints on MPEG 4:2:2 P@ML compression to ensure interoperability in television production

Technical requirements on MPEG compression - Single bit rate at 50 Mbit/s and I-frame only compression and a constant number of bytes per GoP (Group of Pictures)

EBU Technical Statement D86-1999 - Video compression systems for new disc based camcorders for television

Recognising the video compression systems: SX 18 Mbit/s; DV based compression algorithms 25 Mbit/s and 50 Mbit/s; an agreed version of the 4:2:2 profile of MPEG 50 Mbit/s; and states that the priority is to avoid the introduction of new compression systems-formats into a production chain that is already overcrowded with them.

EBU Technical Statement D89-2000 - Quality and interoperability in a 625/50 digital television production

environment using MPEG compression

Statement concerning quality and interoperability issues for MPEG compression in TV production.

**EBU Technical Statement D94-2002** - Use of MPEG 4:2:2 P@ML compression standards and specific application ranges in mainstream television production User requirements for MPEG-2 4:2:2P@ML compression

### DV compression (4:2:0 for 625/50) within other EBU Documents

#### EBU/SMPTE Task Force - Final Report - August 1998

Chapter C.2. "Compression families for networked television production" states the following:

For core applications in production and post-production for Standard Definition Television, two different compression families on the market are currently advocated as preferred candidates for future networked television production:

DV / DV-based 25 Mbit/s with a sampling structure of 4:1:1, and DV-based 50 Mbit/s with a sampling structure of 4:2:2, using fixed bit-rates and intra-frame coding techniques exclusively. DV-based 25 Mbit/s with a sampling structure of 4:2:0 should be confined to special applications.

MPEG-2 4:2:2P@ML using both intra-frame encoding (I) and GoP structures and data-rates up to 50 Mbit/s. MPEG-2 MP@ML with a sampling structure of 4:2:0 should be confined to special applications.

The EBU strongly recommends that future networked television production should focus on compression families based on DV and MPEG-2 4:2:2P@ML which have been identified as being appropriate for television production operations.

The EBU has issued Statement D-82: "M-JPEG in Networked Television Production", to discourage its future use

#### Report - EBU Tests on Sony DVCAM - April 2000

Refers to EBU/SMPTE Task Force concerning DV-based 25 Mbit/s and a sampling structure of 4:1:1 and the fact that a 4:2:0 version has been offered for 625/50 TV applications, more recently.

It also states that consumer type DV (4:2:0 for 625/50) can be intercut into DV-based 25 Mbit/s 4:1:1 and 50 Mbit/s 4:2:2 via IEEE 1394, but the pre-filtering of the DV device is not closely specified.