

Hitachi, Ltd.

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Federal Communications Commission
November 16, 1987
Office of the Secretary

Mr. Terry Haines
Policy and Rules Division
Mass Media Bureau of FCC
1919 M Street, N.W.
Washington, D.C. 20036

87-2681

Dear Mr. Haines:

The attached official documents come from Hitachi, Ltd., Tokyo, Japan. They are being sent to you from this office in New Jersey to insure your receipt of this information.

An original set of these documents has also been sent to you direct from Hitachi, Ltd., Tokyo, Japan. If you receive both sets, please file this one.

Thank you.

Sincerely,



Kei Yamashita/CPRC
Senior Researcher

KY:mcb

Attachments

0711

PHONE: 0423-23-1111
TELEX: 2832522 CHUKEN J



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Federal Communications Commission
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Policy and Rules Division
Mass Media Bureau of FCC
1919 M Street, N.W.
Washington, D.C. 20036

Dear Sirs:

We, Hitachi, Ltd. would like to file our formal comments to the Notice of Inquiry in MM Docket ~~87-268~~, FCC 87-246. Enclosed therefore, please find the original plus 11 copies of our comments.

To insure delivery of our comments to the FCC, the same will be sent to you from our office in New Jersey, U.S.A. If then you receive two of the same comments from Hitachi, Ltd., please file one set.

We hope that our comments are helpful to FCC in deciding the ATV scheme in U.S.A.

Yours faithfully,

Takahiko Fukinuki, PhD.
Chief Researcher
Central Research Laboratory
Hitachi, Ltd.
Kokubunji, Tokyo 185, JAPAN



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Federal Communications Commission
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HITACHI'S activity on FCC's NOI about ATV

Before the
FEDERAL COMMUNICATIONS COMMISSION

In the Matter of
An Inquiry Relating to
Advanced Television Systems
and Their Impact on the
Existing Television Broadcast
Service

Fully Compatible EDTV (Enhanced TV)

Hitachi, Ltd.

Hitachi, Ltd. has been developing EDTV (Enhanced TV) since 1983, first by computer simulation and then by prototypes implementation. The results have been presented to academic societies and at exhibitions for TV broadcasters, TV manufacturers and so forth.

Since BTA (Broadcasting Technologies Association) was founded, we have been working as a member with the proposal of our EDTV. A brief history of our work with the EDTV is shown in Appendix 1.

The philosophy of our EDTV is based on the following four points.



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1) Compatibility is very important. In Japan, There are more than 70 million TV sets. And, even the DBS is transmitting TV programs under NTSC systems rather than MAC systems.

Therefore, it is very important to improve the picture quality with NTSC standards.

2) NTSC image quality can be easily improved by introducing 3D signal processing techniques. PAL is not suitable to this, because of 1/4 offset of a color subcarrier.

3) The so-called IDTV (Improved TV) will be available to the public soon. With IDTV, Motion-adaptive line interpolation (progressive scanning) and Motion-adaptive YC Separation are applied. These techniques can be applied to EDTV in the same way. EDTV sets can be produced by adding small electronic circuits to IDTV.

4) Presently, high-resolution home VTRs, called SVHS or ED-Beta are commercially used. New TV broadcasting schemes with higher resolutions are desirable.

The basic idea of the EDTV is described in the Notice of Inquiry in MM Docket 87-268, FCC 87-246, paragraphs 24. and 91. We are very much pleased that our EDTV system is referred to in the proceeding. EDTV's resolution of luminance is improved by following the two methods.

a) Vertical resolution: The scanning conversion technique is applied. In the camera, the picture is scanned progressively and converted to interlaced scanning at transmission. At TV



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receivers, the picture is re-transformed to progressive-scanning by line interpolation.

b) Horizontal resolution: Higher resolution components of horizontal luminance signals are frequency-shifted and inserted in the vacant frequency domain of NTSC signals.

This insertion scheme mentioned in the term b) is applicable to other systems by changing the inserted information or parameters. For example, the additional information for 5:3 aspect ratio and color high frequency components can be inserted. Actually, this scheme has been applied to many other systems published so far.

However, the statement that "Small amount of color information is sacrificed in exchange for higher resolution luminance information (Paragraph 24)" is not exactly true. For the insertion of high-resolution component, the vertical resolution of color signals should be limited. This, however, is a common technique to other schemes, as is stated in paragraph 23: The bandwidth of color signals is under half of that of luminance signals, so there are no problems even if vertical resolution of color signals is also reduced by half. In addition, high-resolution luminance components are inserted not in the frequency areas of modulated color signals, but in the conjugated areas in the temporal-vertical frequency domain. These areas are not efficiently used in the NTSC standards.



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This EDTV has reception and transmission compatibilities with current NTSC systems, as stated in paragraph 91. In addition to these, it was designed to reduce the deficiencies of NTSC (paragraphs 9 through 16).

The techniques described above mainly improve luminance signals. It is also desirable to expand the color signal bandwidths if this can be achieved easily. The bandwidths utilized in all commercially available TV sets in Japan are only 0.5 MHz for both I and Q signals, although a 1.5 MHz I signal is transmitted. Therefore, the first step is to use all the information transmitted.

Also, because of the compensation of Gamma correction, color resolution can be psychovisually improved by 30 to 60%. In addition, Q signal bandwidth can be easily expanded if necessary.

The list of references previously published by Hitachi is shown in Appendix 2.

NOI questions will be answered in the following paragraphs. We hope that Hitachi's activities in the BTA and its philosophy on the EDTV scheme are useful to the FCC in deciding how to implement ATV in the U.S. We will gladly submit more information if necessary.



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Section 2 Background

[Q1] Compatibility with NTSC standards is most important for EDTV. An evaluation of EDTV (Enhanced TV) should show that image quality improvement and cost are essential on condition that they are compatible with current transmission systems and receivers. In addition, the relation between EDTV and the so-called IDTV (Improved TV), which reproduces better images from present NTSC signals, should be considered. This is because motion adaptive line interpolation for progressive scanning and motion adaptive 3D YC separation are the basic techniques of IDTV. These techniques are not only suitable for IDTV but also EDTV. Also, it is indispensable that the LSI of an IDTV can be easily installed in an EDTV.

[Q2] IDTV receivers, which were described in Question 1, will be available from some Japanese manufacturers by 1987 to 1988. These are complete digital ATVs using digital signal processing and IC techniques. BTA is currently studying NTSC fully compatible Enhanced TV to improve resolution and picture quality.

[Q3] This answer is the same as for Q2. The IDTV is now approaching commercialization. Experimental models of EDTV have been developed which will give higher resolution with little modification of standards. Standardization issues are being discussed in Japan and a decision will be reached by



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spring, 1989.

[Q4] The EDTV receiver is similar to IDTV in terms of hardware. The former can be implemented with little addition of circuits to the latter. Therefore, the relative cost for consumers can be almost negligible if the IDTV is commonly in use.

[Q5] Because the EDTV designed is compatible with the present transmission system, it can be transmitted within the channel capacity allocated to today's TV broadcasting. It is very advantageous that EDTV will be introduced with this compatibility.

Section 3

[Q6] With EDTV, it is not necessary to distinguish between UHF and VHF. Both can be adopted to EDTV transmission.

[Q7 - Q22] There are no problems about these questions in the case of the EDTV, because it has full transmission compatibility with existing NTSC channels, and it does not need any auxiliary channels.



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HITACHI, LTD.
P.O.BOX 2, KOKUBUNJI, TOKYO 185

For further information, contact:

Dr. Takahiko Fukinuki

Chief Researcher

Central Research Laboratory, Hitachi, Ltd.

Kokubunji, Tokyo 185 JAPAN

Phone: +81-423-23-1111 ext. 3515

FAX: +81-423-23-1900

Telex: 2832522 CHUKEN J

Appendix 1 Short History of EDTV in Hitachi, Ltd.

- Feb. 1983 Principal idea was born.
- July 1983 Presented at a domestic academic meeting.
Computer simulation carried out.
- Feb. 1984 Presented at SMPTE TV Conference.
- April 1984 Presented to commercial broadcasters.
- Feb. 1985 Presented to MPT (Ministry of Post and
Telecommunications).
- Dec. 1985 Presented to BTA members.
- July 1986 Proposed to BTA's EDTV committee.
- Nov. 1986 Opened to the public.



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Appendix 2 Bibliography on the EDTV proposed by Hitachi, Ltd.

- (1) T. Fukinuki and Y. Hirano: "Extended Definition TV Fully Compatible with Existing Standards," IEEE, Trans. Communications, Vol. COM-32, No.8, pp. 948-953, (Aug. 1984).
- (2) T. Fukinuki, Y. Hirano and H. Yoshigi: "Experiments on Proposed Extended-Definition TV with Full NTSC Compatibility", SMPTE J. Vol.93, No.10, pp. 923-929, (Oct. 1984).
- (3) T. Fukinuki, Y. Hirano and H. Yoshigi: "NTSC Fully Compatible Extended Definition TV -Proto Model and Motion Adaptive Processing-", GlobeCom. No.4.6, (Dec. 1985, New Orleans, USA).
- (4) T. Fukinuki, Y. Hirano and H. Yoshigi: "Extended Definition Television--Higher Quality Image with Compression Technology--", GlobeCom. No.11.1, (Nov. 1987, Tokyo).