

AUSTRALIAN BROADCASTING CONTROL BOARD

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TECHNICAL SERVICES DIVISION

REPORT NO. 32

TITLE: Colour Reception from Videotape Replay over the Australian  
Monochrome Television System

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TITLE: Colour Reception from Videotape Replay over the Australian  
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# Colour Reception from Videotape Replay over the Australian Monochrome Television System

## 1. Introduction

An increasing proportion of the 625-line videotapes received from Europe contains colour information mostly recorded on "high band" recorders. The Board requires that the colour burst be removed from such programmes before they are transmitted. In many cases, particularly by the A.B.C., the imported programme is dubbed onto a low-band videotape recording, which process considerably degrades the colour information but permits replay to air by low-band machines.

However, those stations with high-band machines naturally prefer to replay the original tapes, to achieve the best monochrome picture quality. Colour reception of a number of these latter transmissions has been reported, using a receiver system known as "Chroma-Lock" (referred to in earlier documents as the New PAL system of reception) which does not depend on the presence of a colour burst, except to maintain lock during gaps in the transmission of colour information.

The purpose of this investigation was to establish the technical status of such "unintended" reception, and, if considered undesirable, to determine whether sufficient colour information could be removed without degrading the monochrome picture quality.

## 2. Colour Filters

Because the colour information is interleaved with luminance (black and white detail) information on a frequency basis, it is extremely difficult to remove the colour information completely without degrading the compatible black and white picture. However the problem of partial removal is much easier, and has already been tackled by the A.B.C. in removing enough colour information from 525-line colour pictures incoming from U.S.A. by satellite, to permit operation of their monochrome standards converter. The A.B.C. has been good enough to make up and supply a version of this filter, scaled up from the 3.58 MHz U.S. colour sub-carrier frequency to the 4.43 MHz European frequency. It comprises two notch filter sections in cascade followed by a phase correction network.

During the same period, television station HSV at the request of F.A.C.T.S. whose assistance had been sought by the Board, made up a low-pass filter with a first zero of transmission at 4.43 MHz. Comparative measurements of both filters showed that the HSV low-pass unit had noticeably less effect on the luminance waveform from high-band tapes; it was therefore decided to use this filter for initial tests, and to change to the A.B.C. notch filter if the colour filtering appeared inadequate with the less severe filter.

## 3. Monochrome Receiver Test with Viewer Panel

A first test was carried out on Thursday, May 6th, when HSV transmitted two half-hour English comedies "Please Sir" and "Ours is a Nice House" from high-band colour videotapes, using normal high-band monochrome operation of their replay system. For each programme most of the colour information was removed during the second 15-minute period of each programme by the HSV-designed filter. Twelve members of the Board staff observed the tests on their domestic monochrome receivers, with the following conclusions:-

	<u>First 15-minutes</u> (Normal-filter out)	<u>Second 15-minutes</u> (Filter in)
6 observers	Dot pattern visible	{Dot pattern disappears. {No change in picture {quality
3 observers	Dot pattern visible	No change in quality
1 observer	Dot pattern visible	{Slight reduction in {quality
1 observer	Dot pattern invisible	{Slight reduction in {quality
1 observer	Dot pattern visible	{Apprecialbe improvement {in quality due to removal {of course patterning

4. First Colour Receiver Test

A test was carried out on Thursday, 19th June, when the above test transmission procedure was repeated, using the current episodes of the same programmes.

Observations were made in the Board laboratory by four members of the Technical Services Division and Mr. J.H.T. Fisher of HSV.

Four receivers were used:-

- (A) The Board's imported Philips colour receiver, modified to "chroma-Lock" by the Adelaide office.
- (B) The Board's imported Blaupunkt colour receiver, with standard PAL colour circuits.
- (C) Conventional valve-type monochrome receiver.
- (D) Latest solid-state monochrome receiver.

The results of the tests during the first 15 minutes of each programme were inconclusive. Horizontal bands of colour over the whole picture area were obtained on receiver A, normal monochrome reception on the receiver B, and the two monochrome receivers. Some of the bands of colour on receiver A provided correct colour rendering, others were quite false but equally vivid. It was thus evident that either the receiver had not been converted adequately for "Chroma-Lock" feature, or alternatively the colour signal being radiated by HSV was non-standard.

Despite this limitation, during the second 15 minutes of each programme it was possible to observe adequately the effects of the filter in removing colour from those portions of the picture previously giving acceptable colour rendering. As expected, all large areas of colour were removed, but colours remained around black-and-white outlines. It was however considered by all present that the procedure would be an adequate discouragement to purchase of colour receivers by the public. During this part of the test no disturbance of the monochrome picture on the other three receivers was observed.

The lack of degradation of the black and white picture when the filter was introduced in both tests is surprising, contrary to the expressed predictions of many engineers in the industry, and the expectation of Board engineers.

A careful examination of the frequency spectrum of the black and white information in the tape replay signal has been made by HSV, and reveals that the fine detail information has been filtered during the making of the tape -

presumably to minimise interaction with the colour information.

Under these circumstances the addition of a further similar filter during replay would not be expected to affect the overall result to any extent.

#### 5. Second and Third Colour Receiver Tests

To decide whether the inadequacy in colour reception on receiver A lay in the colour receiver or the unintended colour transmission, arrangements were made with AWA for the loan of one of their two experimental chroma-lock colour receivers, which had given acceptable results on Sydney transmissions. This was received in the laboratory towards the end of June.

Observations were made on June 30th, of HSV transmission of the Liberace show 7.30 - 8.30. p.m.

Mr. A. Stewart, AWA Melbourne manager, and transmitter representative on the Industry Colour Steering Committee was present, together with Board staff.

A locked colour picture of acceptable quality was readily obtained on the AWA receiver, but not on receiver A.

Measurements were subsequently made of the lock-in range of the two receivers, and it was found that the range of the AWA was approximately three times as great. Appropriate circuit modifications were made to receiver A, and on the corresponding Liberace programme on Wednesday, July 7th, a locked picture was obtained. Once locking had been achieved, a frequency counter was used to measure the colour sub carrier frequency and this was found to be 300 Hz above its nominal value. This resulted from HSV's videotape replay machine being driven by a normal monochrome synchronising generator which could have a frequency variation corresponding to  $\pm 4,000$  Hz at colour sub carrier frequency, and still be within monochrome tolerances. The permissible variation when specified colour signals are radiated will be + 4 Hz. It thus appears likely that imported European chroma-lock receivers designed to work with precision colour transmission would not lock on to the present transmissions without considerable modification.

#### 6. Colour Picture Quality

Locking problems having been solved, attention was then directed to the quality of the colour pictures obtained. This was much better on the AWA than on the Board's receiver A.

On the latter, the fine tuning setting for best colour did not coincide with that for sharpest black-and-white detail, and there was a considerable displacement of the colour blocks to the right of the detail. (This displacement was also visible in the AWA receiver, but was much smaller).

Detailed measurements showed that the alignment of receiver A was very poor, it having apparently suffered during transit on its Adelaide trip.

Even after the alignment had been restored, the picture was still not as sharp and bright as that of the AWA receiver, and it is evident that there have been considerable improvements in domestic shadow mask colour display tubes between 1967 and 1970, the probable design dates of the two receivers.

Apart from the above, the general picture quality on both receivers was quite acceptable, and gave considerable aesthetic satisfaction.

Colour banding (in 16-line bands, due to change from one video tape rotating head to the next) was visible on close inspection on both receivers, but noticeable only on fairly plain orange or red backgrounds. In the absence of colour corrective devices at the replay machine, this was quite impressive and says a good deal for the advantages of the Chroma-lock system (referred to in earlier Board documents from 1965 onwards, under the name of the "New Pal" system of reception).

Following the insertion of local commercials in the programmes observed, or other breaks in the colour signal, there is one chance in four of a receiver relocking to give correct colour. Locking in incorrect phase gave green or magenta "flesh tones" (in normal colour transmission, the presence of the burst ensures relocking in correct colour phase).

Three or four times during each hour's programme, it was necessary to press one of two push-buttons (on an extension lead in the case of the AWA receiver) to restore correct colour.

#### 7. Final test - effect of filter in colour and monochrome reception

On 21st July a further test was carried out in conjunction with HSV on the effectiveness of the low-pass filter, this being switched in for the second and fourth quarter-hours of the 7.30-8.30 p.m. Liberace programme. Both colour receivers and a bank of five assorted monochrome receivers were set up and adjusted for best black and white reception. The test was observed by Mr. Stewart of AWA, as well as Board staff.

Results essentially similar to those of paragraph 4 above were obtained - on the two colour receivers all large areas of colour disappeared, although colour remained in outlines and fine detail. Of the five black and white receivers dot pattern was visible on three, and disappeared when the filter was inserted, with no other change in picture quality. A "dirty" background on an older receiver became less objectionable with the filter inserted. One receiver showed the course 1.07 MHz beat pattern between colour and sound carriers, which disappeared with filter insertion. (In the absence of the filter, both the latter receivers could be made to give an acceptable black and white picture by slight adjustment of fine tuning.)

In no case was the black and white picture quality considered to be degraded by the insertion of the filter.

#### 8. Conclusions

1. It is possible for a skilled technician to modify a standard PAL colour receiver to produce acceptable pictures from colour videotape replayed by "high-band" videotape machines, when these are transmitted without colour burst through the existing system, adjusted for best monochrome operation.

2. No co-operation or special colour adjustment on the part of the station is necessary, although colour locking would be much easier if precise sub-carrier frequencies were radiated.

3. Once the receiver is modified, it can be operated after instruction by most people. However, the ordinary viewer would be put off by the necessity to lock the colour oscillator at the beginning of reception, the need to press the colour reset buttons after most colour breaks, and the limited availability of programmes, currently 2 hours weekly in Melbourne.

4. The insertion of a low pass filter following the video-tape replay machine at the station removes 90% of the colour from the picture without any noticeable degradation of the already filtered black and white information from the videotapes as viewed on black and white receivers. Picture quality on some older black and white receivers from these transmissions is slightly improved by inserting the filter. The filter would be expected to produce appreciable degradation of live camera pictures, or those from monochrome videotapes making full use of the available bandwidth.

#### 9. Acknowledgements

This work has been made possible by the close co-operation, which is gratefully acknowledged, of Messrs. Wilhelm and Thiele of the A.B.C., of Messrs Fisher and Albiston of HSV, of Mr. A. Stewart of AWA, and with the assistance of Mr. Horvath of the Board's Adelaide office, and Mr. Hernan of the Board's Laboratory.