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POSTAL AND TELECOMMUNICATIONS DEPARTMENT

Broadcasting Engineering Division

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AUSTRALIA AND DATA BROADCASTING - UK "TELETEXT", FRENCH "ANTIOPE" AND CANADIAN "TELIDON"

Issued by:

First Assistant Secretary
Broadcasting Engineering Division
Postal and Telecommunications Department
Marland House
570 Bourke Street
MELBOURNE VIC 3000

CONTENTS

SYNOPSIS

This report examines the three broadcast Teletext services presently receiving worldwide attention: United Kingdom "TELETEXT", French "ANTIOPE" and Canadian "TELIDON". Reference is made to the Departmental discussion paper on the introduction of Broadcast Teletext within Australia. From this and other considerations, three possible engineering options are presented related to the introduction of such services.

1. INTRODUCTION

This report examines the immediate options regarding the possible introduction of broadcast data services in Australia (i.e. Broadcast "Teletext").

The examination includes consideration of the material submitted in the twenty replies to the Departmental discussion paper which was circulated in December 1978 for comment by the broadcasting industry (Appendix 1).

In addition, three competing systems which are currently receiving worldwide attention, Teletext (UK), Antiope (France) and Telidon (Canada) have been subjected to engineering evaluation. It should be noted that because each of these systems are at a different stage of evolution, comparisons have been difficult.

The only practicable method of producing these comparisons, with the resources available to the Department, was by reference to a library of overseas reports and documents, which unfortunately limits the degree of real knowledge as to practical system limitations. The Department's virtually non-existent experience with Antiope and Telidon equipment has required that it use the claims of entrepreneurs as to system capabilities and performance. This is scarcely enough and there is more extensive work to be done when resources become available.

The recent Telidon demonstrations in Australia conducted by the Canadian Department of Communications, while being valuable, were in fact simulations of a broadcast data service using a wired communications link.

The Antiope demonstration at IREECON '79 while representative of a broadcast data service, operated over a link comprising a few metres of co-axial cable - not exactly a field demonstration.

In the case of UK Teletext, even with "test" transmissions operating in Australia for two years or more, it has not been possible to conduct detailed field investigations into system performance due to lack of Departmental resources.

Pressures are being mounted by the broadcasting industry for permission to introduce services immediately. In these circumstances and considering the incomplete engineering knowledge of system performances, this report offers options regarding processes by which the Government might allow full-scale services to be introduced.

In brief, three options are possible:

(A) Permit UK Teletext only to be introduced on a fully operational basis as soon as possible.

(B) Permit each television station to adopt individually any system on a fully operational basis - but still as an experimental service.

(C) Continue the present limited test transmissions, but permit stations to conduct trials on Antiope and Telidon before deciding on a system standard for Australia.

2. RESPONSE TO THE DEPARTMENTAL DISCUSSION PAPER ON BROADCAST TELETEXT

2.1 General

The twenty submissions received in response to the discussion paper have been subject to a previous report, however since that initial summary, all the documents have been carefully re-evaluated in detail. (Attachment 4 is a list of organisations responding to the discussion paper).

On analysis, as previously reported, eleven submissions supported the introduction of the UK Teletext system, eight favoured the "wait and see" approach while the Federation of Australian Radio Broadcasters had no comment either way.

Sections 2.2 and 2.3 following, represent concise summaries of the two alternative viewpoints.

2.2 Rejection of the UK System

The submissions rejecting the immediate adoption of the UK system do so on the following combination of factors:

(a) There is no real urgency or demand for the early introduction of a broadcast data service - no reason exists to adopt a first generation system;

(b) It is unwise to commit Australia to a particular system when international standards (eg. CCIR) have not been determined;

(c) Premature adoption of a standard and the establishment of a broadcast service may, because of the potential terminal equipment compatability problems, influence the development and introduction of related wired services;

(d) The data transmission rate of UK Teletext is such that system error performance is highly dependent on transmission anomalies (eg. short term reflections);

(e) The "data" coverage area appears to be less than the conventional "television" coverage area;

(f) Test conducted within Australia (by the ABC) have indicated dramatically reduced error performance on Band I, comapred to Band III operation;

(g) The UK system has poor graphics resolution capabilities - later generation systems will have improved performance in this area;

(h) The UK system does not allow the terminal to be optimised for a particular application thus complicating the compatability problems between interactive and non-interactive services.

2.3 Adoption of the UK System

When examining the pro UK Teletext submissions, it is difficult to assemble a comprehensive list of specific reasons supporting the early or immediate introduction of the system. The following list however represents a consensus of broad opinion.

(a) The facilities offered by the UK system are totally adequate and do not require augmentation.

(b) The system has been satisfactorily tested and operated for an extended period of time in the United Kingdom.

(c) The system is available for immediate implementation due to the availability of LSI decoders at reasonable cost.

(d) Ten to twenty per cent of the viewing population require "sub-titles" to aid nerve deafness disabilities - Teletext provides urgently needed broadcasting system enhancement.

(e) As the colour television receiver population is nearing saturation point, the industry needs a stimulus to both increase capital turnover and keep trained service personnel within the industry.

2.4 Comments

The overall response to the discussion paper could only be described as poor, both in the number of submissions received and the quality of material presented. Twenty submissions were received - approximately 500 discussion papers were distributed!

Considering the pro UK submissions, the fundamental engineering argument is that the UK Teletext system is available now for immediate introduction, additional facilities are not required, and the system has been adequately tested - it must therefore be introduced immediately.

It is interesting to note that commercial television stations possessing UK Teletext source equipment, capable of presenting multi-page services, are pushing vigorously for the introduction of "their" system.

The factors raised by those submissions rejecting the immediate introduction of the UK system, do so on several valid engineering grounds. Lack of international standards, demonstrated data corruption cuased by non-ideal transmissions and inability to optimise terminal facilities to suit varying applications, can all be classified as significant reasons to adopt caution with regard selection of this system.

In summary, the engineering arguments presented sounding caution in the immediate adoption of the UK Teletext system outweigh the counter arguments supporting the system's early introduction. In addition, the Federation of Australian Commercial Television Stations suggest a twelve month postponement in a decision to introduce full scale broadcast data services. By this time some indication should be available about a possible international standard to be adopted by the CCIR.

3. UK TELETEXT/ANTIOPE/TELIDON

3.1 UK Teletext

UK Teletext has been transmitted by various commercial television stations throughout Australia (together with the ABC) for approximately two years. At a guess, there is probably some $300,000 of UK source equipment located in various television stations around Australia. Some stations have simple "fixed" page generators, while others (such as ATN-7 and TCN-9), have elaborate computer based equipment capable of storing several hundred pages of material and servicing information provider terminals.

Despite the two years of test transmissions, it has not been possible to resolve the question relating to the suitability of this system to the Australian television system. A recent report produced by the Australian Broadcasting Commission (submitted to the Department as a response to the Discussion Paper on Broadcast Teletext), indicates an alarming difference between the error performance of the UK system on Band 1 (VHF), compared to Band III (VHF). On Band III, some 60% of the observed cases had adequate error performance, however on Band I, this figure dropped to only 30%.

If these figures are representative of the true field situation (and there is no reason to doubt their validity), then a thorough engineering investigation would seem a reasonable course of action before committing the country to this particular Teletext standard. The basis of this investigation would be to determine the cause of degraded performance on low-band channels, more than merely verifying the ABC results. It may well be that Band I operation will have degrading effects on other data broadcasting systems such as Antiope and Telidon, although both use asynchronous transmission, thus allowing data rate optimisation; in addition, Telidon will use a "forward" error correction scheme.

The UK Teletext system has been operational on a domestic scale since November 1976 in Britain - although its acceptance by the general public could only be described as poor. In 1978 approximately 9000 Teletext equipped receivers were sold, however in the same year, some 1.75 million colour receivers were purchased. The British Radio Equipment Manufacturers Association (BREMA), have commented that the poor sales record of Teletext receivers could see an early demise of the service if the market does not dramatically improve.

In summary, the UK Teletext system was the first developed in the world and as such is a credit to its designers. Unfortunately, like most "first off" ideas or developments, it is not an optimum system. Both the French and Canadians have had the benefit of hindsight in developing their systems, and thus both these systems offer various improvements over Teletext. Additionally, the high data transmission rate used by this system makes it more susceptible to data errors caused by transmission/receiver anomilies.

3.2 Antiope

It is a characteristic of the French to develop an alternative to

any new system or idea, (for example SECAM colour television). In the case of the Antiope broadcast data service however, the French have devised an alternative to the British system which overcomes Teletext's major diadvantage.

In a single phrase, "...Antiope uses asynchronous data transmission..."

The use of an asychronous data transmission scheme results in the page size being independant of the data transmission rate. This independence means that the bit rate of Antiope, unlike Teletext, can be optimised for a particular type of transmission path, without compromising page size. In UK Teletext, when used with the 'System B' television standard (as in Australia), the transmission rate is fixed at 6.9375Mb/sec (444fh) giving a page size of 40 characters by 24 rows (i.e. 960 characters/page maximum). In the case of Antiope, any data rate can be utilised; the French have suggested that for System B, 6.203125 Mb/sec (397fh), is a good compromise between transmission speed and acceptable error rate.

In addition to differences in data transmission architecture, some improvement has been made to the graphic display capabilities of Antiope. Both Teletext and Antiope use the "alpha-mosaic" display technique, this resulting in relatively low graphics resolution capability. In order to optimise the alpha-mosaic system, Antiope has been designed such that control characters do not occupy character positions (as blank spaces) on the screen. While this is a worthwhile modification, the alpha mosaic system cannot compete with the 'bit-map' system as used in Telidon.

In summary, the Antiope broadcast data system will be available for possible implementation in Australia in 18-24 months. Its major advantage over the UK system is its use of the Didon asychronous data transmission technique. (See Attachment 2 for a full system description).

3.3 Telidon

Telidon, the Canadian developed data system differs from both Teletext and Antiope in that it uses so-called Picture Description Instructions (PDIs) to describe graphic images. (Alpha-numeric information is transmitted in a similar format to the other systems as ASCII data bytes).

The architecture of Telidon allows the operational facilities (e.g. graphic resolution) to be determined not by the system, but the system hardware. Stated alternatively, the system and hardware are independant. For example, in the future when display technology improves the resolution of the domestic display, no modifications to Telidon will be required to take advantage of such hardware improvements.

Attachment 3 presents a brief engineering review of Telidon.

It is extremely difficult to predict when Telidon will be fully marketable such that it could be introduced for domestic usage. The Canadians have indicated they propose to conduct a two year field study - market trial. On this basis, it is unlikely that the system

could be adopted before 1982/1983. However, due to its wide general acceptance since it was first released in August 1978, the Canadians may reduce the proposed trial period and increase the effort assigned to implementation. National prestige and the need to sell the system overseas may overtake the desire to introduce Telidon under ideal engineering and social circumstances.

4. OPTIONS FOR THE INTRODUCTION OF DATA BROADCAST SERVICES IN AUSTRALIA

4.1 General

Before presenting the options regarding the introduction of Broadcast data services to Australia, it must be emphasised that it is generally accepted worldwide that while "broadcast" (non-interactive) and "wired" services (which make interactive operation possible) are complementary in function, the social impact of high capacity information storage and fast retrieval systems, with or without interactive capability (wired or hybrid broadcast/wired) will be significantly greater than the simple broadcast services of low capacity with which this report is concerned.

Nevertheless, all the proposed data systems announced to date, designed to serve the general public, are based on using the standard domestic television receiver equipped with a digital data decoder, specific to the system, to form a display terminal. This implementation ensures that the data service would have not only the widest possible coverage, but also the highest immediate customer penetration because the receive sub-system thus becomes a minimum cost item. Such an arrangement could possibly become a permanent feature of these data services whatever the capacity and whether interactive or not, and it would be wise to consider the question of system standards, if only to maximise convenience to the purchaser and the manufacturer or television receivers.

When examining the question of introducing a broadcast data service, it is necessary to consider whether there is an essentially close technical relationship between these simple systems (based on using the vertical interval facility of the television picture transmission) and the high capacity and interactive services which may be developed in the future and therefore whether the introduction of broadcast data services should await the resolution of system standards for high capacity (wired or hybrid) services. It is considered that the very low transmission capacity of the broadcast system with which this report is concerned, makes it a limited facility with limited market acceptance. For these reasons, its impact on existing media would have little social significance. Therefore perhaps it should not be subject to stringent regulation, except insofar as the television picture transmission requires to be protected from interference and as the vertical interval capacity of the channel requires to be apportioned and standardised.

The social impact of high capacity systems, either wired or which might fully occupy a wide band broadcast channel, would be much greater as they would have the intrinsic capacity to eventually displace conventional printed media distribution and to be equipped with interactive facilities, e.g. program learning, etc, etc. The case for regulating these systems would seem to be very strong.

4.2 Option A:

Allow the introduction of UK Teletext within Australia on a fully operational basis as soon as possible - say early 1980

If this decision was taken, it would allow the pro UK faction within the commercial industry, together with other interested stations, to begin data operations - in some instances immediately.

As Australia is unlikely to introduce a full scale wired data service in the immediate future and considering the expected limited life span of UK Teletext (in its present form) it could be concluded that there is little immediate need to develop system standards related to this entire family of possible applications of Teletext (or any other chosen system) principles. Also, perhaps a solicitous concern for the Teletext viewer, whose reception facility could become outmoded, might be misplaced considering the limited population of the service, as judged by the experience of the UK, where ½% of TV receivers sold included Teletext facilities (1978 figures).

It is almost impossible to estimate the expected data receiver penetration within Australia, however, assuming a few thousand sales in the first 12 months operation, the question relating to the technical suitability of the UK system to our "B Standard" Australian television service, will probably be answered. Unfortunately, if the service proved to be unsatisfactory (characterised by inadequate coverage area resulting from excessive receiver sub-system error proneness), this could reflect on the Department's competence to make sound policy decisions.

It should be remembered that a field investigation recently conducted by the Australian Broadcasting Commission, to determine the suitability of the UK system to Band I (VHF) transmission (as used by many ABC stations), demonstrated a dramatic increase in error proneness compared to Band III operation. (Channels 6-11 in Australia).

As there is no reason to doubt the validity of this result, it would be considered in some quarters, that adopting "Option A" is simply succumbing to pressure from a small sector of the commercial industry.

In summary, this option eliminates immediate pressures on the Department at the cost of future embarrassment. As the UK is expected to have a system limited competitive lifetime, it would be expected that policy reformulation would be necessary in a few years time when future generation systems become available (e.g. Telidon).

4.3 Option B:

Allow the industry now to adopt any data broadcasting system on a fully operational basis - but still as an experimental service

The Department would specify only the maximum number (and position) of data lines per field, maximum allowable logic 'one' modulation level and data pulse spectrum[1], sufficient to protect the primary television transmission form interference.

Footnote: 1

In the case of the present test transmissions, two data lines per field have been allocated on an interim basis - 20(333) and 21(334). The binary "zero" data level is 0(±2)%, binary "one" data level is 66(±6)% - reference to peak white picture level. The one-bit data pulse is shaped such that its spectral content above 5MHz is minimal. Detailed consideration would be required as to the suitability of these parameter values, however they all represent realistic nominals.

The concept of allowing the industry to make their own individual choices is based on the following:

(a) UK Teletext is the only system available for immediate implementation. Many stations have studio source equipment capable of operating multi-page services - ATN-7 for example. In addition, some Australian suppliers have produced limited quantities of proto-type receivers for the UK system;

(b) Pressure is removed from the Department regarding the adoption of an Australian broadcast data standard; a final decision would be made in the future when the overall situation involving data services is clarified;

(c) The Department will have the opportunity to investigate the field performance of all systems by purchasing suitable test equipment. To date, the engineering investigations have been carried out primarily as office studies using overseas reports.

To summarise, this option allows the industry to begin fully operational services using first generation systems - UK Teletext and the presenting proposed French Antiope system. The cost of full scale commercial and technical trials would be borne by the entrepreneurs (and to which the Department might relate its further studies) in a full commercially competitive situation. Each station would provide its own selected system and the Australian public could be the judges. This mode of introduction might perhaps invite public irritation at viewers having to decide for themselves what system to invest in. The receiver manufacturing industry could perhaps be even more irritated. The prospect of sub-titling for the deaf could be compromised.

Manufacturers might be expected to mount a drive for standardisation, but even here, subject to constraints aimed at protecting the primary television picture transmission, the industry, broadcasters and the market might be encouraged to sort out such matters without Departmental paternalism.

It may be considered relative to the expected future developments in the field of data services involving later generation systems and techniques, that the facilities offered by the first generation (while being a necessary evolutionary development) are all limited and technically and socially insignificant in their impact. There is a view that as such they do not appear to warrant the forulation of major policy at this time. Adoption of this option may invite embarrassing precedents in other areas e.g. AM stereo which in any reasonable view should not be permitted to be introduced without a Government approved system of transmission.

4.4 Option C:

Continue the present policy of allowing "test transmissions", however permit stations to trial Antiope and Telidon, in addition to the UK system.

While both Antiope and Telidon have not yet been introduced as fully operational domestic services, it is possible to purchase studio source and decoder equipment for Antiope today; similar Telidon equipment will be available in 1980/81.

This option would allow both the Department and industry to thoroughly

evaluate, on an operational basis, the performance of the three competing systems. At present, it would be considered that the Government has a somewhat biased policy, allowing only trials of the UK system, although this is largely be default.

In addition to gaining operational experience, the continuance of the test transmissions will allow time for overseas developments to stabilise, particularly activities involving the CCIR and CCITT. It must be emphasised that it is unlikely that a single system standard will be ratified, however modifications to each of the systems are expected to allow simplified international data exchange.

Difficulty may however be experienced in expecting commercial stations to purchase expensive data equipment knowing that a considerable percentage would be discarded once a particular system was chosen. One method of implementing this option would be for the Department to purchase trial equipment and loan it to one or two stations for a fixed period - it would then be circulated to other stations. Such a proposal would cost $200,000 - $300,000 and it is doubtful it if should be recommended.

In summary, this option allows stations to test other systems without licence to commence operational services - it could be classified as a "wait and see" approach.

4.5 Discussion

The predominant difficulty involving the question of introducing data services (both interactive and non-interactive), relates to the present maturity of the three competing systems - British, French and Canadian.

The United Kingdom have pioneered the technology of data services (i.e. CEEFAX/ORACLE and PRESTEL), however as has been demonstrated throughout history, any new idea or invention is invariably subject to second, third and later generation modifications. For example, NTSC colour television was the first practical system in the world, however both the PAL and SECAM systems were devised to overcome limitations of the original NTSC. In effect, NTSC would be considered as a catalyst which allowed the development of more advanced systems. It must be remembered however that NTSC still exists in many countries (e.g. USA and Japan) despite its technical limitations.

Similarly, the Antiope system was devised by the French to overcome the deficiencies of the UK Teletext; Antiope was designed to use asynchronous rather than synchronous data transmission with operational advantages.

Telidon, a subsequent development by the Canadians, has been designed to overcome limitations of both British and French systems. The Telidon architecture allows independent from hardware technology while being able to take advantage of improvements in that technology.

Unfortunately, both the first generation Antiope and second generation Telidon are not yet available for commercial implementation, thus Administrations attempting to select the "best" possible system, face an obvious dilemma: Adopt the UK technology or await the full developments of the other systems. In this regard, the three options previously presented summarise the Department's possible actions.

If it is considered that Australia requires a broadcast data service as soon as possible, the then UK technology (Options A and B) represents the possible engineering solution. (The same comments

could apply to interactive services - Prestel being the only system presently available on a marketable basis).

If the introduction of a service is not required immediately, then Option C requires careful consideration. Option C can be considered as a stalling tactic allowing overseas developments to take place before any binding policy decision is taken.

4.6 Recommendation

A final recommendation cannot be advanced at this stage.

ATTACHMENTS

ATTACHMENT 1 - UK TELETEXT: AN ENGINEERING PROFILE

1.1 General

The BBC Ceefax Broadcast Teletext service together with the IBA Oracle service have been fully operational in the United Kingdom since November 1976. The two services are identical in that they both conform to the jointly published BBC/IBA/BREMA "Broadcast Teletext Specification" published in September 1976.

The aim of the Teletext service was to use a suitably equipped domestic television receiver, and the existing television channel which feeds it, to provide an extra service of written news and other information to the viewer.

Ceefax/Oracle uses the vertical blanking interval for the insertion (on a time-division-multiplexed basis) digitally encoded data signals representing "pages" of alphanumeric and simple graphic information.

The vertical blanking interval represents 8% of the 625 line video channel resource (on a time division basis). Obviously this can be directly related to lack of spectrum productivity; Teletext therefore can be considered as a means of improving video channel productivity.

1.2 System Requirements

The following represents the major requirements of domestic data broadcasting service as specified by the British:

(a) The capacity of the service should be large enough to allow the broadcaster to provide a comprehensive range of information;

(b) The information should be provided promptly so as not to try the patience of the user;

(c) The eventual cost of the receiving equipment should be reasonable;

(d) The display facilities should be such as to encourage the service editors to produce attractively varied presentations of data on different pages;

(e) The transmission of data should be accomplished without interfering with normal television viewings;

(f) The data signal should not place new and onerous requirements of the maintenance of broadcaster's distribution network;

(g) The service area of the data transmission should not be less than that of the associated colour television signal;

(h) The effects of transmission errors should be minimised;

(i) The transmission should be arranged so as to offer as many options as possible in the design of the receiving equipment;

(j) The form of the transmissions should facilitate future expansion of the service and not prejudice the future development of new user.

1.3 Transmission System

The nature of the broadcast television channel is such that numerous methods of adding a supplementary data channel are possible, however the use of the vertical blanking interval was finally chosen as the optimum.

After considerable investigation the British decided to use a Non-Return-to-Zero (NRZ) coding scheme operating at bit rate of 6.9375 Mb/sec (ie. 444f horizontal).

Within a given bandwidth, it was found that NRZ can be transmitted at least twice the bit rate of Biphase for the same resistance to noise. NRZ also withstands bandwidth limiting more readily than Delay Modulator because of the effects of intersymbol interference on Delay Modulation.

The two factors which frequency militate against the adoption of NRZ binary coding for data transmission are, first, that the data signal has a large low-frequency component and secondly that occasionally there is no timing information contained in an unconstrained NRZ binary signal.

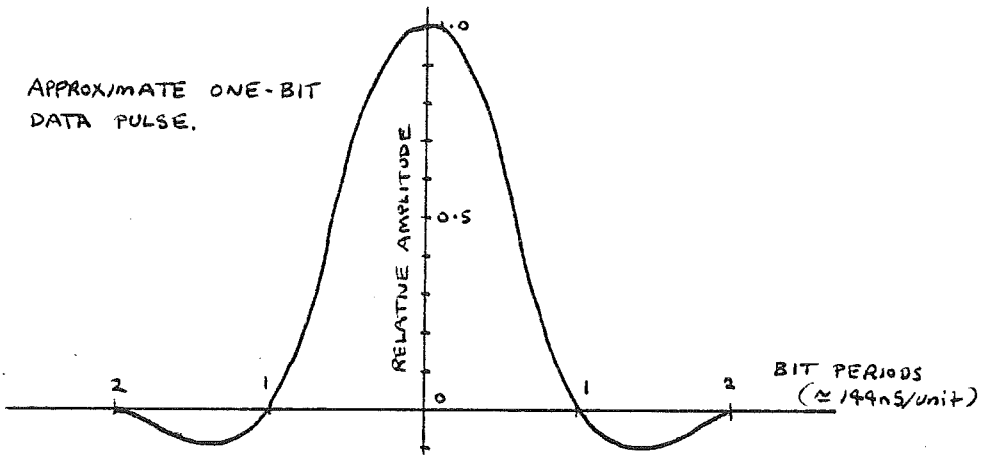
The DC component of the data signal can be dismissed as this is small compared to that of the picture APL, while timing information can be regenerated within the decoder by using a switchable synchronised oscillator. When insufficient data transitions occur (dependent on data) the parity bit ensures there is sufficient timing information to synchronise the decoder.

The transmission system for Ceefax/Oracle can be described as NRZ using primary coding operating at a signalling rate of 6.9375 Mb/sec, odd parity being used during "data" byte transmission. The address and page control information is protected by the use of hamming code to reduce the possibility of the wrong Character Row being stored in the receiver.

1.4 Data Nomenclature

The UK system was designed such that the complete row of displayed test together with the necesssary address information occupies a complete television scanning line. This approach was taken to both simplify and cheapen the data decoder and improve the systems data integrity in the presence of degraded transmission.

As a consequence, the binary transmission rate was set at 6.9375 Mb/sec or 444 times the line scanning rate of 15625 Hz, (a single data pulse can be considered a 1.44T pulse). The single data pulse is filtered before transmission to remove energy above 5.0 or 5.5 MHz, depending on the host television systems operational video bandwidth. In the United Kingdom, the use of System I permits 5.5 MHz video bandwidth, compared to the Australian 5.0 MHz for System B. The final pulse shape adopted is of the raised cosine variety - see figure below.



The data level differential between logic zero and logic one should ideally be as large as possible (700 mV), however due to problems of intercarrier buzz and data visibility in inadequately designed receivers, this ideal value requires compromise. UK experience suggests a value of 66(±6)% for logic one and 0(±2)% for logic zero, referenced to peak picture white level.

1.5 System Characteristics

Display Format: Twenty four rows of 40 characters; rows numbered from 0 to 23. Row 0 is the page header.

Character Sets: Both alphanumeric and mosaics are available; while the character set is suitable for Australia, difficulties would arise if the system was required for use in Europe. Multiple ROM character operation could be arranged using the unused control bits C12, C13 and C14.

Display Characteristics:

(i) Individual characters can be displayed in any one of seven colours: white, yellow, cyan, green, magenta, red and blue;

(ii) Characters can be double height - the top and bottom halves of the single page are displayed alternatively in this mode;

(iii) The background colour of the character rectangle is black during the "black" background mode. Whenever the new background control character occurs the display colour then set is adopted as the new background colour;

(iv) Characters can be made to flash on and off to catch attention of the viewer. The rate of flashing (½ Hz) is controlled by an oscillator within the data decoder;

(v) All characters intended for display on Newsflash of subtitle pages will be in the Boxed mode, which defines the part of the page which is to be inserted (keyed) into the normal television picture.

(vi) Conceal/Reveal: The conceal mode inhibits the display of certain specified characters - selecting the reveal mode (at the receiver) permits display of previously hidden characters. The facility is used for quizzes and games and is particularly suited to programmed learning.

1.6 Page Access Time

The following page access time data is applicable to the Australian television system - System B.

Number of Characters/Line: 40
Number of Rows/Page : 24

Useful data bytes/TV line[1]: (5) + 40
Data rate : $444f_H$ (6.9375 Mb/sec)

Page rate (full page)[2]: 4.16 pages/sec
Access time (100 pages): 24 sec

1. The figure shown in () are used for synchronisation purposes.
2. Based on 2 Teletext lines/field.

1.7 Conclusion

UK Teletext was the first broadcast data service in the world and as such credit should be directed to the engineering teams responsible.

From an engineering viewpoint, the UK Teletext system has two disadvantages:

(i) The use of the 6.9375 Mb/sec transmission rate results in the data being more susceptible to corruption by transmission anomalies (eg. short-term reflections), poor receiver RF and IF performance and/or inadeuq-te antenna/feeder performance;

(ii) The graphics facilities are extremely elementary - perhaps more an afterthought than an original design feature.

With respect to the transmission rate, many argue that no serious data corruption results due to its use, however experience to date in Australia indicates exception - particularly on Band I. Examination of overseas literature report little field testing on low-band channels, and as Australia uses many such allocations (particularly the ABC) caution should be observed.

As the integrity of the broadcast data service is dependent on accurate demodulation of the transmitted video signal, it is not totally unexpected that low-band transmission could effect error performance. (Antenna directivity and feeder losses are both lower when using low-band transmission).

Obviously, this potential problem faces any system, however methods have been suggested (and will be implemented) to overcome the overall problems of data corruption caused by transmission problems. The use of advanced error correction schemes and reduction of the transmission rate represent practical solutions.

The graphics facilities of UK Teletext have always been considered by the British as totally adequate for a "text" service as it is only necessary to display elementary images. As technology now allows improvements in resolution, the overall usefulness of a data system can be significantly enhanced over that provided by a first generation system.

ATTACHMENT 2 - ANTIOPE: AN ENGINEERING PROFILE

2.1 General

In 1973, the Centre Commun d'Etudes de Television et Telecommunications (CCETT) undertook the development of a service which was given the name: Acquisition Numberique et Televisualisation d'Images Organisees en Pages d'Ecriture or as an acronym, Antiope. In English, this roughly translates as: digital acquisition and visual display of pictures presented as pages of lettering.

The Antiope system has been designed to provide interactive, broadcast (or mixed) operation, the type of service depending on the nature of the data transmission path employed. Current implementations of Antiope are by the data broadcasting network (Didon) and the public switched telephone and data networks.

Antiope, unlike the United Kingdom Broadcast Teletext system, was not designed around a particular television standard. Instead, the French have developed the Didon digital data transmission system which is compatible with all present television standards.

2.2 Didon - The Data Broadcasting System

Didon is a data packet broadcasting system which can be used to supplement the existing analogue television transmissions; it has been designed to improve the spectrum productivity of the analogue television video channel. Didon data packets (each corresponding in time duration to one television scanning line) can be inserted within the vertical blanking interval, or even on a full field basis. Didon is not a Teletext system but a supplementary data channel which normally utilises unused video line time slots.

2.3 The Didon Data Packet

A data packet can be considered as a two part block of non-return-to-zero (NRZ) binary bits. In the case of the French television standard (Standard L), the total packet consists of 40 octets; the first 8 octets are termed the header, the remaining 32 octets being the actual data for transmission. Figure 2a diagrammatically represents the header/data block packet, while figure 2b defines the packet header.

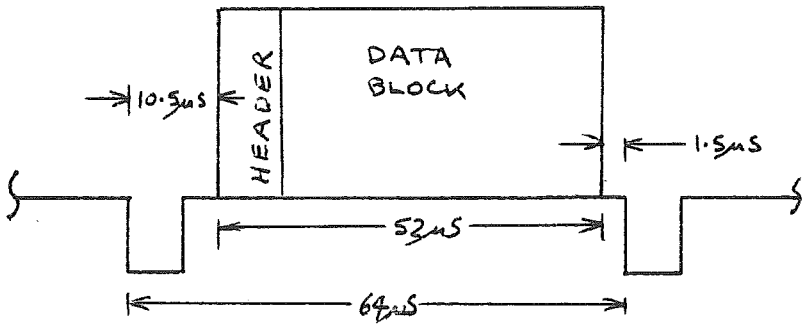


FIGURE 2a - Didon data packet for television system B

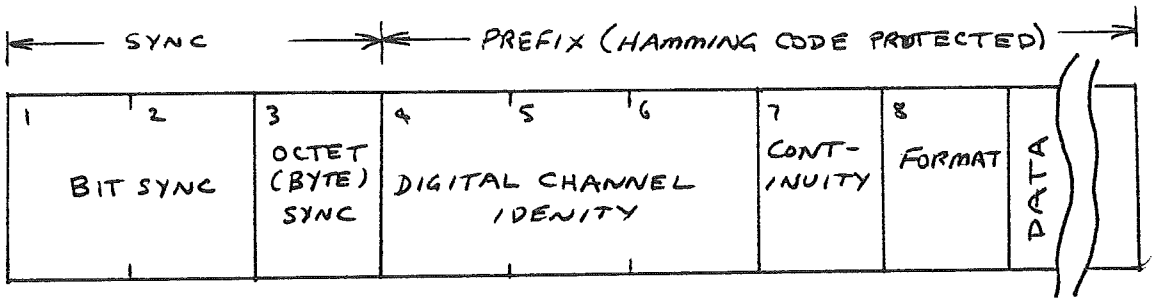


FIGURE 2b - The Didon packet header structure

As in the UK Teletext System, the first three header octets are used for synchronisation of the data receiver. Octets 1 and 2 provide bit sync (a string of alternating 1 and 0 logic levels), while octet sync involves the transmission of a fixed framing code which is matched to a hardware receiver reference. Careful choice of this code ensures that octet sync is maintained even in the presence of a single bit error.

The remaining five octets (4 to 8), collectively form the packet prefix, this information acting as block management for the remaining data. Octets 4, 5 and 6 provide digital channel identification, Octet 7 is a continuity index used to verify that no packet has been lost in transmission, while Octet 8 indicates the size of the data block.

In certain respects there are similarities between a UK Teletext transmission and the Didon data transmission technique. Didon however is a digital data broadcasting channel and not in itself a Teletext system. Any form of digital information can be transmitted over Didon, the actual bit data either synchronous or asynchronous to the television line scanning rate. (The data packet is always synchronous to the line scanning rate, however the actual data octets (bytes) need not represent implied specific character positions on an alphanumeric display).

2.4 Didon Field Performance

Of fundamental importance in a digital information transmission channel is the error rate; additionally as Didon is a supplementary service, it is essential that the received quality of the conventional analogue television transmission be comparable with that of the data service. Obviously, the public would not accept a product inferior in quality to that which it currently enjoys.

The CCETT have conducted field trials into the performance of Didon; pseudo-random test sequences designed to thoroughly exercise the digital channel have indicated that 85% to 90%* of the French population would have a maximum error rate of 10^{-4}, this value considered to be satisfactory for foreseeable services.

*85% corresponds to urban areas, 90% to country (mountainous) areas.

Detailed analysis of field results indicate that in 83% of observed cases, errors are single bit; in 85% of cases, double bit errors occur. In addition, in 80% of cases a single bit was incorrect in a particular data packet. These results suggest that the implementation of simple error correcting procedures would improve channel performance without significant reduction in data flow.

2.5 Didon and Data Rate

The Swiss PTT in September 1978 undertook extensive field trials into the NRZ coded data signal using three different bit rates; 6.9, 6.2 and 4.3 M bits/sec. These trials were conducted with the co-operation of CCETT. Forty-five sample signals at 16 different locations were investigated with three types of receiver (envelope, synchronous and quasi-synchronous detectors). Based on a limiting bit error rate of 10^{-4} and a transmission speed at 6.9 M bits/s, it was found that a reduction of bit rate by 10% increased the number of samples with successful data reception by 13%.

The 10^{-4} bit error rate chosen as a limit value for satisfactory data transmission would result in (based on the UK Teletext standard) a text page quality between criteria B (no errors in three selections of a page) and C (no errors in one repetition of a page). It is interesting to note that the trials showed no significant performance difference between synchronous and envelope demodulation; short term reflections being the main cause of data errors.

2.6 The Antiope Data Broadcasting System

Having discussed the transmission system of Antiope (Didon), it remains to describe the facilities of the actual system.

Display Format: Twenty-five rows of 40 characters; rows numbered from 0 through 24. If required, row 0 can be inhibited from the display.

Character Sets: Both alphanumeric and mosaics are available; decoders presently manufactured in France contain a character generator with 254 shapes including all Latin and Cyrillic. The graphic characters total 128.

Display Characteristics:

(i) Individual characters can be displayed in any one of eight colours: black, white, blue, green, red, yellow, magenta and cyan;

(ii) Characters can be double height and/or double width;

(iii) The character background colour can be transposed with character colour;

(iv) Characters can be flashed between normal and transposed colour (as in (iii)) at a low frequency rate (e.g. 0.5 Hz);

(v) The 'box' mode permits messages to be inserted within the active picture area of a conventional television broadcast. The box removes a section of the displayed picture such that text can be keyed in. As with flashing, boxing is useful for newsflash items; additionally it can be used for subtitling;

(vi) Conceal/Reveal: The conceal mode inhibits the display of certain specified characters - selecting the reveal mode (at the receiver) permits display at the previously hidden characters. The facility is used for quizes and games and is particularly suited to programmed learning.

2.7 Page Access Time

In all Broadcast Teletext systems, the data-base for transmission is sequentially scanned (page by page) and transmitted in a bit serial fashion. Once the end of a magazine is reached, the system automatically repeats the page sequence. As the digital channel has a certain data transmission rate limit (a function of bit rate and the number of lines allocated per field to Teletext), a compromise must be reached with regard the number of magazine pages and page access time. (Access time is defined as the time duration between requesting a particular page and being able to view that page).

In the case of Antiope, the following access time data is valid for the Australian TV standard (System B). The figures in square brackets relate to the UK based CEEFAX/ORACLE system for comparison purposes.

Number of Characters/Line	: 40	{40}
Number of Rows/Page	: 25	{24}
Useful data bytes/TV line[1]	:(8) + 32	{(5) + 40}
Data rate	:397fH; 6.203125 Mb/s	{444fH; 6.9375 Mb/s}
Page rate (full page)[2]	: ≈3.2 pages/sec	{≈4.16 pages/sec}
Access time (100 pages)	: 31.25 sec	{ 24 sec}

1. The figure shown in () are bytes used for synchronising purposes.
2. Based on 2 Teletext lines/field.

The data presented above indicates that the "Access-time" of the Antiope Teletext system is approximately 30% greater than for CEEFAX/ORACLE. If however the Antiope data rate was increased to 6.9 Mb/s, (as is the case for CEEFAX/ORACLE), the "Access-time" differential reduces to approximately 13%. This reduction in transmission rate is caused by the need to transmit additional housekeeping information (ie. packet header; bytes 4, 5, 6, 7 and 8) and slightly larger page size (1000 characters for Antiope, 960 for CEEFAX/ORACLE).

2.8 Conclusion

The foregoing summary has highlighted the salient features of the Antiope Videotex/Teletext system - in particular the Broadcast Version of Antiope.

Unfortunately, it has not been possible to field test Antiope under Australian conditions; hopefully an opportunity will occur in the near future if a full system appraisal is to be attempted.

Sofratev, the French company marketing Antiope worldwide, proposed at the recent IREECON '79 in Sydney, a version of Antiope suitable for use with the Australian television standard. A data transmission rate of 6.203125 Mb/s (397 fH) was chosen - this is approximately 10% less than that used in the UK Teletext system. Based on the same number of active Teletext lines per field, Antiope would be 30% slower in response time.

A major feature of Antiope is its ability to be used with different types of data transmission paths; in the case of the Broadcast Antiope, the use of the Didon data packet transmission system permits lower bit rates to be utilised without need to reduce the actual page size - bit rate and page size are independent.

Finally, it should be noted that Antiope is not yet available as a public service. Work performed by the French subsidiary of Texas Instruments has lead to the development of LSI custom integrated circuits which will form the basis of "consumer" decoders. It is expected that an operational system will be available for implementation in late 1981, early 1982.

ATTACHMENT 3 - TELIDON: A BRIEF ENGINEERING REVIEW

3.1 Introduction

It is difficult at this point in time to produce a consolidated report on the Telidon Videotex system; this difficulty relates to the infancy of the system - Telidon is only 15 months of age. Fortunately, the system architecture is sufficiently developed and defined to contrast Telidon against UK Teletext and Antiope.

3.2 System Description

Telidon differs from both UK Teletext and Antiope in several important respects; the following summary highlights the major differences between these character-orientated systems and Telidon.

Telidon describes images through the use of Picture Description Instructions (PDIs) together with associated data. By using terminals with sufficient intelligent to interpret these PDI codes (and data) it is possible to introduce independence between the systems and hardware. This independence has three major consequences:

(i) Both high resolution graphics and alpha-photographic transmission (facsimile) modes are possible;

(ii) The format of the data base is dependent of the system architecture. (This independence means that the system could be modified or replaced in the future, without the need to change expensive data bases);

(iii) Telidon exhibits forward/backward compatability. (In the future, the then generation of terminals, together with earlier generations and later generations, will all be compatable with the system. Each terminal generation however will perform to the limit of its own capabilities - eg. terminals with low resolution displays will simply truncate high resolution data).

3.3 Picture Description Instructions

Alpha-numeric transmission in the Telidon system is similar to that used for both Antiope and UK Teletext, however in the grpahics mode of operation the seven Telidon PDI codes (each of 7 bits plus 1 bit parity) allow images to be described in drawing primitives such as line, area, arc etc. The full set of seven PDI codes are listed below:

POINT - sets the drawing beam to any position in the display space and optionally draws a point

LINE - draws a line based on its end points

ARC - draws a circular arc based on the end points of the arc and its radius. The end points of the arc may be joined by a chord or by lines to the radius point and the area so defined optionally filled in

AREA - draws a rectangular outline or fills in an area of specified length and width

POLYGON - draws a polygon outline or fills in the circumscribed area based on a series of defined vertices.

BIT - draws an image point-by-point, or run-length encoded, in a similar manner to the operation of facsimile equipment.

CONTROL - provides control over the modes of drawing commands. One of its major functions is to set up the colour of an object

PDI graphics are analogous in many ways to the sentence structure of text messages. Sequential characters form an instruction "word", a series of words form a graphic sentence, and a series of sentences compose a full graphic picture. The instructions are all accompanied by data which actually define vertices, radius etc.

The use of a sentence structing technique means that simple graphic images require only a short group of defining sentences, while more complex images may require scores of defining sentences. For example, a simple graphic in the present Canadian Department of Communications demonstration data base has approximately 800 8 bit bytes, while complex pages have 3000 bytes. Obviously the variable length of pages means that economies in data transmission can be realised over fixed format transmission.

3.4 "Broadcast" Telidon

To date, the Telidon system has been demonstrated (as was the case in Australia) in the "wired" configuration only. As the system is universal with regard data transmission technique, it is of course possible to adopt Telidon to broadcast operation - either using a vertical interval or on a full channel basis. Trials of a broadcast version are just beginning in Canada, however no finalised detail has yet been published on the specifications (ie. modulation system, error correction technique, data transmission rate and page access time).

Despite this lack of information, the Canadians have published the basic design considerations of the proposed broadcast version:

a) Compatable with existing television broadcast signals;
b) Flexible encoding/decoding scheme adaptable to one-way or two-way services;
c) Compatible with existing Telidon coding methods;
d) Adaptable to various broadcast services as well as being suitable for Broadcast Videotex;
e) Minimise decoder hardware complexity at the expense, if necessary, of complexity at the encoder;
f) Forward error correction capabilities to minimise the need for repeat transmissions at high data rates.

In addition, it has been indicated that the coding format to be used is similar to Antiope in that a "line of data" consists of a Header followed by the data, however an additional Error Correction Character (ECC) will be added to the end of the data sequence.

To summarise, the broadcasting industry worldwide awaits with interest the final specifications to be adopted for Broadcast Telidon. It would be expected that the Canadians will firm up their specifications some time in 1980, on completion of their field trials.

3.5 Conclusion

Telidon can be described as a second generation data system suitable for both interactive and non-interactive operation.

The systems overall capabilities are superior to those of UK Teletext and Antiope - in addition Telidon's flexibility allows optimisation of the hardware to a particular situation.

Telidon's major (and only) disadvantage is that it is not available for immediate implementation. Today it is difficult to predict precisely when the system will be available for implementation, however a guess estimate would be 2 to 3 years.

ATTACHMENT 4 - ORGANISATIONS RESPONDING TO THE DEPARTMENTAL DISCUSSION PAPER ON BROADCAST TELETEXT

In response to the Departmental discussion paper on the introduction of Broadcast Teletext within Australia, the following organisations submitted comment:

Amalgamated Television Services Pty Ltd
Television Centre
EPPING NSW 2121

Australian Broadcasting Commission
SYDNEY NSW 2000

Australian Electronics Association
NEUTRAL BAY NSW 2089

AWA-Thorn Consumer Products Pty Ltd
RYDALMERE NSW 2116

AWA-Thorn Consumer Products Pty Ltd
RYDALMERE NSW 2116
(second submission)

Canberra Television Ltd
CHATSWOOD NSW 2067

Mr D.A. Drake esq
EPPING NSW 2121

Educational Technology Centre
(SA Education Dept)
ADELAIDE SA 5000

Electronic Importers Association
SYDNEY NSW 2000

Federation of Australian Commercial Television Stations
SYDNEY NSW 2000

Federation of Australian Radio Broadcasters
MILSONS POINT NSW 2061

Goulburn-Murray Television Ltd
SHEPPARTON VIC 3630

Newcastle Broadcasting and Television Corporation Ltd
NEWCASTLE NSW 2300

Department of Agriculture
NSW Government
SYDNEY NSW 2000

OTC (Australia)
Martin Place
SYDNEY NSW 2000

Philips Electronic Systems
CLAYTON VIC 3168

South Australian Telecasters Ltd (SAS 10)
GILBERTON SA 5081

Swan Television and Radio Broadcasters Ltd
TUART HILL WA 6060

Telecom Australia
SYDNEY NSW 2001

Texas Instruments Australia Ltd
NORTH RYDE NSW 2113

ATTACHMENT 5 - TERMINOLOGY

Confusion appears to exist within the industry as to the terminology regarding "Teletext" - the following summary will hopefully clarify the situation.

(a) Two fundamental forms of public data service are possible:

(i) Interactive data services characterised by the use of a bi-directional data communication channel - for example, the conventional telephone line equipped with suitable data modems;

(ii) Non-interactive data services characterised by the use of a uni-directional data communications channel - for example, "piggy-back" data signals accompanying a conventional analogue television transmission inserted during the vertical blanking interval.

(b) "Wired Teletext" or "Videotex" are terms synonymous with 'interactive data service'.

'Broadcast' Teletext is a term synonymous with 'non-interactive data service'.

(c) In many instances, the term "Teletext" is used to describe the general classification of non-interactive services; additionally some writers use the same term when talking about the United Kingdom's broadcast data service - this leading to some confusion.

In this document the term "Teletext" is normally proceeded with "UK" to indicate reference to their actual system. (The BBC/IBA use the marketing name CEEFAX and ORACLE respectively, both services conforming to the BBC/IBA/BREMA Broadcast Teletext specification, September 1976.

(d) The term "Hybrid" represents that class of data service using a combination (for example) of a telephone line for data request and a television broadcast channel for data distribution. This type of future service is presently undergoing evaluation within the USA as it represents a realistic means of providing comprehensive public data systems.

The hybrid service is an attempt to optimise the request and distribution data channels to data traffic flow. Obviously, data requests require only a small volume of transmitted information while data distribution necessitates a means of high volume transmission.

(e) The following table of information provides a summary of the various marketing names used by different countries to describe data services:

Country of Origin	Non-Interactive (Broadcast)	Interactive (Videotex)
United Kingdom	CEEFAX (BBC) ORACLE (IBA)	PRESTEL formerly "Viewdata"
France	ANTIOPE	TELETEL
Canada	TELIDON	TELIDON
Japan	CAPTAINS (designed for ideographic language)	-

ATTACHMENT 6 - REFERENCES

Major References:

(a) Broadcast Teletext Specification,
BBC/IBA/BREMA joint publication,
September 1976

(b) Antiope/Videotex,
Technical Information,
May 1979
SOFRATEV, France

(c) IEEE Transactions on Consumer Electronics
Special Issue,
Teletext and Viewdata,
July 1979, No. 3 ISSN 0098-3063

(d) A General Description of Telidon:-

A Canadian Proposal for Videotex Systems,
CRC Technical Note No. 697-E
Department of Communications, Canada
December 1978

Miscellaneous References:

A considerable number of overseas reports and documents have been collected on the general subject headings of Teletext, Videotex, etc, over the past twelve months.