REPORT 1073-1

TELEVISION STANDARDS FOR THE BROADCASTING-SATELLITE SERVICE

(Question 2/10 and 11, Study Programme 2F/10 and 11)

(1986-1990)

1. Introduction

The present Report briefly describes in a comparative manner the basic characteristics of some of the systems which have been developed for television transmission with sound and data services for satellite broadcasting. Recognizing that there are advantages in reducing the number of modulation methods and the differences in the characteristics of these modulation methods, the basic parameters of each system were used to produce tables which stress the similarities between systems. Only fully specified systems adopted, or being seriously considered for adoption, by at least one administration, were considered in these tables. The detailed specifications of these systems are contained in a separate CCIR publication (Specifications of transmission systems for the broadcasting-satellite service).

Special considerations should be given to those systems that have adopted the general principle of time-division multiplexing since it permits an improvement in the quality of the signals by eliminating, in particular, the problems of intermodulation and cross-colour. A time-division multiplex structure also permits subsequent compatible introduction of further services or further improvements to the quality of the basic services. For example, wide-screen aspect ratio pictures can be transmitted. Displays of the 4:3 type can present the most interesting portion of the picture, selectable by a digital data signal. Further details are given concerning these improvements to the vision signal in Report 1074.

All systems described in this Report apply digital techniques for the sound (and for the data) in order to utilize to the greatest possible extent the capacity made available by the channels defined by the WARC-BS-77 and the RARC SAT-83, taking into account if necessary the need for direct translation on distribution networks with narrower bandwidths. The use of a sound/data multiplex (associated with the service-identification system) making available the capacity required, and at the same time the maximum flexibility, is also a very important asset. Possibilities of scrambling the signal for secure transmission and controlled reception are increasingly viewed as an important feature of such systems.

This Report presents a short summary of the main features of each of the fully specified systems considered. It is followed by tables listing values for the main characteristics of each system.

2. Summary description of the systems

2.1 *MAC/packet family*

The MAC/packet family of standards has three members all suited to satellite broadcasting: C-MAC/packet, D-MAC/packet and D2-MAC/packet. These systems have been optimized under different constraints and meet the various broadcasting-satellite service requirements in the 12 GHz band when the 625 line standard is used with a satellite channel of 27 MHz bandwidth.

The systems incorporate the following common features:

- time division multiplexing;
- MAC picture coding, with the capacity for extended aspect ratio (see Report 1074);
- packet multiplexing for sound and data;
- digital high and medium quality sound coding and error protection method (see Recommendation 651 and Report 632);
- service identification and conditional access systems with video and audio scrambling [CCIR, 1986-90a, b].
- full channel digital mode, when the area of the television frame normally reserved for the MAC vision signal (and its blanking interval) is replaced by data burst (see Report 1228).

The clock frequencies used in these three systems have simple relationships with the sampling frequencies of the digital studio standard defined in Recommendation 601.

This close relationship between these systems allows for the development and introduction of receivers capable of functioning with all of the standards.

2.1.1 *C-MAC/packet*

The C-MAC/packet system was, in part, developed to provide a high data channel capacity.

The particular features of the C-MAC/packet system are:

- the use of an RF time division multiplex wherein the carrier is frequency modulated by analogue picture signals during a certain fraction of line duration and 2-4-PSK modulated during the remainder of the line duration by a multiplex conveying several sound channels, synchronization and data signals;
- the capacity of the sound/data multiplex is about 3 Mbit/s, equivalent to eight high quality sound channels of 15 kHz bandwidth with near instantaneous 14/10 bit companding (protected by one parity bit per sample). The spare data capacity can be used for other services.

The C-MAC/packet system was adopted by the United Kingdom in 1983 and by Finland, Iceland, Norway and Sweden in August 1984* for broadcasting-satellite services.

2.1.2 D-MAC packet

The D-MAC/packet system was, in part, developed to provide both a high data channel capacity and a single baseband interface to other transmission and distribution media.

The particular features of the D-MAC/packet system are:

- a baseband time division multiplex in which the analogue picture signals are combined with duobinary encoded digital sound, synchronization and data signals;
- the capacity of the sound/data multiplex is about 3 Mbit/s, equivalent to eight high quality sound channels of 15 kHz bandwidth with near instantaneous 14/10 bit companding (protected by one parity bit per sample). The spare data capacity can be used for other services;
- the single baseband representation of the time division multiplex signal is frequency modulated for satellite broadcasting.

* The adoption was also supported by the Administration of Denmark.

The D-MAC/packet system has been under further investigation by experts of a number of organizations and has been shown to be also suitable for satellite broadcasting.

As a result of these developments, the United Kingdom now intends to use the D-MAC/packet system for broadcasting-satellite services.

2.1.3 *D2-MAC/packet*

The D2-MAC/packet system was, in part, developed to provide a single baseband interface to other transmission and distribution media.

The particular features of the D2-MAC/packet system are:

- a baseband time division multiplex in which the analogue picture signals are combined with duobinary encoded digital sound, synchronization and data signals;
- the capacity of the sound/data multiplex is about 1.5 Mbit/s, equivalent to four high quality 15 kHz sound channels with near instantaneous 14/10 bit companding (protected by one parity bit per sample). The spare data capacity can be used for other services;
- the single baseband representation of the time division multiplex signal is frequency modulated for satellite broadcasting.

The Federal Republic of Germany and France have adopted the D2-MAC/packet system for operational use with their broadcasting-satellite services (TV-SAT and TDF-1)* when implemented.

2.2 *B-MAC systems*

Two closely related implementations of the B-MAC system have been developed for 525 and 625 line applications. Both systems are well suited to use in broadcasting-satellite service applications in the 12 GHz band using either 24 MHz or 27 MHz channelling.

The B-MAC signal is a baseband time division multiplex comprising analogue picture signals combined with a four (or two) level data burst containing digital sound, synchronization and data information.

Vision signal coding is performed using the same time compression factors as the C-MAC/packet and D2-MAC/packet systems. The clock frequencies of 625/50 and 525/60 B-MAC systems are the same multiples of the relevant line scan frequencies to permit use of the same integrated circuit devices for both systems. In the 525 line version the clock frequencies are simply related to the NTSC sub-carrier frequency, facilitating simple transcoding to NTSC. Both B-MAC systems can be configured to permit transmission of pictures with 16:9 aspect ratios.

The B-MAC systems provide a total data capacity of about 1.6 Mbit/s. This can be used to provide six high quality 15 kHz audio channels using adaptive delta modulation which features error concealment and parity protection (see Report 953); alternatively these channels may be configured as 204 kbit/s data channels. A utility data channel makes use of spare capacity in the data multiplex.

Included in the B-MAC structure is a conditional access system based on line translational scrambling for video, and data encryption for digital audio. Because of the high degree of commonality between the 625 and 525 line B-MAC systems it will be possible to develop a single receiver capable of receiving either B-MAC system.

The B-MAC system provides a single baseband interface to other transmission and distribution media.

The 625 line B-MAC system has been adopted in Australia for the Homestead and Community Broadcasting-Satellite Service (HACBSS) which commenced operation in October 1985.

The 525 line B-MAC system is under active consideration by the Direct Broadcasting Satellite Association and the Advanced Television Systems Committee in the United States and also by Canada.

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* Direct broadcasting 12 GHz band satellites of the Federal Republic of Germany (TV-SAT) and of France (TDF-1)."

2.3 *Digital sub-carrier/NTSC system*

In this system a digital sub-carrier is frequency multiplexed with the conventional NTSC vision signal. It has been developed for use in the broadcasting-satellite service.

The vision parameters of the system are based on those of system M/NTSC described in Report 624, thus the system is compatible with the terrestrial vision standard.

The sound/data signals are carried on a 5.73 MHz sub-carrier using differential 4-phase shift keying. This sub-carrier, together with the vision signal, frequency modulates the main carrier. The data capacity of the system is about 2 Mbit/s. This can provide four 15 kHz high quality audio channels using 14/10 bit near instantaneous companding, or two 20 kHz very high quality channels through the use of 16 bit linear coding. An additional data channel is also provided in both cases. Both schemes use BCH (63,56) coding error protection.

This system was adopted by the Japanese Administration in 1982 for use with its operational broadcasting-satellite service. This service commenced operation in May 1984 using BS-2a; it conforms to the WARC-BS-77 Plan.

Detailed specifications have been defined for the data channel, the capacity of which varies from 224 to 1 760 Kbps depending on the mode of sound transmission. A packet multiplexing scheme is used for the data channel (see Report 954, section 4.1) [CCIR, 1986-90c].

TABLE I – *Vision/data multiplex structure*

	Parameter/System	MAC PACKET SYSTEMS			B-MAC (625 line)	B-MAC (525 line)	Digital sub-carrier/ NTSC
		C	D	D2			
General parameters	1.1 Modulation frame frequency (Hz)	25				29.97	
	1.2 Number of lines per picture (frame)	625				525	
	1.3 Line frequency (Hz)	15 625				15 734	
	1.4 Number of time increments per line	1 296			1 365		–
	1.5 Nominal reference clock frequency (MHz)	20.25			21.328	21.477	–
Multiplex structure	1.6 Multiplexing principle	Radio frequency	Baseband				Sub-carrier
	1.7 Vision coding	Time multiplexed analogue components					Composite (1)
	1.8 Nominal transmitted vision bandwidth (MHz)	8.4 (2)			7.5 (2)	6.3 (2)	4.5
	1.9 Nominal vision amplitude (V peak-to-peak (3)	1.000					
	1.10 Data coding	See § 4.2 of Table IV	Duobinary		Quaternary/binary (4)		See § 4.2 of Table IV
	1.11 Symbol rate (Mbaud)	20.25		10.125	7.11	7.16	2.048
	1.12 Occupied data spectrum (MHz)	Not applicable	10.0	5.0	7.11 (5)	7.16 (5)	1.2
	1.13 Nominal data amplitude (V peak-to-peak) (3)	Not applicable	0.800	0.800	0.770		See Table IV
	1.14 Number of bits per symbol	1			2/1 (4)		1

TABLE I *(continued)*

	Parameter/System	MAC PACKET SYSTEMS			B-MAC (625 line)	B-MAC (525 line)	Digital sub-carrier/ NTSC
		C	D	D2			
Multiplex structure	1.15 Instantaneous bit rate (Mbit/s)	20.25		10.125	14.22/7.11 (4)	14.32/7.16 (4)	2.048
	1.16 Multiplex description (6)	Flexible (7)			Rigid		–
	1.17 Basic frame multiplex configuration	See Fig. 1					–
	1.18 Basic line multiplex configuration	See Fig.2(a)	See Fig.2(b)	See Fig. 3	See Fig. 4		–
Reference signals	1.19 Synchronization principle	Digital code word					Vision: (1) Data: digital code word
	1.20 Clock recovery	Recovered from data			10 cycle (20 symbol) reference burst on each line		–
	1.21 Line synchronization	6 bit word			Not applicable		(1)
	1.22 Frame synchronization	64 bit word in line 625			1 131 symbols in line 2 (8)		16 bits/data frame
	1.23 Reference level for video and data clamping	Constant level			Average level of 20 symbol (binary) reference burst in HBI		Vision: (1) Data: irrelevant
	1.24 Clamp period (μs)	0.75			2.81	2.79	Vision: (1) Data: irrelevant
	(number of clock periods)	15			60		
	1.25 AGC reference level (V) (3)	± 0.500 relative to clamp level on one line per field in the VBI			−0.500 relative to clamp level on one line per field in the VBI		–

Footnotes to Table I

(1) The system is based on baseband characteristics of the M/NTSC system (see Report 624).

(2) In each case this bandwidth is below the limit imposed by the sampling frequency (see Report 1074).

(3) All voltages are measured with respect to a 75 Ω load.

(4) Two data coding implementations are possible. Firstly a quaternary system with 2 bits per symbol and secondly a more rugged binary code.

(5) Before transmission, the spectrum is intentionally bandwidth-limited by 6.3 MHz filtering.

(6) The multiplex structure may be compatibly reconfigured for full field data.

(7) By description of each component in terms of time increments and line numbers in line 625.

(8) This is line two of the B-MAC format, equivalent to PAL line 625.

TABLE II – *Vision coding*

	Parameter/System	MAC packet C, D, D2	B-MAC (625 line)	B-MAC (525 line)	Digital sub-carrier/ NTSC
General video parameters	2.1 Scanning method	Left to right, top to bottom			
	2.2 Active lines per frame	574		483	
	2.3 Spare lines per frame (available for additional services and test signals)	47	21/38 (1)		24
	2.4 Interlace ratio	2 : 1			
	2.5 Aspect ratio	4 : 3 (2)			4 : 3
	2.6.1 Assumed gamma of display	2.8		2.2	
	2.6.2 Overall gamma	1.2		1.0	
	2.7 Primary colour chromaticities:		x	y	
	Red:		0.67	0.33	
	Green:		0.21	0.71	
	Blue:		0.14	0.08	
	2.8 Chromaticity coordinates for equal primary signals $E'_R = E'_G = E'_B$	Illuminant D_{65} $x = 0.313$, $y = 0.329$			Illuminant C $x = 0.310$, $y = 0.316$
	2.9 Luminance signal equation	$E'_Y = 0.299\ E'_R + 0.587\ E'_G + 0.114\ E'_B$			
	2.10 Colour difference signal equations	$E'_R - E'_Y = 0.701\ E'_R - 0.587\ E'_G - 0.114\ E'_B$ $E'_B - E'_Y = -0.299\ E'_R - 0.587\ E'_G + 0.886\ E'_B$		$E'_I = -0.27\ (E'_B - E'_Y) + 0.74\ (E'_R - E'_Y)$ $E'_Q = 0.41\ (E'_B - E'_Y) + 0.48\ (E'_R - E'_Y)$	

TABLE II *(continued)*

	Parameter/System	MAC packet C, D, D2	B-MAC (625 line)	B-MAC (525 line)	Digital sub-carrier/ NTSC
Luminance	2.11 Number of clock periods	696	750		Not applicable (3)
	2.12 Compression ratio	3 : 2			
	2.13 Nominal sampling frequency (MHz)	13.500	14.219	14.318	
	2.14 Uncompressed bandwidth (MHz) (nominal)	5.6 (4)	5.0 (4)	4.2 (4)	4.5
	2.15 Reference black level (V) (5)	−0.500 relative to clamping level			Not applicable (3)
	2.16 Transmitted luminance signal equation (V) (5)	$-0.500 + E'_Y$			
	2.17 Amplitude range (V peak-to-peak) (5)	From −0.500 to +0.500			
Chrominance	2.18 Number of clock periods	348	375		
	2.19 Compression ratio	3 : 1			
	2.20 Sampling frequency (MHz)	6.750	7.109	7.159	
	2.21 Uncompressed bandwidth (MHz) (nominal) (6)	2.4	2.1		
	2.22 Zero chrominance reference level (V) (5)	0.000 relative to clamping level			
	2.23 Transmitted chrominance signal equations (V) (5)	$E'_{DB} = 0.733\ (E'_B - E'_Y)$ $E'_{DR} = 0.927\ (E'_R - E'_Y)$	$E'_{DB} = 0.694\ (E'_B - E'_Y)$ $E'_{DR} = 0.926\ (E'_R - E'_Y)$		

TABLE II *(continued)*

	Parameter/System	MAC packet C, D, D2	B-MAC (625 line)	B-MAC (525 line)	Digital sub-carrier/ NTSC
Chrominance	2.24 Amplitude range ([7]) (V peak-to-peak) ([5])	From −0.500 to +0.500			Not applicable ([3])
	2.25 Sequential transmission	E'_{DB} transmitted on odd active lines of each field E'_{DR} transmitted on even active lines of each field			
	2.26 Vertical pre-filtering ([8])	Filter parameters left to choice of broadcaster	0.25, 0.5, 0.25		
	2.27 Coincidence between luminance and chrominance	Chrominance is transmitted one line before associated luminance			
Scrambling process	2.28 Scrambling process for conditional access	Double cut component rotation or single cut line rotation	Line translation		Under consideration

([1]) The lesser figure pertains to a full conditional access system.
([2]) The systems can also provide for an aspect ratio of 16 : 9.
([3]) The system is based on baseband characteristics of the M/NTSC system (see Report 624).
([4]) This bandwidth may be extended to approach the Nyquist bandwidth (e.g. to accommodate a 16 : 9 aspect ratio).
([5]) All voltages are measured with respect to a 75 Ω load.
([6]) This bandwidth will be limited in the encoder by a filter designed to minimize ringing.
([7]) The chrominance signals accommodate 75% saturation and 100% amplitude colour bars.
([8]) A 0.5, 0, 0.5 filter should be used in the receiver.

TABLE III – *Data multiplex structure*

	Parameter/System	C-MAC/packet D-MAC/packet	D2-MAC/packet	B-MAC (625 line)	B-MAC (525 line)	Digital sub-carrier/ NTSC
General data parameters	3.1 Useful data burst (bits/line)	2 × 99 (1)	99	102/51 (2)		–
	3.2 Type of multiplex	Packet		Continuous		Continuous for sound, packet for data
	3.3 Organization	2 × 82 packets of 751 bits/frame (1)	82 packets of 751 bits/frame	6 channels of 203 kbit/s plus one channel of 62.5 kbit/s	6 channels of 204.5 kbit/s plus one channel of 62.9 kbit/s	Data frame comprising 32 columns of 64 bits each
	3.4 Mean data rate (Mbit/s)	3.08 (3) (2 × 2 050 packet/s)	1.54 (3) (2 050 packet/s)	1.59	1.60	2.048
	3.5 Scrambling (for conditional access)	By addition of mod. 2 of pseudo-random binary sequence at data channel level synchronized on modulation frame		Not disclosed		Under consideration

TABLE III *(continued)*

<table>
<tr><th colspan="2">Parameter/System</th><th>C-MAC/packet
D-MAC/packet</th><th>D2-MAC/packet</th><th>B-MAC
(625 line)</th><th>B-MAC
(525 line)</th><th>Digital sub-carrier/
NTSC</th></tr>
<tr><td rowspan="8">Sound coding</td><td>3.6 Audio sampling frequency</td><td colspan="2">32 kHz for high quality (HQ)

16 kHz for medium quality (MQ)</td><td colspan="2">Basic audio rate
(for high quality)
203 kbit/s 204.5 kbit/s
Step size control
7.8 kbit/s 7.9 kbit/s
Emphasis control
7.8 kbit/s 7.9 kbit/s</td><td>32 kHz
or
48 kHz</td></tr>
<tr><td>3.7 Audio pre-emphasis</td><td colspan="2">CCITT Recommendation J.17</td><td colspan="2">Adaptive</td><td>50/15 µs</td></tr>
<tr><td>3.8 Audio coding method</td><td colspan="2">Linear 14 bit/sample (L)
or
near instantaneous 10 bit/sample (I)
Coding range: 5 levels</td><td colspan="2">Adaptive delta modulation
(see Report 953) (4)</td><td>14/10 near
instantaneous
or
16 bit linear</td></tr>
<tr><td>3.9 Protection</td><td colspan="2">Protection range: 2 levels
1 – first level by 1 parity bit per sample;
or
2 – second level by 5 bit Hamming code
per sample</td><td colspan="2">2.33 bits per 13 bit block</td><td>BCH (63,56),
SEC, DED</td></tr>
<tr><td>3.10 Packet rate per monophonic or stereophonic channel (packets/s)</td><td colspan="2"><table><tr><th></th><th>MQ mono</th><th>HQ mono</th><th>HQ stereo</th></tr><tr><td>I1</td><td>253</td><td>503</td><td>1 003</td></tr><tr><td>L1</td><td>336.3</td><td>669.7</td><td>1 336.3</td></tr><tr><td>I2</td><td>336.3</td><td>669.7</td><td>1 336.3</td></tr><tr><td>L2</td><td>447.4</td><td>891.9</td><td>1 780.8</td></tr></table></td><td colspan="2">Not applicable</td><td></td></tr>
<tr><td>3.11 Identification of coding method</td><td colspan="2">Explicit by interpretation blocks</td><td colspan="2">Not applicable</td><td>Control code</td></tr>
<tr><td>3.12 Maximum number of high quality monophonic audio channels</td><td>8</td><td>4</td><td colspan="2">6/3 (2)</td><td>4 (15 kHz)
or
2 (20 kHz)</td></tr>
</table>

TABLE III *(continued)*

	Parameter/System	C-MAC/packet D-MAC/packet	D2-MAC/packet	B-MAC (625 line)	B-MAC (525 line)	Digital sub-carrier/ NTSC
Service identification	3.13 Service identification data location	1 line per frame in VBI and data channel 0 of packet multiplex		2 lines per frame in VBI		Under consideration
	3.14 Service description data organization	Data groups, commands and parameters carried by packets		Not applicable		
Conditional access	3.15 Control of descrambling	Control word for initialization of pseudo-random binary sequence		Not disclosed		Under consideration
	3.16 Secret information	Authorization keys per service Distribution key per subscriber		Not disclosed		
	3.17 Entitlement checking and management	Encrypted control words and authorization keys are broadcast in the data multiplex		Not disclosed		
	3.18 Addressing rate (addresses/h)	150 000 per kbit/s		1 000 000		
	3.19 Maximum number of addresses	64×10^9		256×10^6		
Data Broadcasting	3.20 Teletext coding	CCIR Teletext Systems A,B [CCIR, 1986-90d]				
	3.21 Protection	Protection range: 2 levels 1- CRC within teletext data block (2 teletext data blocks/packet) 2- CRC within teletext data block plus (24,12) Golay code FEC overall (1 protected teletext data block/ packet)				
	3.22 Identification of coding method	Set by parameter (DCINF) in the Service Identification channel				

(1) In assembling the packet multiplex, two data bursts can be utilized as a single entity.

(2) Two data coding implementations are possible: firstly a quaternary system with 2 bits per symbol and secondly a more rugged binary code.

(3) The multiplex structure may be compatibly reconfigured for full field data.

(4) Report 795 contains a description of a sound system under development in the United States which transmits four channels of directional information in two discrete channels using adaptive delta modulation for sound coding.

TABLE IV – *Modulation parameters*

	Parameter/System	C-MAC/packet	D2-MAC/packet D-MAC/packet	B-MAC (625 line)	B-MAC (525 line)	Digital sub-carrier/ NTSC
Modulation parameters	4.1 Nominal channel bandwidth (MHz)	27		24		27
	4.2 Data signal modulation 4.3 Vision signal modulation	2-4-PSK FM	FM			4Φ-DPSK-FM FM
	4.4 Polarity of frequency modulation	Positive				
	4.5 Reference level frequency position	Exactly centred in channel				–
	4.6 DC component	Preserved				a.c. coupled
	4.7 Frequency deviation (MHz/V)	13.5		16.5	17.5	17.0 (1)
	4.8 Pre-emphasis characteristic	El(3) = $H(f) = A\,\frac{1 + jf/f_1}{1 + jf/f_2}$				CCIR Recommendation 405
	4.9 Pre-emphasis parameters A:	0.7071				
	f_1 (MHz)	0.84		1.87		
	f_2 (MHz)	1.50		3.74		
	4.10 Energy dispersal (kHz)	600 Triangular frame synchronous waveform				
	4.11 Sub-carrier frequency (MHz)	Not applicable				5.7272 (2)
	4.12 Frequency deviation of main carrier by sub-carrier (MHz)	Not applicable				± 3.25

(1) This refers to video only deviation, i.e. without the sub-carrier.

(2) The sub-carrier frequency has been determined to be 8/5 times the nominal colour sub-carrier frequency considering the margin of the filter characteristics to avoid mutual interference between picture and PSK signal, and others.

(3) In addition to El, a non-linear emphasis may be used for the MAC/packet family, see Report 1074, section 3.4.1.

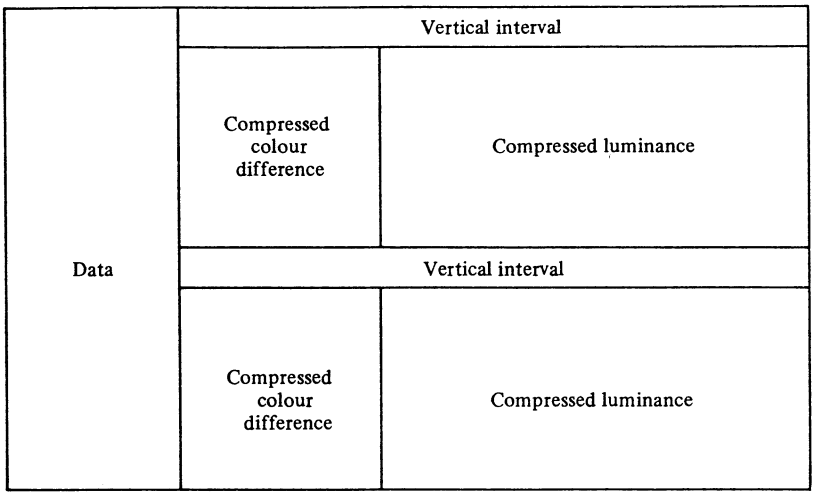

FIGURE 1 – *Basic TDM frame configuration*

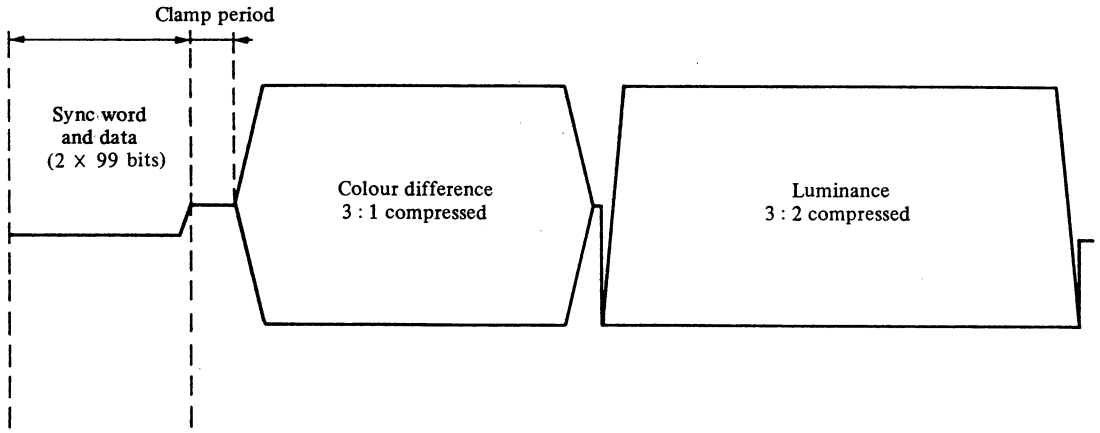

FIGURE 2(a)– *C-MAC/packet signal waveform (unscrambled)*

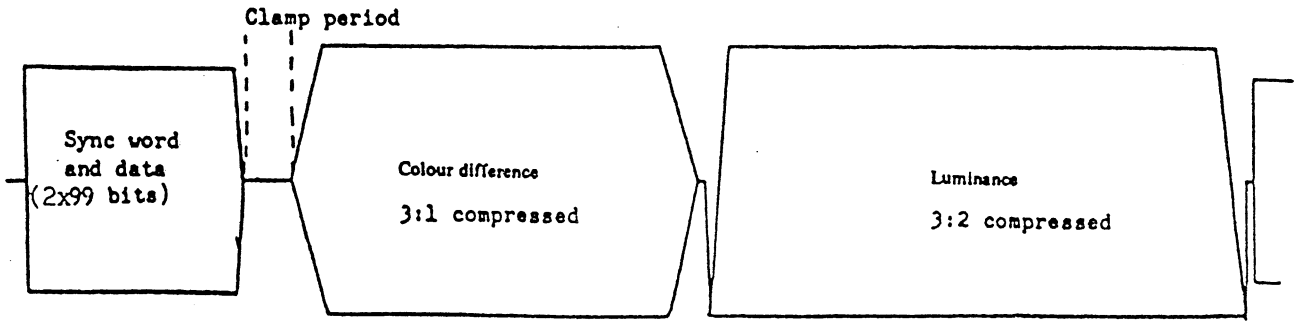

FIGURE 2(b) - D-MAC/packet signal waveform (unscrambled)

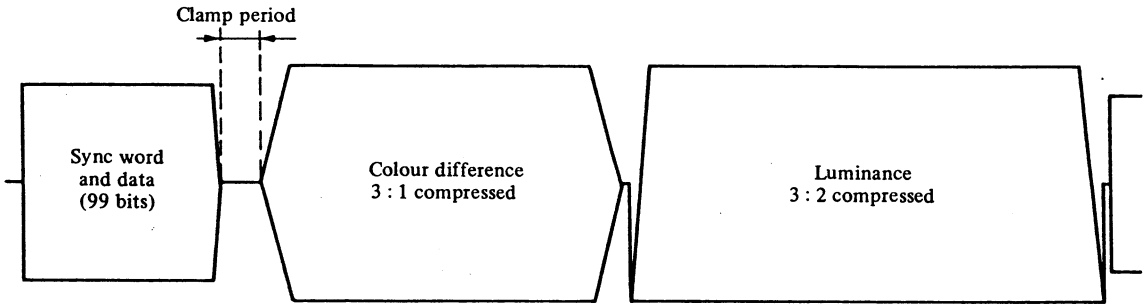

FIGURE 3 – *D2-MAC/packet baseband signal waveform (unscrambled)*

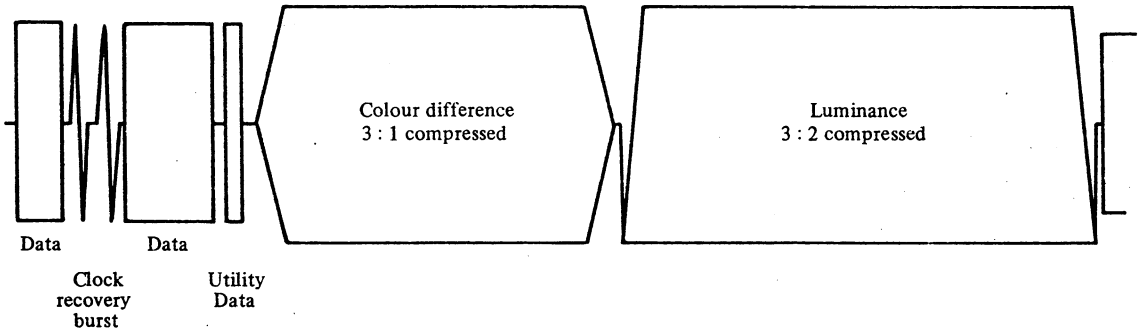

FIGURE 4 – *B-MAC signal waveform (unscrambled)*

REFERENCES

CCIR Documents

[1986-90]: **a.** JIWP 10-11/3-116 (France); **b.** JIWP 10-11/3-117 (United Kingdom); **c.** 10-11S/119 (Japan); **d.** JIWP 10-11/5 CP36 (EBU).

BIBLIOGRAPHY

TODD and CRAIG [August, 1987] A compatible digital audio format for broadcast and cable television. IEEE Trans. Consumer Electronics, Vol. CE33, 3, 297-305.

CCIR Documents

[1982-86]: 10-11S/127 (CCIR); 10-11S/154 (IWP 10-11/3); 10-11S/164 and Addendum 1 (EBU); 10-11S/165 and Addendum 1 (EBU); 10-11S/170 (France); 10-11S/179 (France); 10-11S/178 (USA); 10-11S/182 and Addendum 1 (France, Germany (Federal Republic of)); 10-11S/193 (Australia); 10-11S/204 (Japan).