1.   SCOPE

Free TV Australia Operational Practice OP42 describes the technical/operational practices associated with their distribution to and subsequent monitoring and transmission by broadcasters of Closed Caption data on line pair 21/334 of an SDTV signal.

For HDTV refer Free TV Operational Practice OP47 which describes the technical/operational practices associated with the storage and distribution of Teletext data such as closed captions/subtitles in the vertical ancillary data space of the 10 bit serial HD-SDI signal complying with Recommendation ITU-R BT.1120-7.

Note: That this document does not deal with the technical standards of the actual Closed Captions. It is merely intended to ensure that Closed Captioned program material with characteristics in accordance with the appropriate Australian and International standards will be successfully delivered to end users via the broadcasters' distribution and emission processes).

2.   BACKGROUND

The legislated requirements of digital broadcasting have prompted an increase in the number of captioned television programs and advertisements. The specifications in this OP are based on, but contain some additional requirements to those detailed in the European ETSI standard, EN 300 706, *Enhanced Teletext specification* [1].

In addition, where Teletext-based Closed Captions are encoded for DTTB transmissions these operational practices will need to take account of ETSI EN 300 472 (*Digital Video Broadcasting (DVB); Specification for conveying ITU-R System B Teletext in DVB bitstreams*) [2].

CAPTION CLEAR COMMAND

A Command to clear any existing caption shall be included in the first two (2) seconds of a **program**. A Command to clear shall also be included two (2) seconds before the end of a program.

A command to clear any existing caption shall be included in the first half (0.5) second of a **commercial**. Where closed caption data is included, the caption information should commence no earlier than a half (0.5) second after the start of active video and a caption erase signal is required (last caption time code out) not later than a half (0.5) second before the end of active video. First caption time code in will be at an arbitrary point determined by content.

4. TECHNICAL CHARACTERISTICS

For the distribution or transmission of Closed Caption data the following specifications shall apply:

Note: That these characteristics are not intended to fully define the internal structure of a Closed Caption service. For this information reference should be made to the appropriate Australian and International standards documentation.

(a)	Data Lines	Lines 21 and 334.
(b)	Data Lines Blanking	Lines 21 and 334 shall carry dummy headers[1] except during the actual transmission of caption content. Dummy headers must not be inserted between a caption header and caption text lines.
(c)	Magazine Address and Page Number	Magazine 8 shall be used and reserved for Closed Caption and related information transmissions. Where only one Closed Caption version is broadcast it shall be on Page 801.
(d)	Double Transmission of Caption Data	Closed Caption data may be transmitted twice to reduce the possibility of reception errors. On the first transmission control bit C4 should be set to 1. Whilst on the second transmission it should be set to 0. This was a requirement to analog transmissions but is not required for digital transmissions.
(e)	Parallel Mode Transmission (2.3.1)	Control Bit C11 shall be set to 0 (Parallel mode) for all Teletext services in the same video signal to ensure compatibility between Teletext and Closed Caption transmissions.
(f)	Sub-title Indicator Bit (2.3.1)	Control Bit C6 shall be set to 1.
(g)	Update Indicator (2.3.1)	Control Bit C8 shall be set to 1.
(h)	Live Closed Captions	For live Closed Captions it shall not be necessary for the erase page bit C4 to be set to 1 between the transmissions of caption data. Double transmission of caption data is not recommended for live closed captions as it can limit speed of word by word or letter by letter updates.

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1 The "dummy" headers are time filling headers. For more details refer Section 8 of this Operational Practice.

3.   VIDEO TIMING AND DATA LEVELS
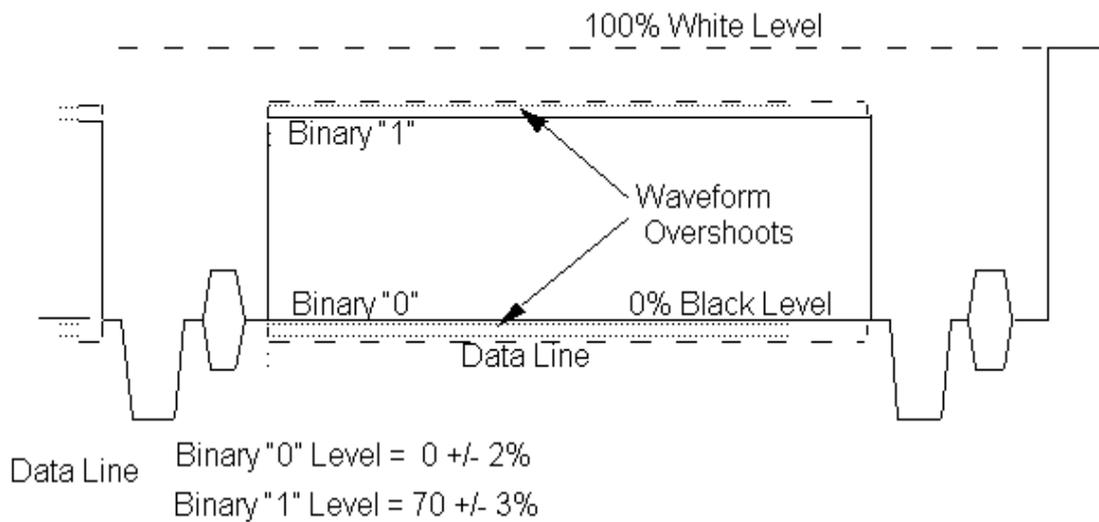
Figure 1 : Data Levels

The Australian standard specifies 8 clock run in pulses, (2 bytes of 101010……..) with the penultimate "1" appearing 12 +/- 0.288uS after the line time reference (leading edge of line sync, NOT zero reference of line blanking). As such the start of the 8 clock run in pulses can be as early as 11.2uS after start of line blanking.

In an analog transmission environment this did not cause a problem. However, when this signal is passed through a digital system that has a 12uS blanking (so called wide blanking) then up to three of the clock pulses can be truncated.
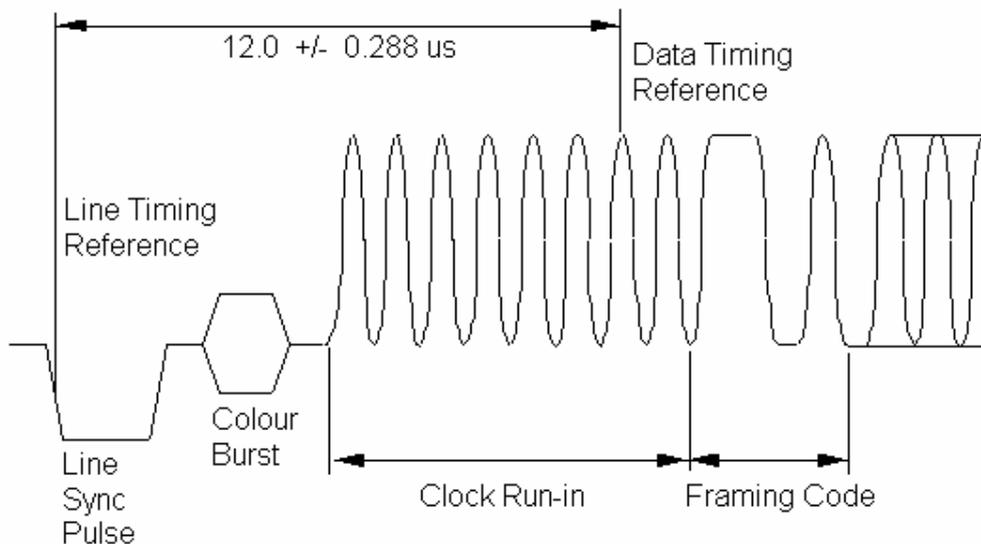
Figure 2 : Data Timing

As a result, the Closed Caption waveform no longer meets the Australian standard, (which does have a passing reference to the fact that in some circumstances the first one or two binary ones may be absent). This loss of clock run in pulses on the distribution feed does not necessarily mean that a Closed Caption decoder won't work. It can however cause problems if the distributed signal is subsequently passed via a

recording, compression or
transmission system that either expects the correct number of clock pulses or truncates more of the clock run in pulses. Network distribution signals should therefore be configured with a modified timing so that the distributed signals meet the requirement for 8 clock run in pulses, provided the last bit of the last character on the line is not blanked
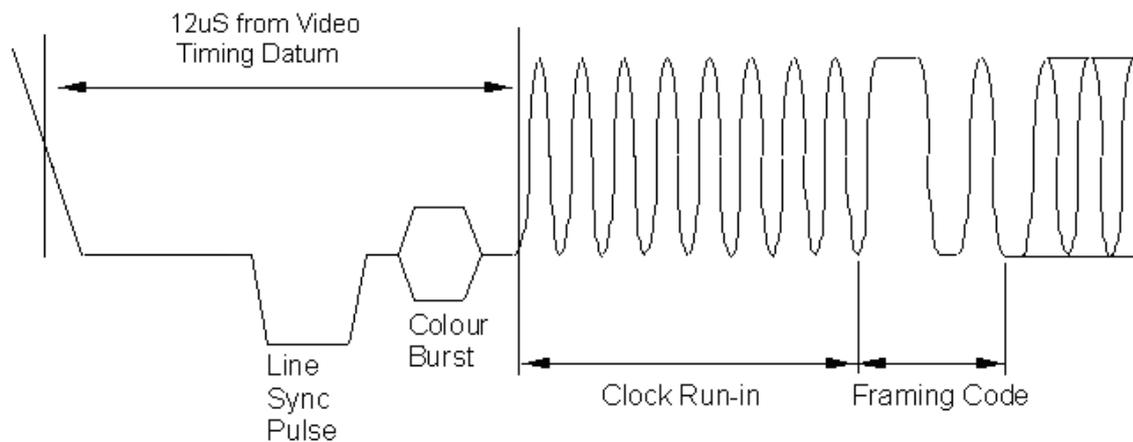
Figure 3 : Modified Data Timing

4.   USE OF LINE 21/334

Line 21/334 of all recorded and distributed video should only be used for Closed Captions. Content such as vertical interval time code, should not be inserted on line pair 21/334. Free TV Australia Operational Practice OP36 states that vertical interval time code should be on lines 18/331 and 20/333 [3].

Problems can occur when broadcasters' equipment "locks up" on the incorrect line resulting in captions being on lines other than 21/334. It is possible to automatically correct this and return the captions to lines 21/334, and it is strongly recommended that such devices are included in the distribution path.

5.   MONITORING OF CLOSED CAPTIONS

Increased requirements for captioning of programs, there have been regular occurrences of lines other than 21/334 being used to distribute captions to other markets. The existence of conflicting data on these lines can corrupt or blank a Closed Caption decoder's display.

Before monitoring, recording or broadcasting of a network distribution feed, ALL vertical blanking interval lines of any incoming program relating to Closed Captions conforming to World System Teletext, except for line pair 21/334, must be replaced by blanking level. Network program originators will need to inform broadcasters which lines of the VBI are used for this purpose.

When monitoring captioning "Off Air" no lines should be blanked to ensure the home viewer is receiving the correct product. Since Closed Captions are covered by regulatory requirements it is strongly recommended that off air monitoring at the presentation/MCR point includes the ability to confirm both the presence and the technical quality of the Closed Captions. It is also highly recommended that off air logging equipment includes the capability to record and replay the Closed Caption data lines.

6.   CONTINUOUS AND "BURSTY" CAPTIONS

The Closed Captions of some programs are configured as short bursts of caption data with periods of black between them. This mode of captioning is commonly referred to as "bursty" Closed Captions. It is supported by the Australian Standard.

With bursty captioning some digital television receivers and digital decoders are known to have problems correctly displaying such bursty Closed Captions. This is because in a European environment, some Teletext is always present in the vertical blanking interval , and the decoders have constant vertical blanking interval data being presented.

Because digital receiver equipment will increasingly be "international" and will not be specifically configured for the Australian environment it is highly recommended that:

a)   the captions on all programs provided to or produced by networks should be of a continuous nature. (This is achieved by the caption system being configured to insert dummy headers on line pair 21/334 between caption updates).

b)   all network originated programs should be distributed to broadcasters via a caption processor that will convert bursty type captions to a continuous format by inserting dummy headers on line pair 21/334 whenever line pair 21/334 is at blanking level.

7.   CLOSED CAPTION TRANSMISSION

The distribution, recording and emission of Closed Caption data can all contribute to loss of data integrity due to noise, reduced eye height, and distortion. All stations should insert a processor/re-timer in the transmission path as close as practicable to the final emission / final MPEG encoding point, to restore the data to its original timing and eye height.

In the absence of an update of the caption information data on line pair 21/ 334 (or blanking level with no caption content) for a total of 10 seconds, the processor should insert a blank page with a clear down signal (Page 801 with the clear bit C4 set to 1 and no StartBox Characters) followed by continuous dummy headers on line pair 21/334. The blank page and cleardown should be repeated every 10 seconds.

If the caption content on programs that have previously been advertised as carrying Closed Captions, is either corrupt or missing, the processor re-timer may insert an "apology" caption in place of the blank page.

If the caption content on program that have previously been advertised as carrying Closed Captions, is either corrupt or missing and a Closed Caption apology is **not** inserted then an on screen super apology must be provided.

8.   TIME FILLING (DUMMY) HEADERS

In the course of this document reference is made to "dummy headers". These were originally introduced so that the intervening frames between "captioned" frames contained valid but non-displayed caption data. They are referred to as time filling headers, and by convention are 0,FF (Magazine 0 known as 8, page FF) with a "subcode" of 0x3F7E.

Due to problems with the decoding of Closed Captions in a small number of receivers, some Australian and NZ broadcasters used a page number of FE subcode 0x3F7E. More recently the code page number 0,FE (i.e. Magazine 8, page FE) has been allocated in Europe to a specific function, and European Teletext capable receivers can "lock up" if they receive the a time filling header of 0,FE. It is believed that as a result, some stations may have changed to a code of 0,FD or 0,EE.

Australian broadcasters have agreed to use the internationally accepted 0,FF as the time filling header, with any subcode in the range 0x0000 to 0x3F7E, however the recommended subcode is 0x3F7E. Note: the use of subcode 0x3F7F is forbidden.

9.   REFERENCED STANDARDS

[1]	EBU Enhanced Teletext Specification	ETSI ETS 300 706 (1997 – 05)
[2]	Digital Video Broadcasting (DVB); Specification for conveying ITU-R System B Teletext in DVB bitstreams	EN 300 472 V1.3.1 (2003-05)
[3]	Free TV Australia Operational Practice OP-36 Quality specifications for delivery of SDTV and HDTV commercials on storage media	Issue 8 (2016-07)

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