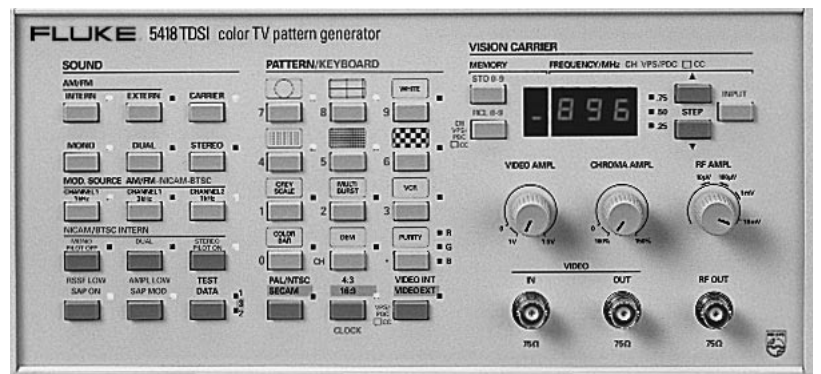
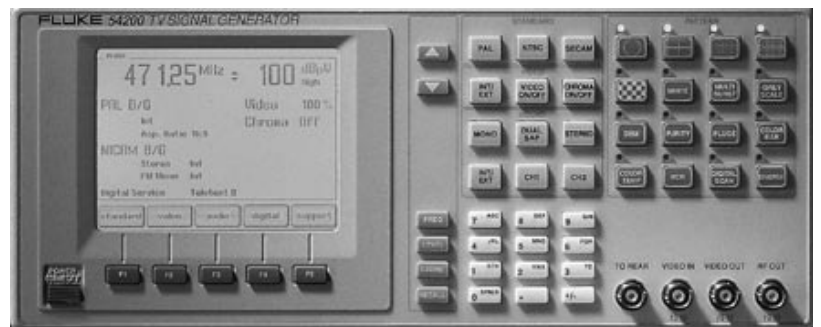


Cost-effective testing of Closed Caption TV receivers.

Application Note

TV signal generators provide an economic solution.



Today's TV receivers and video recorders have many new functions which increase viewing enjoyment and convenience for the consumer. However, many of these extra functions bring with them specific testing requirements for developers, manufacturers and service workshops.

One of these functions is Closed Caption, which enables subtitling for the NTSC broadcast standard, and is a legal requirement on TV sets sold in the USA. A cost-effective solution for the testing of TV receivers equipped with Closed Caption capabilities is provided by the TV signal generators from Fluke.

Closed Caption (CC) is a subtitling (caption) system which enables the display of text information on the screen at the same time as a TV program. The system was developed mainly for use by the hard-of-hearing, and is at present used in the USA, Canada and Taiwan. TV receivers sold in the USA with a screen size larger than 13 inch are legally required to be fitted with a CC decoder. At present, hard-of-hearing TV viewers in PAL and SECAM countries are served by their respective teletext systems, but there are also plans to transmit CC information in some of these countries.

As well as the display of text information corresponding to the spoken content of a program, CC allows additional information to be shown. For example, the broadcaster can inform viewers about several subjects, such as the weather report. This information can be selected whenever the viewer wishes to see it. Captions contain the text information corresponding to the spoken part of the program. The availability of different text channels enables the broadcaster to transmit separate information or languages, for example a local and several foreign languages. Furthermore, the text modes also allow for additional information to be presented.

CC transmission

The CC information is transmitted in the vertical blanking interval, using line 21, which means it is normally invisible on the TV screen. The TV receiver has to decode the CC information and display the selected Caption or Text mode. It must also be possible for the entire program - including the caption - to be recorded on a video cassette recorder. When a recording containing CC information is played back, the TV set will decode the CC information in just the same way as when it was originally transmitted.

Fig. 1 shows an example of a television line containing CC

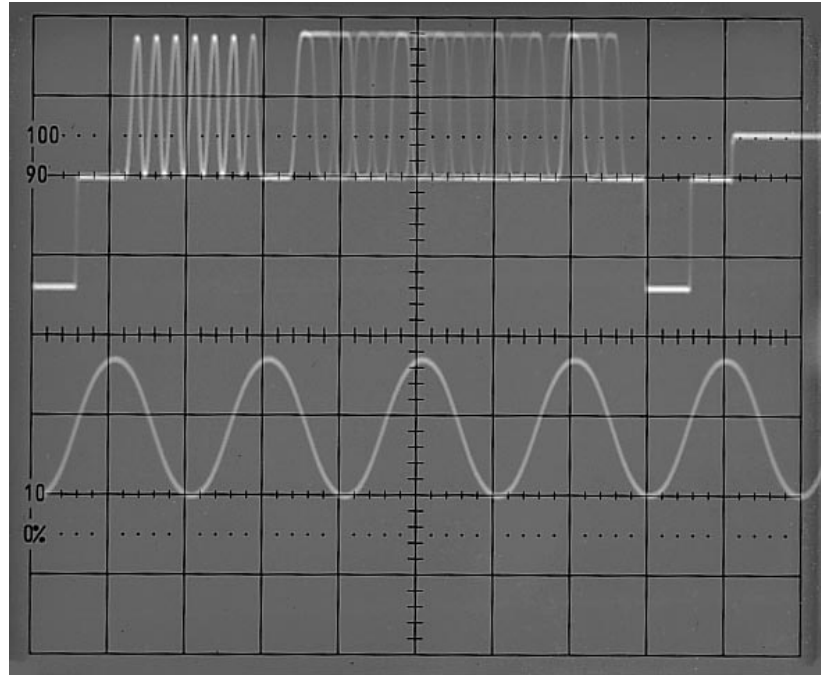


Fig. 1: CC transmission (line 21).

information. The clock run-in (7 cycles) expanded via DTB mode of oscilloscope (bottom trace) is used to synchronize the circuitry. The second part contains the real CC information; 1 start bit plus 2 characters. Each character consists of 7 bits plus 1 parity bit (odd parity). Several frames (CC lines) are necessary to transmit a complete Caption or Text mode information string. The CC decoder receives the information and the internal software transforms it into the correct Caption or Text mode. One of these can then be displayed if and when it is selected by the viewer. In Text mode, information is displayed in a box with the normal TV program as background. The box is centred in the middle, and covers 80% of the

visible image area (in height and width). The information in the box scrolls automatically, like a normal text editor, as new lines of text are received by the decoder (see Fig. 2). The foreground and background colors of the characters can be set by special control commands. Besides the color features, there are special commands to clear the screen and position the characters. Caption mode also displays the characters on the video image, but normally uses only a small part of the screen. Whereas Text mode has a fixed box size, Caption mode enables the size of the box to be predefined, with a maximum size corresponding to that used for Text mode (80% of the visible image area).

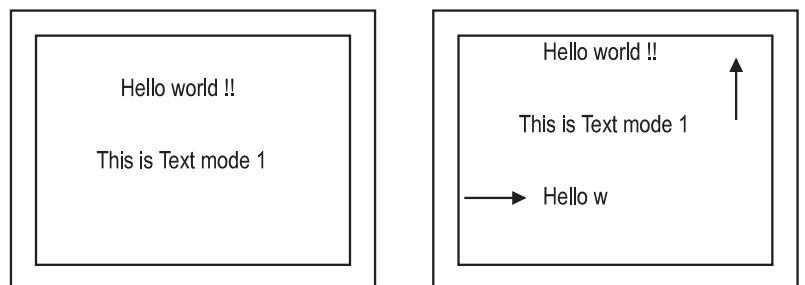


Fig. 2: Text mode example, showing the scrolling of text on two successive screens.

Like Text mode, there is also a facility for setting the color, the position and the contents of the captions. In addition, three different display modes are available:

- Roll-up
- Pop-up
- Paint-on

These three display modes control the way in which the text characters are displayed on the video image:

'Roll-up' scrolls the information in a predefined caption box. The first line disappears automatically when the box is filled and when the next line is received. The Roll-up caption box contains 2, 3 or 4 lines.

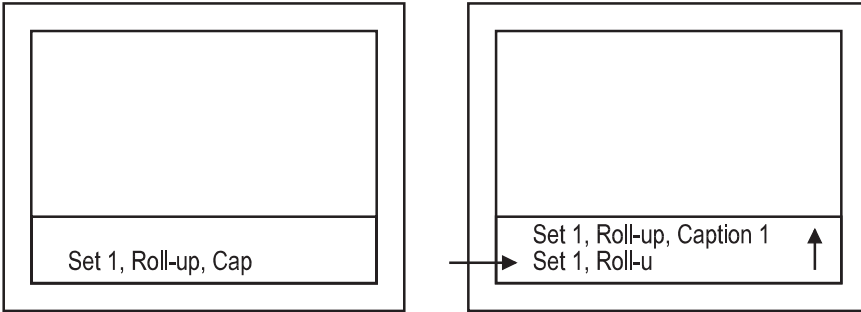


Fig. 3: 'Roll-up' caption test example, showing two successive TV screens.

The **'Pop-on'** mode first memorizes the transmitted characters and then displays the information on-screen when the complete character string and a command for display is received. A maximum of 4 complete lines can be memorized and displayed on-screen in a single or multiple 'Pop-on' sequence.

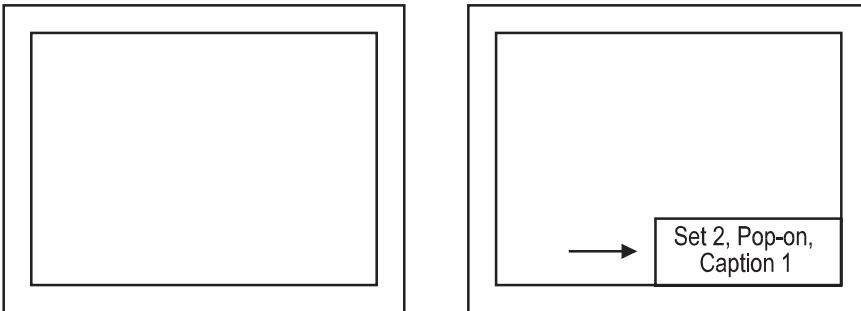


Fig. 4: 'Pop-on' Caption test example, showing two successive TV screens.

'Paint-on' mode displays the transmitted information directly as it is received by the CC decoder. When the predefined box is completely filled, the caption has to be cleared. It is also possible, as for 'Pop-on' mode, to use more than one 'Paint-on' caption. Single or multiple 'Paint-on' sequences can again consist of a maximum of 4 complete lines.

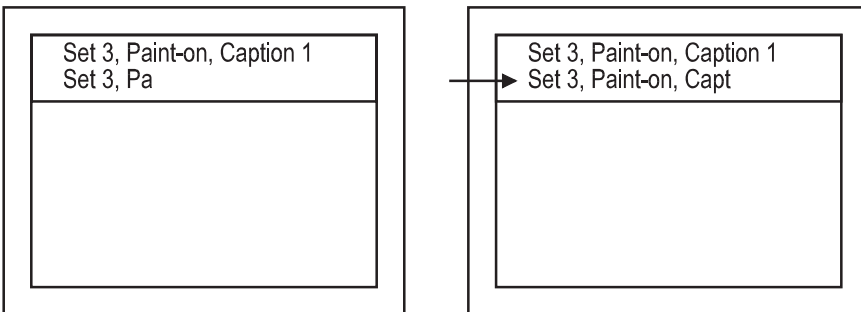


Fig. 5: 'Paint-on' Caption test example, showing two successive TV screens.

Test capabilities

Both Caption and Text modes are provided by the Fluke TV signal generators. These instruments offer factory precoded CC information with a selection of different types of information. The contents of these memories are precoded with 'Roll-up', 'Pop-on' and 'Paint-on' captions in a way that covers virtually all color, position and content possibilities.

Additionally, there is an automatic sequence of all the different types of information, so that all display modes can easily be tested. These CC test capabilities enable convenient testing of the CC decoder functionality of a TV receiver. They also enable the CC recording capabilities of a video recorder to be tested.

The test facilities offered can be used for visible testing and to perform special measurements. The CC mode, character size and typing of the characters can easily be checked by observing the screen while the appropriate test facility on the generator is selected. When the visual check fails, it may be necessary to measure the inputs and the outputs of the CC decoder chip using an oscilloscope, while the generator provides the required signals. The video input measurement on the CC decoder chip allows possible problems caused by the preceding hardware to be eliminated. Measurements on the RGB output and other peripherals can be used to check whether the CC decoder chip needs to be replaced.

Fluke Corporation

P.O. Box 9090, Everett, WA 98206

Fluke Europe B.V.

P.O. Box 1186,
5602 BD Eindhoven,
The Netherlands

For more information call:
In the U.S.A.: (800) 443-5853
or Fax: (425) 356-5116
In Europe/M-East:
+31 (0)40 2 678 200
or Fax: +31 (0)40 2 678 222
In Canada: (905) 890-7600
or Fax: (905) 890-6866
From other countries:
+1(425) 356-5500
or Fax: +1 (425) 356-5116
Web access: <http://www.fluke.com>