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Foreword

This Technical Report (TR) has been produced by Joint Technical Committee (JTC) Broadcast of the European Broadcasting Union (EBU), Comité Européen de Normalisation ELECtrotechnique (CENELEC) and the European Telecommunications Standards Institute (ETSI).

NOTE: The EBU/ETSI JTC Broadcast was established in 1990 to co-ordinate the drafting of standards in the specific field of broadcasting and related fields. Since 1995 the JTC Broadcast became a tripartite body by including in the Memorandum of Understanding also CENELEC, which is responsible for the standardization of radio and television receivers. The EBU is a professional association of broadcasting organizations whose work includes the co-ordination of its members' activities in the technical, legal, programme-making and programme-exchange domains. The EBU has active members in about 60 countries in the European broadcasting area; its headquarters is in Geneva.

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1 Scope

The present document is intended as a companion document to the full specifications, EN 300 707 [1] and EN 300 708 [2], covering the data format and transmission via Teletext of an Electronic Programme Guide (EPG). It is primarily aimed at EPG/Teletext service providers and network operators with the intention that the specifications are interpreted in a consistent way while recognizing that there are many options available to all the parties involved in creating the total system.

The present document outlines the basic EPG concepts and highlights the key parameters for a successful service. It makes recommendations as to how aspects of the specifications should be implemented and suggests strategies to maximize the transmission efficiency of both normal Teletext and EPG services when they coexist in the same TV channel.

The present document has been revised in the light of the knowledge and experience gained from operating real services with a variety of decoders available. It is anticipated that the operation of enhanced EPG may require a further revision.

2 References

For the purposes of this Technical Report (TR) the following references apply:

[1] ETSI EN 300 707: "Electronic Programme Guide (EPG); Protocol for a TV Guide using electronic data transmission".

[2] ETSI EN 300 708: "Television systems; Data transmission within Teletext".

[3] ETSI EN 300 706: "Enhanced Teletext specification".

[4] ETSI EN 300 231: "Television systems; Specification of the domestic video Programme Delivery Control system (PDC)".

[5] ETSI TS 101 231: "Television systems; Register of Country and Network Identification (CNI), Video Programming System (VPS) codes and Application codes for Teletext based systems".

[6] ETSI TR 100 287: "Television systems; Code of practice for enhanced Teletext".

3 Definitions and abbreviations

3.1 Definitions

For the purposes of the present document, the following terms and definitions apply:

application information: Data block providing the name of the EPG service provider and a list of the networks supported. The total number of programmes and number of days covered for each network is indicated.

attributes: additional "machine-readable" information on a programme event, e.g. "live" or "subtitled"

NOTE: Can be used by a decoder as a filter when searching the database. Also known as "Feature Flags".

bundle information: Data block applicable to all data broadcasting applications within a given stream. It enables the number of applications and their type to be identified.

category: content of a programme event; e.g. "News", "Sport", "Drama"

composite EPG decoder: decoder which compiles a multiple channel display by scanning several EPG services on different networks

conditional access: method by which network operators/EPG service providers can restrict access to all or part of their service to a particular group of viewers

database: The EPG service provider's store of all programme-related data. In a decoder context, the sub-set of the EPG transmission which the decoder has stored.

data stream: continuous sequence of EPG-related data

NOTE: In order to maximize efficient use of the VBI capacity and to guarantee a maximum performance for an EPG service, the total EPG data stream can be split into two separate streams (Stream 1 and Stream 2) for transmission purposes.

decoder: collects and decodes the transmitted EPG data. It processes and stores the data and under user control selects the information for display

NOTE: Decoders can differ in their storage capacity and display capability.

EPG service provider: generic term for the different parties involved in compiling an EPG database and formatting it ready for transmission

event area: part of the EPG display screen where programmes are listed or menu items are displayed

far information: programmes which are not scheduled for transmission today or tomorrow but for the third day onwards

NOTE: Compare with Near information.

feature flags: See "Attributes".

filler packets: dummy packets inserted onto otherwise unused VBI lines which exist as a result of obeying the 20 ms rule

full EPG: multiple channel EPG service which includes navigation and sorting information

header area: The top-most part of the EPG display screen. Its contents are defined by the EPG service provider.

housekeeping data: elements within an EPG transmission that are essential to its operation but which do not form part of the programme database

Level 1, 1.5, 2.5, 3.5: Teletext presentation levels

message area: part of the EPG display screen where text messages defined by the EPG service provider are displayed

NOTE: Normally the text will be linked to a highlighted event in the Event Area.

multiple channel EPG: EPG service transmitted on a particular network which comprises information on programmes from more than one network or TV channel

navigation: method by which the viewer interacts with the decoding system via menus, leading him to the desired programme information

navigation area: the bottom-most part of the display screen where the decoder displays locally generated user-interface prompts and messages to enable the viewer to access the EPG

navigation information: Data block used to create a menu structure for navigation purposes within a Full EPG. It defines the text to be displayed and the links to the next level of menu or programme information.

near information: programmes scheduled for transmission today or tomorrow

network operator: generic term for the different parties responsible for the delivery of the EPG data

now and next: details about the current TV programme (or programmes in the case of a multiple channel service), plus the programme(s) that follow on immediately

OSD information: data block used to define display data for areas of the display screen that are under the control of the EPG service provider

programme information: data block containing information about one programme event. It includes channel, times, ratings, themes, etc.

refresh procedure: constant transmission of the complete EPG database

NOTE: Different parts of the database can be transmitted at different rates according to the priority of the data.

Stream 1: The Teletext pages carrying Near Information. Their transmission obeys the 20 ms page clearing rule. The pages are distinguishable from those in Stream 2 through the allocation of a value of "0" to the S3 component of the page sub-code.

Stream 2: The Teletext pages carrying the remaining EPG data that is not included in Stream 1. Their transmission does not have to obey the 20 ms page clearing rule. The pages are distinguishable from those in Stream 1 through the allocation of a value of "1" to the S3 component of the page sub-code.

transparent strings: Sequences of characters and attributes defined by the EPG service provider as part of the EPG database. Spacing attributes (a sub-set of those available with Level 1 Teletext) can be used within each string. Accented characters and symbols found in Level 1.5 Teletext transmissions are also accessible.

update procedure: transmission of information which enables a decoder to update quickly a section of its database when changes occur in the programme schedule

20 ms page clearing rule: This rule defines the minimum interval between the transmission of the page header (row 0) of a Teletext page and the transmission of the remaining packets. It is essential for some existing Teletext decoders to give them time to erase the old page from memory. Level 2.5 (and above) decoders can operate without such a delay being necessary. This is referred to as the 20 ms rule in EN 300 707 [1].

3.2 Abbreviations

For the purposes of the present document, the following abbreviations apply:

AI	Application Information
BI	Bundle Information
CNI	Country and Network Identification code
EACEM	European Association of Consumer Electronic Manufacturers
EPG	Electronic Programme Guide
HI	Helper Information
LI	Language Information
MI	Message Information
MIP	Magazine Inventory Page
NI	Navigation Information
OI	OSD Information
OSD	On Screen Display
PDC	Programme Delivery Control
PI	Programme Information
TI	(sub-)Title Information
TV	TeleVision
UI	Update Information
VBI	Vertical Blanking Interval
VCR	Video Cassette Recorder
VPS	Video Programming System

4 Introduction to Electronic Programme Guides (EPG)

EPGs are to be seen as a major improvement of broadcasting information about TeleVision (TV) programmes to the viewer. The technology used to present or display the information may be different from that used to transmit the data.

The subject of the present document is the EPG standard conceived by the European Association of Consumer Electronic Manufacturers (EACEM). The full coding details are specified in EN 300 707 [1]. The present document also covers the transmission of the data as one form of data broadcasting via page-format Teletext. These aspects are dealt with in EN 300 708 [2]. A commercial name for EPG services based on these specifications is given in annex A.

Electronic programme guides go far beyond the possibilities of programme listings provided by normal Teletext services. It is to be seen as a major improvement resulting from the transmission of additional programme information and a new generation of decoders especially designed for the purpose of handling an EPG service.

The vertical link between hardware and software manufacturers on the one side and the Teletext broadcasters on the other will provide the viewer with a fast, attractive and easy to use information service about TV programmes. As a consequence, it may improve the attractiveness of a broadcaster's programmes as well as the products of a TV or VCR manufacturer who chooses to implement an EPG decoder. In addition, it can be implemented in a multimedia PC equipped with a video/Teletext capture card.

An EPG will offer easy, attractive and fast access to a listing of programmes in the "near" future (for example, today and tomorrow) for one or more channels. Depending on the editorial policy of the broadcaster concerning the scope of his EPG service, the guide may also cover programmes further ahead across several channels. Going beyond the chronological listings of TV programmes, the more elaborate implementations of an EPG will enable the viewer to select programmes by personal criteria, e.g. programme theme.

Another important part of an EPG service will be the navigation elements which will help the user to view and select the various categories of programme information displayed by the EPG decoder. Navigational elements can also make the application attractive by their design and presentation and, therefore, they should focus on the graphical possibilities of Level 2.5 Teletext as defined in EN 300 706 [3]. Compatibility with lower Teletext levels shall still be maintained as some EPG displays will be very simple. Depending on the display hardware used in the decoder, the appearance of the display may well exceed that available even with Level 3.5 Teletext, for example in a multimedia PC.

An EPG does not only include various ways of listing programme information but also offers an easy method of programming VCRs through its common link to the established PDC and VPS protocols as defined in EN 300 231 [4]. In addition, it is possible to create a special service for programme information, which can be a separate service from the traditional Teletext service.

The EPG data is carried by the network operator's video signals as part of the Teletext stream. It is additional data to the "normal" data transmitted in a Teletext service. It is transmitted to the TV receiver or VCR where it is stored in a database. (From an editorial point of view, it does not matter whether the decoder resides in a TV receiver or a VCR.) The "computing power" of the decoder processes the database and under the user's command extracts the programme data and formats it for display.

There may be many EPG services available to the viewer, either single or multiple channel and transmitted on one or more TV channels or networks. The viewer will have to select the EPG services he wishes to decode, store and use.

In a simplified form the system can be presented as shown in figure 1.

This code of practice aims to:

- provide the essential background information about an EPG service;
- highlight the key parameters and concepts for successful EPG operation;
- make suggestions on how an EPG service may best be exploited;
- give recommendations and examples of how an EPG service may be implemented;
- suggest strategies to maximize the efficiency of both the Teletext and EPG services.

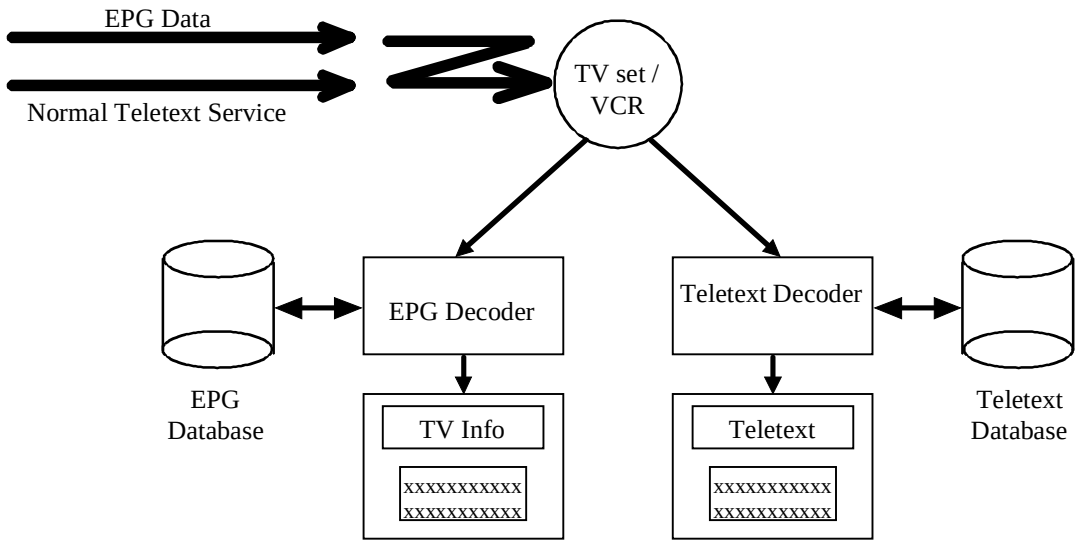


Figure 1: Basic system concept

5 Fundamentals of an EPG

5.1 A non-proprietary and non-discriminatory system

The ETSI standard EN 300 707 [1] is an open system which is non-proprietary and non-discriminatory. It is to be considered as an enabling specification which any broadcaster can adopt providing that they respect the fundamental agreements.

NOTE: There are no licensing costs for a network operator or EPG service provider.

5.2 Key concepts

When thinking about an EPG one has to be clear as to what one is actually considering. Often very similar terms are used for the various types of transmission and capabilities of decoders. Similarly, there are very many possibilities so there are often paradoxes where the capabilities of the specification exceed the Teletext transmission capacity.

Fundamental to an EPG is the transmission of a large database of programme information. The decoder's database may be of a different size in different products. Only the minimum size is stated in the specification. Through the use of input filters only a subset of the total database will usually be stored.

The information is stored in the TV receiver or VCR and when the information is retransmitted, the opportunity may be taken to modify it. This refresh operation is different from the explicit update of information to the decoder's database.

The programme information can be categorized by the following terms:

This channel: data relating to the network/channel carrying the EPG;

Other channels: data relating to other networks/channels;

Near information: data for programmes scheduled for transmission within two days;

Far information: data for programmes further in the future.

Near and *Far Information* may be transmitted in slightly different ways but this will be transparent to the viewer.

If one assumes that a decoder will be tuned to a channel for a few minutes each day, it will be able to store the frequently transmitted *Near Information*. When the viewer turns on the TV tomorrow, he can be presented with the information for the current day from the stored database.

Because a VCR is likely to be powered continuously, there is ample opportunity for its stored database to be refreshed and updated. However, a TV receiver can only acquire new information if it is turned on and tuned to the channel carrying the EPG service.

NOTE: Some high-end receivers will contain a second tuner to support *Picture-in-Picture* operation. In some circumstances this will allow the EPG data to be refreshed and updated while the viewer is watching a different channel.

Because of this, the transmission of the entire database should be completed within 20 to 30 minutes (the duration of a typical TV programme), the *This Channel/Near Information* within 30 s, *This Channel Now and Next Four Programmes* within 10 s. An EPG decoder can start to acquire data at any point in the refresh cycle and, accordingly, a fairly constant transmission is preferred over infrequent bursts of data.

EPG and the existing Teletext services can share the same VBI lines. A complex EPG service can be sent in the same way as display enhancement data for Level 2.5 or 3.5 Teletext, occupying some or all of the spare capacity that cannot be used by the normal Teletext service due to decoder constraints.

5.3 Basic editorial decisions

The attractiveness of an EPG service depends upon the performance of the decoder implemented in the TV receiver or VCR and on the quality of the programme information.

The main editorial decisions to be considered are as follows:

- the kind of programme data to be transmitted:
  - the number of days the information will cover;
  - the number of programmes and channels;
  - the depth of information per programme.
- the refresh and update procedure of the data;
- the arrangement of navigational elements;
- Conditional Access (CA);
- copyright;
- the organization of the data transmission within the Teletext stream.

Recommendation:

Decisions on the amount of programme information to be transmitted via Teletext to the EPG decoder can have several consequences for the Teletext service. The aim is to find a "balance" between the EPG data and the "normal" Teletext pages of the service. The transmission of EPG data should not adversely affect the capacity of the Teletext service.

There are several different technical measures that may be taken to minimize the effect of the EPG on the Teletext service.

5.4 EPG and Teletext

Even if the EPG and Teletext represent different services there are more common links besides the fact that the source data for EPG is transmitted via Teletext.

Both services not only share VBI lines they also obey the same display specifications (at least Level 1.5 Teletext with the corresponding character sets and serial attributes). Both systems are compatible with PDC/VPS and use page-based Teletext transport. To identify a broadcaster, both systems make use of the country and network identification data (CNl) which is transmitted in packet 8/30 format 2 of the normal Teletext service or via VPS.

The EPG protocol includes the possibility of the reuse of text from existing Teletext pages, but the reading of an information block out of a Teletext page is quite a complicated process where many problems may occur. For example, the text block has to be referenced not only by its page number but also by its exact position (row and column). In addition, it requires more decoding than when handling explicit EPG text data. It is dependent on the Teletext service and so the text will take longer to acquire.

If the reuse of Teletext information is required in order to reduce the amount of transmitted data for the EPG, it should be kept in mind that the perceived advantages are off-set by a number of disadvantages. The reading of Teletext pages is only allowed for the "long information" block (see clause 8.3.1). The only data that is imported from a Teletext page is the foreground character information as would be displayed after the addition of any Level 1.5 accented and supplementary characters carried in packets 26, and replacing any colour control characters or other attributes with "space". This text is then processed, stored and displayed as if it were explicitly transmitted in the EPG data stream. The colours of the text and background of the message box are defined by the decoder manufacturer.

Recommendation:

For consistency, the same source of basic programme data should be used for both EPG and Teletext services.

6 Characteristic elements of EPG services

The provider of an EPG has to consider the four main points which determine the functionality of an EPG service:

- single channel;
- many channels;
- navigation;
- *Near* and *Far* programmes.

The EPG service as broadcast is independent of the complexity of the decoder used by the TV set or VCR. Therefore it is necessary to consider both the various types of broadcast (this clause) and the types of decoder (clause 7).

Recommendation:

The range and depth of the information carried by an EPG shall be at least as comprehensive as that on the existing Teletext service; e.g. a broadcaster whose Teletext service already offers multiple channel programme listings should also offer a multiple channel EPG.

6.1 This Channel EPG

As shown in figure 2, a *This Channel EPG* service only contains information on the programmes of the network or TV channel on which the EPG service is broadcast.

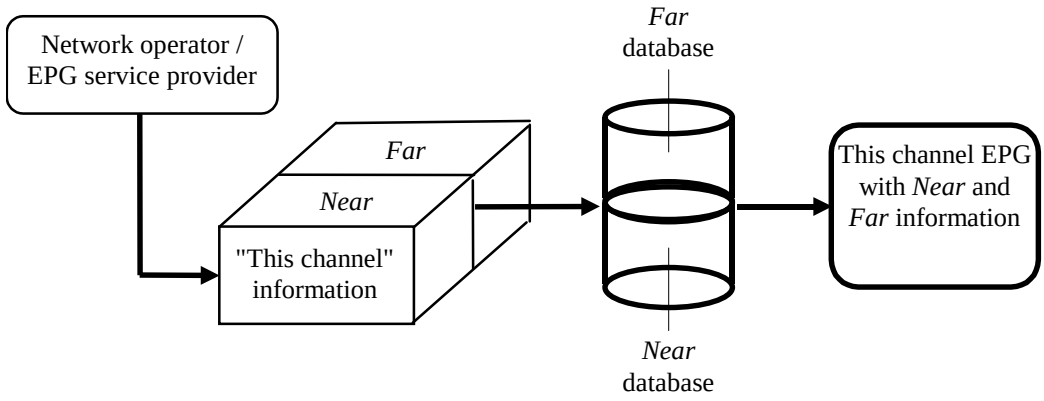


Figure 2: This channel EPG

Recommendation:

Ideally, all broadcasters should transmit at least This channel/Near Information on all of their channels every 10 s, and the remainder of This Channel/Near at a reasonable transmission rate. However, the minimum service should contain Now information and the next four programmes for the channel although this is not likely to be regarded as a true EPG service.

6.2 Multiple channel EPG

A *Multiple Channel EPG* service is shown in figure 3 and comprises information on the programmes of more than one network. The EPG service provider has to maintain a database of all the channels in his service. The theme of a programme is defined only by the categories included in the specification. These should be used by all broadcasters.

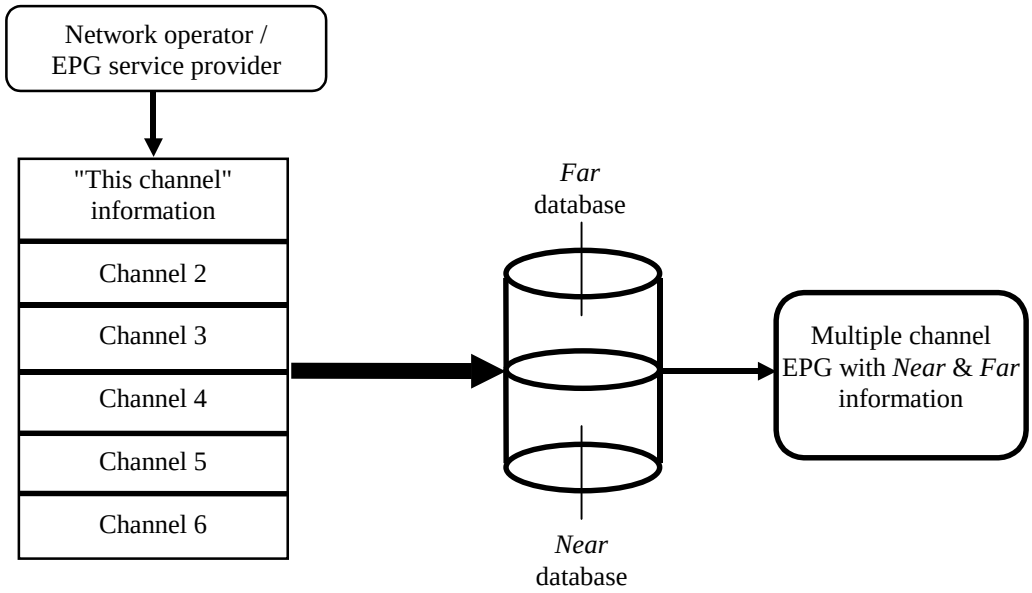


Figure 3: Multiple channel EPG

6.3 Full EPG

A *Full EPG* service, as shown in figure 4, is a *Multiple Channel EPG* service with the addition of navigational elements which are under the control of the service provider. These elements should enable the viewer to identify easily programmes that meet their personal criteria.

A *Full EPG* service allows an extensive sorting of programmes by themes defined by the service provider.

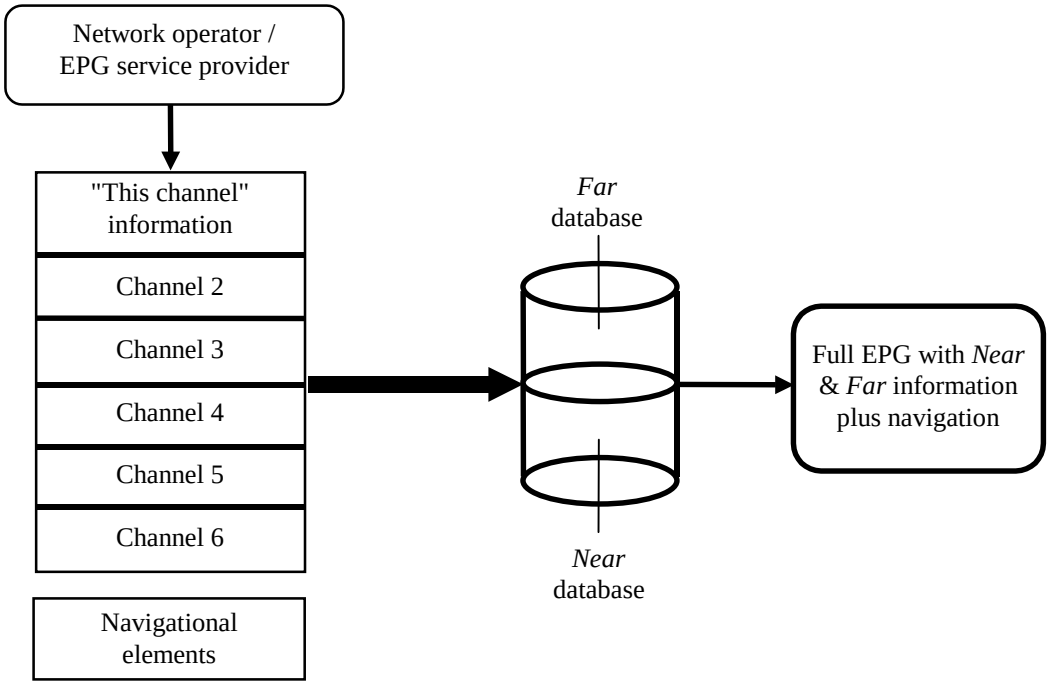


Figure 4: Full EPG with navigation

6.4 The *"Near"* and *"Far"* distinction

The other characteristic of an EPG is the editorial/technical division of the data into *Near* or *Far Information*. *Near Information* will be refreshed more frequently and may contain more details about each programme than *Far Information*.

The *Near Information* for at least the first channel shall be transmitted in *Stream 1*, see clause 8.6. This restriction may cause an editor to limit the number of programmes included for a particular channel.

7 Types of decoder

A range of decoders with different storage capacities, functionality and display features is envisaged. Editors may offer a level of service which simple decoders are not capable of handling in full.

7.1 Simple decoder

These decoders will have a very limited amount of memory but they will support at least the minimum service level (*Now* and the next four programmes for *This Channel*).

7.2 Single channel decoder

These decoders will have sufficient memory to handle the *This Channel* information (*Near* and *Far*) extracted from the selected EPG service.

7.3 Multiple channel decoder

These decoders will have sufficient memory to handle the *Near* and *Far Information* from a multiple channel service. Any navigation features are defined by the decoder.

7.4 Full EPG decoder

These decoders will have sufficient memory to handle the *Near* and *Far Information* from a multiple channel service. They implement the navigation features defined in a *Full EPG* service.

7.5 Composite EPG decoder

A *Composite EPG* decoder, figure 5, scans any available EPG service and extracts the *This Channel* information. It then composes a multi-channel EPG. As the information comes from many different sources, the display and any navigation features are defined by the decoder.

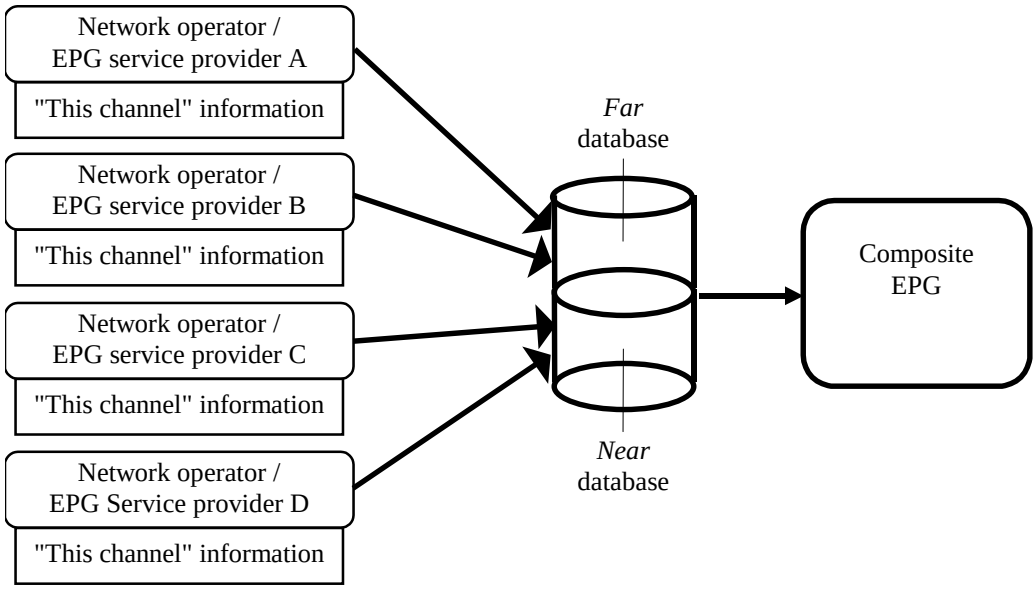


Figure 5: Composite EPG decoder

7.6 Comparison of composite and full EPG systems and decoders

Composite	Feature	Full
As many as can be received by the decoder.	Number of channels	As many as the service carries.
In theory, as many as each EPG service carries. In practice, limited by the size of the decoder's memory.	Number of days	As many as the service carries; limited by the size of the decoder's memory.
Scans all the channels at some time each day: approximately 1 minute per channel for *Near Information.*	Acquisition method	Tuned to one channel for, say, 20 minutes each day: about 30 s for *Near Information.*
Decoder manufacturer.	Screen layout	EPG provider.
Very limited; decoder defined.	Navigation	Flexible; defined by the EPG service provider.
Themes defined in EN 300 707 [1], if supported by the decoder.	Programme categories	Themes defined in EN 300 707 [1] plus those defined by the EPG service provider. Decoder manufacturers may offer additional features.
The *This Channel* information from the channels received (includes *Multiple Channel* EPG transmissions).	Source of information	The selected *Full EPG* service.
The channel is omitted from the channel list.	What happens if a channel does not have an EPG?	Irrelevant; the service provides this information.
Preferred order is the order the TV channels are stored in the decoder.	Order of channels displayed	*Full* EPG service provider defined; CNI list order.
Has to be obtained by the individual EPG service providers.	Copyright of information	Has to be obtained by the *Full EPG* service provider.
Under the control of individual service providers for parts of the EPG.	Conditional Access (CA)	Under the control for all or part by the EPG service provider.

8 The structure of an EPG service

An EPG database can be divided into five main parts:

- Bundle Information block;
- Application Information block;
- programme database comprising a number of Programme Information blocks;
- database for display structures;
- database for navigational structures (Full EPG only).

There are a number of other minor elements but the majority of the data consists of the above. At some point in the transmission chain the data blocks will be encoded for transmission and then packed into Teletext pages in order to be broadcast.

There are instances where the number of bits for a particular field is different in different structures. At all times the value of the field shall be the same.

The Block numbers in each structure should be contiguous to aid the memory management in the decoder.

The broadcaster should note that if a decoder has insufficient memory to store all the blocks of a structure, the latest PIs in time and date may be disregarded.

8.1 The Bundle Information block

EPGs are but one form of data broadcasting and the Teletext pages used to transmit an EPG can also be used to convey data for other applications, including other EPGs from different service providers. The other applications will be coded in a similar manner to the EPG data and a Bundle Information block is transmitted frequently to inform decoders of the number and type of the applications within the data stream.

8.2 The Application Information block

The Application Information (AI) block is a single entity containing data concerning the complete EPG database.

8.2.1 Block contents

The principal contents of the AI block is:

- the name of the EPG service provider;
- the number of networks supported.

For each network:

  - its name (as a text string) and CNI code;
  - number of days covered in the listings;
  - an indication of the first and last programmes in the listings (the first programme will be assumed to be the *Now* programme by a decoder);
  - the Teletext page containing conventional Teletext-style listings;
  - a network identification number that then appears in each Programme Information block belonging to that network.

- the network providing *This Channel* information (see clause 8.2.3);
- the version number of the database;
- indications of the number of each type of data block in the total guide.

Some of the information is included twice when there is a need to inform the decoder as to how the data is split between Streams 1 and 2.

8.2.2 Transmission aspects

Since the Application Information block defines basic reference data for each network it has to be received by a decoder before any Programme Information blocks can be interpreted correctly. Consequently, it has to be transmitted frequently, and only in Stream 1 so that it is accessible to all types of decoder.

It shall be updated and re-transmitted on a change of programme on any network since the data relating to at least the first (i.e. *Now*) programme for that network will have changed. Ideally, this should be linked in real time to the programme change but this may not be practical for other than the *This Channel* network.

8.2.3 Identification of the broadcaster

Where the decoder acquires a multiple channel EPG service there may be problems with the identification of the broadcaster. Thus there is a component within in the *Application Information* block (the *this_network_operator_no* value) which identifies the source of *This Channel* information. The order of the remaining channels is at the EPG service provider's discretion.

To allow a TV or VCR to tune automatically to a channel listed by the EPG, the EPG service should only include data for channels that are broadcasting a CNI code via a packet 8/30 format 2 or VPS. This includes the channel carrying the EPG. The allocation of NI codes to networks is defined in TS 101 231 [5].

If a broadcaster wishes to supply only a Default EPG (see clause 13) a Magazine Inventory Page (MIP) shall be transmitted.

Some EPG decoders use the last 8 characters in packets X/0 to determine the time. These characters do not necessarily carry the time so it is desirable to the transmitted Teletext stream contains packet 8/30 format 1 with the correct UTC and Local time offset so that the date and local time can be decoded.

8.3 Programme Information blocks

A Programme Information (PI) block is transmitted for each individual programme event in the EPG. It contains text and "machine-readable" data. PI blocks will form the bulk of any EPG database.

8.3.1 Text content

The three text fields in a PI block are:

- *Title*: the name of the programme, maximum length of 40 characters;

NOTE: Early decoders may truncate titles to around 30 characters.

- The *Short Information* can provide details about the programme. Alternatively it may be used for other purposes such as advertising. On the display it will appear in the *Message Area* and shall always be displayed when the programme is selected or otherwise highlighted by the user. Subsequent user actions may result in other information appearing in the *Message Area*. The maximum length of *Short Information* is 255 characters;

- The *Long Information* will be used for longer critiques of films or for information such as recipes or contact addresses associated with the programme. Not every programme will have a *Long Information* within a typical EPG service. This information will be displayed in the *Message Area* or full screen, and the maximum length is 1 000 characters.

Recommendations:

For the Title it is recommended to be as efficient as possible remembering that spacing attributes count as a character. If a Title is greater than 40 characters it should be repeated in full in the Short Information. A carriage return command should not be used within a Title to prevent complications within a decoder.

The recommended length of the Short Information is typically 140 characters as it has to fit within the Message Area (the size of which is defined by the EPG Service Provider via the OSD Information block). The Short Information should explain what the Title does not.

8.3.2 Attributes, categories and ratings

A PI block includes "machine-readable" information about a programme such as network, transmission data and time, PDC/VPS code, sorting categories and other attributes.

Attributes (or feature flags) provide the viewer with extra information about the programme. Attributes can be used to filter and sort programmes in the stored database according to the user's preferences. A list of attributes and other parameters that can be defined for each programme event is given in annex B.

To allow sorting of programmes by category (i.e. theme or genre) each PI block carries thematic information. In other than a *Full EPG* service, the categories are those defined in the EPG specification, see annex C. A *Full EPG* service can define its own categories as well as using the pre-defined set. The pre-defined table of EPG themes is identical to those defined for PDC in EN 300 231 [4].

Recommendations:

Attributes are very important. They are the means by which the viewer can make an individual selection from the programme information available.

Even when operating a Full EPG service, it is recommended to build upon the pre-defined theme categories.

Different categories and attributes can be combined within the decoder to produce new filter criteria. For example, the viewer can choose to select "Football/Live" or "Movie/Widescreen".

Ratings can also be used to help the viewer find a suitable programme. Obviously ratings cannot be considered as objective criteria. Two kinds of ratings are distinguished:

- parental rating (indicating a recommended minimum age for a group of viewers);
- editorial rating (offering a global recommendation concerning the quality of a single programme event).

In both cases a field in the PI block defines values for the event. Editors should set the values appropriately, see in EN 300 707 [1] annex F. Other ratings to advise on specific content issues, e.g. sex, violence, bad language, can be added in the future in such a way that compatibility is maintained with the present system.

8.4 Display related blocks

In addition to the text within AI and PI blocks, text information can be conveyed via other blocks:

- OSD Information blocks: used to define the contents of the Header Area and the text for menus;
- Navigation Information blocks: conveys the text associated with navigation menus in a *Full EPG*;
- Message Information blocks: used for text messages that are not related to a particular event.

For the Enhanced EPG there are three additional structures:

- Object definition structures that support the display of a string contained in an MI NI, PI, or OI structure;
- DRCS definition structures that allow the definition of graphic characters either within the EPG or from the Teletext text service;
- CLUT definition structure structures that allow the definition of Colours either within the EPG or from the Teletext text service.

8.5 Navigation Information blocks

In other than *Full EPG* decoders, the navigation aspects are determined by the decoder manufacturer. In a *Full EPG* service the EPG service provider is not only responsible for the layout of the screen displays but also for the linking and interaction of the navigational structure. This should be designed to aid the viewer to find the information simply, easily and logically. Navigation Information blocks convey the data to achieve this.

8.6 The transmitted data stream

The transmission of data broadcasting information via Teletext is covered by EN 300 708 [2].

The EPG data is additional data that has to be transmitted along with the normal Teletext service. It is the network operator's/EPG service provider's responsibility to ensure that the EPG data is organized correctly and multiplexed with the normal Teletext data in a way that is compatible with all types of decoders which comply with the specifications.

In order to make effective use of the VBI and ensure that the most important programme data is available quickly for the viewer, EPG transmissions are split into two streams. Within the *Stream 1* the normal Teletext *20 ms page clearing rule* applies, within *Stream 2* it does not. *Stream 1* carries the *Near Information* for at least *This Channel* supported by the EPG service. The two streams are distinguished by a decoder through the use of different subcodes.

Stream 1 contains the *Application Information*, the *Programme Information* for at least the *Near Information* of *This Channel*, the *OSD Information* and the *Bundle Information*. *Stream 2* carries the remaining information blocks. The splitting of the data stream in this way will accelerate the transmission of the more important data.

Recommendations:

Network operators/EPG service providers should aim for a minimum repetition rate of 10 s for at least the Now and Next of the This channel component of the Near Information within Stream 1.

Apart from allocating the Near component of at least one channel to Stream 1, the network operator/EPG service provider is free to split the information between the two streams in whatever way he wishes.

The hexadecimal Teletext page number used for the EPG data is redefinable in the MIP. At least one hexadecimal digit is used to make the page "invisible" to normal Teletext decoders.

Recommendations:

A page number which includes at least one hexadecimal digit should be used to transport the EPG *service (see EN 300 708 [2]).*

The default Teletext page for EPG *data is 1DF but is redefinable in the MIP if necessary. The transmission of a MIP is mandatory.*

9 Display aspects

9.1 Screen layout

The display standard of the EPG is based on Teletext. Generally, the display screen is based on Level 1.5 Teletext (24 rows, 40 columns), with a screen aspect ratio of 4:3. The screen is divided into four areas, as shown in figure 6.

- *Header Area*: rows 1 to 3. Content and size are defined by the network operator/EPG service provider to identify his service. Starting from the first column position in row 1, contiguous locations will be filled row by row, left to right, with groups of 40 characters (including serial attributes) provided by the appropriate transparent string in an *OSD Information* block.

- *Event Area*: row 4 until the start of the *Message Area*. Visual layout and navigational elements are presented by the decoder and the displayed information is supplied by the EPG service. The programme title and other parameters such as channel, time and date of transmission will be displayed. In a *Full EPG* decoder, the results from the viewer's selection by theme or other criteria will appear here.

- *Message Area*: Number of rows determined by the size of the data to be displayed. Minimum of 1 row, maximum of 8. If a *Message Area* is defined, it always finishes on row 23. This area can contain the *Short* or *Long Information*, corresponding to the selected event. Alternatively, it can be used for messages, promotion of programmes or advertisements, etc. Starting from the first column position in the first row, contiguous locations will be filled row by row, left to right, with groups of 40 characters (including spacing attributes) provided by the appropriate transparent string in the *Programme* or *OSD Information* blocks. The same appears if the text information is referenced from a Teletext page although colour and other attributes will be added by the decoder, if required. If the text information is smaller than the message area, the manufacturer is free to position it vertically anywhere within the Message Area.

- *Navigation Area*: row 24. This area is used by the decoder to display navigational prompts.

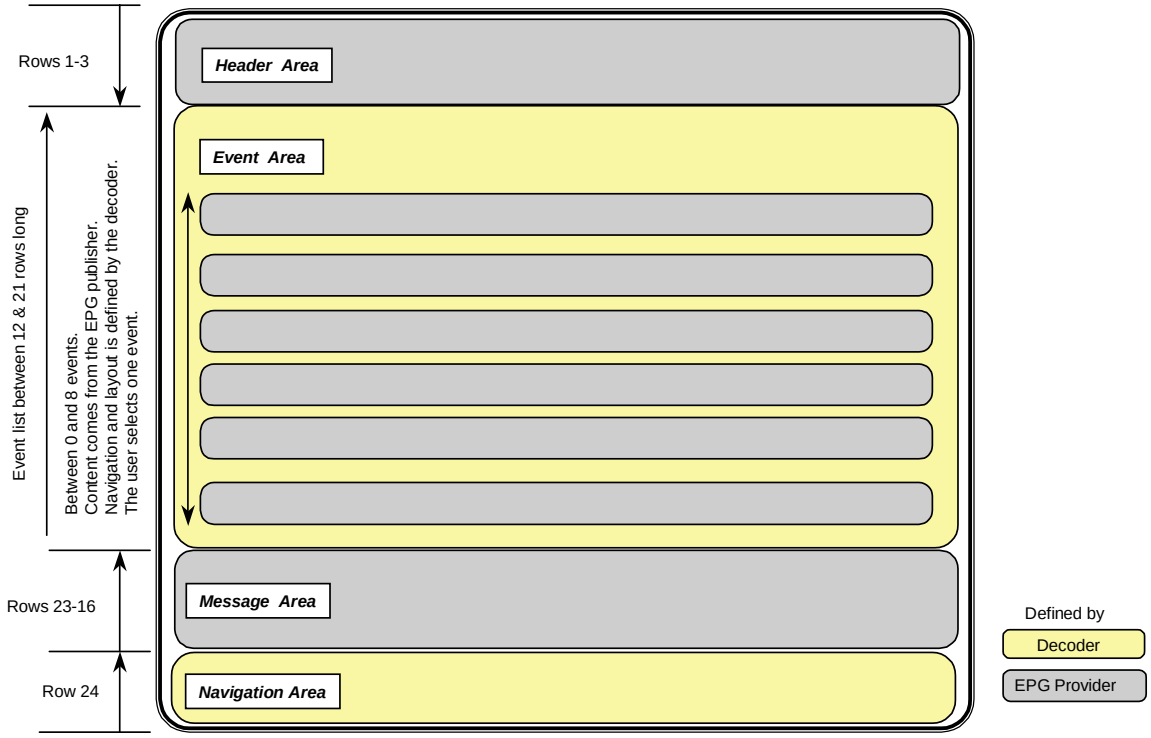


Figure 6: Screen layout

NOTE: A *Composite EPG* decoder may not necessarily display the information in this way.

Recommendations:

The display seen by the viewer will play a large part in determining the impact and success of an EPG service.

It is essential that the service provider is aware of the possible screen layouts to ensure that the information is displayed in a pleasing and correct way.

The image SHALL be checked by the service provider via an EPG decoder prior to transmission.

9.2 The definition of text

Text can be transmitted explicitly as part of the EPG transmission. *Transparent text strings* are sequences of characters and spacing attributes. A limited selection of Level 1 spacing attributes are available plus a *Carriage Return* command for formatting text strings into rows. Accented characters and other symbols available in Level 1.5 Teletext transmissions can be inserted as required. To ensure that some early decoders display text strings in a consistent manner, the escape sequences should be used to overwrite characters only and not attributes. A more technical discussion of Transparent strings can be found in clause 13.

Alternatively, text from pages in the normal Teletext service can be "cut-and-pasted" into the EPG and a complete Teletext page can be used as "Long Information". However, the use of these techniques is not recommended for the reasons outlined in clause 5.4.

9.3 Use of the Carriage Return attribute

A *Carriage Return* command can be transmitted as a spacing attribute within any transparent string. If it is known that only decoders with Teletext type displays are receiving the EPG transmission, such a command should not be used to break a row from column 35 onwards. Explicit spaces should be transmitted instead. This is because one *Carriage Return* command occupies 6 transmitted bytes. The use of a *Carriage Return* command in a string should only be used where all the attributes are set to their default values.

NOTE: Present developments centre around decoders which use Teletext display techniques and, generally, the displays will be character based, with 40 characters per row. Future decoders using more advanced display techniques may be capable of displaying more than 40 characters per row. Such decoders should ignore *Carriage Return* commands which are inserted for the sole benefit of normal Teletext decoders. However, a new *Carriage Return* command that is interpreted only by more advanced decoders will be required in the future in addition to the existing one.

9.4 Enhanced EPG

The enhanced EPG provides the display attributes of Enhanced Teletext to the EPG. For an editorial based overview of these features see clause 4 of TR 100 287 [6].

In adapting these enhancements to the EPG it shall be remembered that the screen is divided into Areas and any particular enhancement shall be contained totally within that area. In addition there are features such as a rotating messages.

There are a number of restrictions within the specification in terms of numbers of objects; DRCS and Colours available; these are unlikely to cause any limitations to normal editorial operation.

Enhancements require more memory in the decoder and more data volume in the transmission. The Enhanced EPG decoder may be able to share its memory between text content and the enhancement data but there is likely to be a limit of 128 kbyte on the enhancement data. The transmission requirements may be only once per complete transmissions of the database, but there may be some elements that need to be transmitted more frequently.

The provision of these enhancements makes the EPG far more attractive and gives the broadcaster more control over the look of the EPG.

10 Copyright and access control

Any information used in an EPG service may be subject to copyright protection for legal reasons.

NOTE: A distinction has to be made between programme information and programme listings. Some broadcasters will not want their listings copied and in some countries legislation may exist to prevent this.

Each EPG data block contains a copyright protection flag which indicates if the block can be used outside of the EPG service in which it was transmitted. By this means the network operator/EPG service provider can prevent the use of information blocks by, for example, *Composite EPG* decoders.

For various reasons all or part of an EPG service may be placed under conditional access control. The network operator/EPG service provider can restrict access to the data for instance if an extended EPG service is not free of charge. Each data block contains a set of flags allowing three modes of conditional access plus free access. More information can be found in EN 300 707 [1].

11 Scope and depth of an EPG

11.1 General considerations

Technical staff may well be asked to replicate the calculations shown in clause 12.5 regarding the volume of data and the effect on the normal Teletext service to match the needs of a particular network.

There are three main decisions:

- How much information per channel, per day?
- What depth of information should any particular day/channel have?
- When will more information be added to the EPG?

The information per channel, per day is best obtained by manually coding the printed version of what is required. A very careful check should be made to ensure the material is typical. The inclusion of *Long Information* can make a difference to the attractiveness of the service at the expense of the total size of the database. For example, it may be required to provide full details of the films to be shown at the weekend during the previous week. Of course, even within a set of title-only listings, there can be a major event(s) which should have *Short* and/or *Long Information*, etc.

The depth of information has a more complex idea to grasp if there is sufficient information already stored in an EPG decoder with non-volatile storage, it need not be sent so rapidly. The concept of *Near* being today and tomorrow was chosen to ensure that a suitable decoder need only be powered-up for a short time the day before to acquire and store sufficiently up-to-date information for the current day. Previously, editors thought of just providing the current days information but this would have had to be transmitted very frequently so that a decoder would have today's information for all channels within a very short time of turning on. Thus it may be useful to transmit a day or two with a listing of the title only; at least this will ensure that the programme title and type/genre are known to the decoder if acquisition has been halted for a day or two.

There is also an important concept regarding the time of day at which new data is added to the EPG. Broadcasters think of large sections of programming, perhaps *morning, afternoon, early evening, late evening and overnight*. It is thus more likely that the EPG will be updated with sections of programming rather than holding a constant number of programmes.

Also, the EPG may grow in data volume at certain times. For example, if the EPG usually covers only the *Near* period (two days) it is likely that by early Friday evening the whole of the EPG for Saturday **and** Sunday will be need to be sent so that viewers can plan their weekend viewing. This will mean that there would be, say, two and a half days worth of information needing to be transmitted and stored in the EPG decoder which has obvious implications. Likewise, the Christmas/New Year period is likely to place a great strain on programme listings.

It is not easy to make EPG calculations with absolute accuracy. Clauses 12.3 and 12.5 give typical figures as a starting point. A particular service will deviate from these figures and the only proof is to generate the database.

11.2 Prioritization

Generally prioritization should be used with caution. The more frequently information is sent, the greater the data rate. One important concept is that once an EPG service is running, the majority of the decoders will have the majority of the information stored, and thus need minimal refreshing. The EPG can operate with the programme information blocks being transmitted in any order and so there is no technical reason why prioritization cannot be applied.

11.2.1 The whole EPG

As reception of the EPG is dependent on the decoder being tuned to the channel there may be occasions, for instance during news bulletins, where the majority of the viewers will be watching this channel. Although the transmission frequency of the EPG is, say, 20 minutes, which is well within a half hour programme, it may be that to send the EPG more rapidly will ensure absolutely that the decoder is updated. Thus it may be a good time to add the next day's guide to the EPG.

11.2.2 Near information

This Channel Near is transmitted very frequently for the benefit of low-end decoders. For other channels, the *Near information* is likely to be stored in the decoder, but perhaps not in the depth that is desired from an editorial point of view. A practical solution needs to be found for each channel. For example, a refresh frequency of, say, 5 to 10 minutes for popular channels and closer to 20 minutes for the less popular ones.

11.2.3 Far information

In general, *Far Information* is for events sufficiently remote from *Near* that it may be deemed to be less important and thus can be refreshed at the most infrequent rates. However, *This Channel Far* may be treated with a similar rate to *Other Channels Near*.

11.3 Editorial guidance

There are many issues that the editor of an EPG should take into account in the way in which the service is delivered. This clause links some of the key parameters that need consideration following on from the general considerations detailed in clause 11.1.

11.3.1 Data volume, data rates and prioritizing

The amount of Teletext capacity in the transmission is likely to be limited. Thus the editor should decide on the best way of using the capacity, which could be a small database transmitted frequently or a larger database transmitted less frequently but with prioritizing so that some information is more rapidly acquired and stored e.g. popular channels, and updates being sent rapidly so that the EPG seems to be accurate at all times.

The frequent repetition of information will often slow down the remaining information very considerably.

As information may tend to be compiled a day or day segment at a time, the data volume will decrease during the day as the programmes are transmitted and then increase when the next segment of information is added to the EPG.

This can be a very technical matter, and advice should be sought.

11.3.2 Time to acquire

The updating of a database starts within a few seconds of the EPG signal being recognized by the decoder.

It is suggested that the complete database should be able to be down loaded within the duration of the typical programme, say twenty minutes. The prioritization of near information and the now and next can make the EPG provide some useful information to the viewer within a minute or so of starting to acquire the EPG.

Many decoders will store the EPG and so will have information available at the time the EPG is used by the viewer.

It should be noted that at installation a decoder will take some time to scan all the channels to provide the viewer with a list of EPGs that can be selected, and then take say 20 minutes to load the complete database. If the EPG is not on page 1DF the scanning time can be reduced by the frequent transmission of the part of the MIP containing the pointer to the EPG page.

11.3.3 Version control

A decoder may totally reconstruct the database when there is a new version signalled, or it may modify the existing information stored. Thus consideration should be given to when the version of the database is changed so that the viewer has the information available when they next access it. For instance if a decoder clears its memory when a New version is transmitted, it would be best to do a version change just after that start of a popular programme as it is unlikely that the viewer will need to access the EPG.

If a major editorial change, such as the deletion of a network operator from the EPG, is being considered, it is highly desirable to delete the higher structures when there is no information in the lower structures. For example if you are deleting the network operator at the end of the month do not send any information for the following month, so that at the end of the month there is only a structure with no information to delete.

Similarly the point in the day when the information for the next days is included in the transmission, which lengthens the time to acquire may need to be considered.

11.3.4 Viewers preferences

The viewer has two basic decisions: what type of decoder and then what level of EPG service to receive.

The editor should be aware of the limitations of the lower end decoders which will tend to store less and not retain the information in non volatile RAM and thus need more frequent updating and retransmission of the database.

But assuming that he majority of decoders are multiple channel the editor should be aware of the mix between a full EPG and a composite EPG amongst the viewership.

There are many features of each and it is likely that early adopters of EPG transmissions will favour the Full EPG as a way of trying to exclude other channels from being within a (composite) EPG.

The navigation in a full EPG is totally under broadcaster control but tends to work in terms of "today" or "tomorrow" with the time of midnight being the divider. A Composite EPG with the navigation being provided by the manufacturer may operate with the next few hours thus providing continuity across midnight for what may be a programme days listings.

11.3.5 Enhanced EPG

The enhanced EPG enables a more attractive service to be designed. Because of the inherent templating in the way that the EPG is set up and transmitted, the editorial overhead of doing some of the enhancements is very low.

Careful use of objects and DRCS - which could be thought of a small icons- can improve the look of the EPG tremendously. As these features requires the memory and capabilities of a high level EPG decoder, the overall functionality of the EPG will be improved for the viewer.

12 Technical background

12.1 Outline

The purpose of this clause is to give some indication of the effects of choosing to transmit a certain size of EPG and the resulting effects on other Teletext services. An EPG is a complex and interrelated system and editorial aspirations may have to be altered to fit the technical limits. It is not easy to discuss one aspect without making reference to many others.

This clause has four main topics:

1) Transmission related aspects, e.g. where does the capacity for *Streams 1 and 2* come from?

2) The size of the constituent parts of the total EPG, and the minimum repetition rates required.

3) Examples of possible service, showing the effects of decisions on the scope of the service and the cycle time.

4) A number of other operational technical issues.

When planning an EPG the basic parameters that have to be considered are:

- What has to be transmitted (e.g. number of channels supported, number of days, depth of information, etc.)?
- How much data is there to be transmitted?
- How frequently does a particular type of data need to be transmitted?
- How much transmission space is there?

Overall these parameters define the shape and style of an EPG. With careful thought, the technical features can be applied to enable a practical and distinctive service to be created.

This clause tries to give some feeling for the size and dynamics of an EPG. There are, of necessity, a number of technical approximations made and these are clearly indicated. Also, the amount of editorial information has been worked out for typical services, other services will need to modify them accordingly.

An EPG is a data broadcast operation transferring information from the EPG service provider's database to the decoder's database where it is stored and then accessed by the viewer. Thus the speed and frequency of transmission are not major issues in themselves.

12.2 Transmission aspects

12.2.1 Page format

Full details can be found in EN 300 708 [2] clause 4. An EPG transport page is of the data broadcasting type *Page Format - Clear*.

A standard Page Format - Clear data broadcasting Teletext page comprises a page header and up to 23 normal packets. The EPG data appears in the 23 packets, each with a capacity of carrying 39 bytes of data. (The first byte is used to indicate where a new block of data starts within the packet). Thus each full EPG transport page can convey a maximum of 897 bytes of data. The actual quantity of EPG data carried will be less than this as the control data elements within the database are Hamming 8/4 coded and thus require two bits to transmit one bit of data. The text components are parity protected.

The S2 and S4 parts of the page sub-code in the header are used to inform a decoder of the number of packets that will be broadcast within this page. The page can be transmitted in fragments, i.e. a header followed by some of the packets. This is repeated until the final packet (as indicated by S2 and S4) has been transmitted. This technique is more likely to be used for *Stream 2* as only a few VBI lines become available at any one time. Fragmented transmission is described in EN 300 706 [3] clause B.6.

The S1 component of the sub-code is used as a continuity index to ensure a decoder processes the pages in the correct order. There will be separate indices for *Streams 1* and *2*. S3 is used to distinguish between *Stream 1* and *Stream 2* pages.

A packet 28/0 may be appended to the page to define its function as a data broadcasting page of type Page Format - Clear and to prevent it from being erroneously decoded by equipment designed to receive the original type of data broadcasting page known as *Page Format - CA* (as defined in EN 300 708 [2] clause 5).

EPG reception may be corrupted on some first generation decoders when streams other than 1 and two are transmitted (for other applications) on the same page number as the EPG.

12.2.2 Stream 1

The EPG database is split into two streams for transmission as page-format Teletext. The specification defines that the pages in *Stream 1* shall contain *This Channel Near Information* (i.e. the programme information for the next two days on this channel) and at least the Bundle Information, Application Information and the OSD Information block defining the contents of the Header Area.

A *Stream 1* page is identified by a value of 0 for the S3 part of the page sub-code.

Stream 1 pages are broadcast obeying the *20 ms* rule like normal Teletext pages and have to be captured by all types of decoder. Thus *Stream 1* pages will either take capacity from the existing Teletext service, or result in a slower cycle time, regardless of whether the transmission mode is serial or parallel.

12.2.3 Stream 2

Stream 2 pages contains the rest of the EPG database, the *Near Information* for other channels, *Far Information* for all channels and, where applicable, further navigation and menu data. It is not constrained by the *20 ms* rule and thus can be transmitted in the filler packet space (see clause 12.2.4) in a similar manner to Level 2.5 Teletext enhancement data (see EN 300 706 [3] clause B.6). Accordingly, the data will not be accessible by the simpler types of decoder.

A *Stream 2* page is identified by a value of 1 for the S3 part of the page sub-code.

12.2.4 Filler packet space

The situation where a VBI line allocated for Teletext is not actually taken up happens quite frequently in many transmissions, especially those operating in serial mode. Unused lines occur because in normal Teletext transmissions it is not permitted to send the page header and another packet for the same page in the same VBI period*;* the *20 ms* rule.

Let us assume that a page consists of 24 packets and it is being transmitted on 10 VBI lines.

NOTE: A normal displayable Teletext page consists of a header (row zero) and a number of other packets. A full page takes 24 packets, but if a row has no information it need not be transmitted. This is referred to as *Row Adaptive* transmission. Fastext, local enhancement data and PDC use more packets per page.

Because of the 20 ms rule only the header packet is transmitted in the first VBI. 10 packets are sent in the next VBI, 10 packets in the following VBI, and the final 3 packets in the VBI after that but there will be 6 VBI lines that cannot be used for the normal Teletext service, assuming the header of the next page is transmitted on the final line. This "space" is often filled with duplicates of the next page header or a packet 8/25. It is in this *filler packet* space that *Stream* 2 can be transmitted.

Table 1 shows how many filler packets result from the transmission of given size of page using a given number of VBI lines per field.

Stream 2 is intended to recover the otherwise lost capacity and the normal text service resumes with the page header for the next page on the last of the VBI lines available. An EPG page can be a minimum of two packets, a page header and one data packet. Therefore, there has to be more than two filler packets available in any VBI to allow *Stream 2* data to be carried.

Table 2 shows the effective data rate that can be achieved using the filler packets alone, assuming 40 data bytes per packet and all the pages in the transmission have the same number of rows per page.

It will become apparent later that for the majority of services there is ample filler packet space for both EPG and enhanced Teletext services. Level 2.5 Teletext has a maximum enhancement data rate requirement of 500 packets in 20 s = 1 kbyte/s.

Many systems use row adaptive transmission and do not have pages of constant length. Either calculation from page lengths or the use of Teletext analysers will determine the filler packet space that is available. Further, there may be other users of the space, e.g. packets 31, see EN 300 708 [2] clauses 6 and 7. However, they are unlikely to exceed 1 kbyte/s.

Table 1: Filler packets created per page in normal transmissions

	Number of rows in text page												
VBI lines	**30**	**29**	**28**	**27**	**26**	**25**	**24**	**23**	**22**	**21**	**20**	**19**	**18**
1													
2		1		1		1		1		1		1	
3		1	2		1	2		1	2		1	2	
4	2	3		1	2	3		1	2	3		1	2
5		1	2	3	4		1	2	3	4		1	2
6		1	2	3	4	5		1	2	3	4	5	
7	5	6		1	2	3	4	5	6		1	2	3
8	2	3	4	5	6	7		1	2	3	4	5	6
9	6	7	8		1	2	3	4	5	6	7	8	
10		1	2	3	4	5	6	7	8	9		1	2
11	3	4	5	6	7	8	9	10		1	2	3	4
12	6	7	8	9	10	11		1	2	3	4	5	6
13	9	10	11	12		1	2	3	4	5	6	7	8
14	12	13		1	2	3	4	5	6	7	8	9	10
15		1	2	3	4	5	6	7	8	9	10	11	12
16	2	3	4	5	6	7	8	9	10	11	12	13	14

Table 2: Data rates achievable through the use of filler packets (kbyte/s)

VBI lines	Number of rows per text page												
	30	29	28	27	26	25	24	23	22	21	20	19	18
1													
2													
3			0,2			0,2			0,2			0,3	
4	0,2	0,5			0,3	0,6			0,3	0,7			0,4
5			0,3	0,6	1,0			0,4	0,8	1,2			0,4
6			0,4	0,7	1,1	1,6			0,4	0,9	1,4	2,0	
7	1,5	2,0			0,4	0,9	1,4	1,9	2,4			0,5	1,1
8	0,4	0,9	1,3	1,8	2,4	2,9			0,5	1,1	1,7	2,4	3,1
9	2,3	2,9	3,4			0,5	1,1	1,7	2,3	3,0	3,8	4,6	
10			0,5	1,1	1,7	2,3	3,0	3,7	4,4	5,2			0,7
11	1,1	1,7	2,3	2,9	3,6	4,3	5,1	5,9			0,7	1,5	2,3
12	2,9	3,5	4,2	4,9	5,7	6,5			0,7	1,5	2,3	3,1	4,0
13	4,8	5,6	6,3	7,2			0,7	1,5	2,2,	3,1	4,0	4,9	5,9
14	7,0	7,8			0,7	1,4	2,2	3,0	3,9	4,8	5,8	6,8	7,9
15			0,7	1,4	2,2	3,0	3,9	4,8	5,7	6,7	7,8	8,9	10,1
16	0,7	1,4	2,2	3,0	3,8	4,7	5,6	6,6	7,6	8,7	9,8	11,0	12,3

12.2.5 Transmission relationship between Streams 1 and 2

Stream 1 and *Stream 2* are independent and asynchronous feeds of data. However, there is a technical requirement to simplify decoder design that the transmission of a page header at the start of a page shall be separated by at least 200 ms (10 fields) from the transmission of another EPG page. Other than this there are no constraints relating the two streams.

The 200 ms rule governs only the true start of pages, that is when the page header will be followed by packet 1. It does not apply to later fragments. If a *Stream 2* page is sent in fragments in the filler packet space, it is possible for it to overlap a *Stream 1* page. Fragmented transmission is covered in EN 300 706 [3] clause B.6.

Figure 7 shows an example of a transmission using 9 lines per VBI. A *Stream 2* page (EPG 2) starts in field 0 and uses the filler packet space as it occurs while row adaptive pages (prefix "M") are being transmitted in the normal service. (The page headers of the later fragments of the *Stream 2* page are marked "epg 2".) A *Stream 1* page (EPG 1) cannot commence until at least field 10, and in this example field 12 has the earliest opportunity. In effect the *Stream 2* page is interrupted during fields 13-15 while the *Stream 1* page is transmitted.

Field															
0	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
M19	M2	M12	epg 2	M1	M10	M19	M1	M10	M20	M1	M10	M19	E1	E10	E19
M20	M3	M13	e3	M2	M11	M20	M2	M11	M23	M2	M11	M20	E2	E11	E20
M21	M4	M14	e4	M3	M12	M21	M3	M12	epg 2	M3	M12	M21	E3	E12	E21
M22	M5	M16	e5	M4	M13	M22	M4	M13	e12	M4	M13	M22	E4	E13	E22
M23	M6	M17	e6	M5	M14	M23	M5	M15	e13	M5	M14	epg 2	E5	E14	E23
EPG 2	M7	M18	e7	M6	M15	epg 2	M6	M16	e14	M6	M15	e17	E6	E15	epg 2
e1	M8	M19	e8	M7	M16	e10	M7	M17	e15	M7	M16	e18	E7	E16	e20
e2	M9	M21	e9	M8	M17	e11	M8	M18	e16	M8	M17	e19	E8	E17	e21
M0	M10	M23	M0	M9	M18	M0	M9	M19	M0	M9	M18	EPG 1	E9	E18	M0

Figure 7: Transmission sequence example

12.2.6 Serial versus parallel transmissions

With reference to table 1 it can be seen that for a typical serial transmission using, say, 9 lines per field, there will be occasions when 8 filler packets occur. However, for a 9 line parallel transmission organized as 3 magazines, each on 3 VBI lines, the maximum number is only 2. While parallel transmissions are more efficient for normal text services, there is much less inefficiency that can be exploited for EPG *Stream 2* use. Also, the transmission equipment may be capable of allocating every available VBI line, perhaps by inserting packets 30 or 31. Consequently, a more significant allocation of transmission capacity to the EPG service may be required when parallel mode is employed and it may be simpler to assume that BOTH streams obey the *20 ms* rule.

12.3 Database components

This clause states the required transmission rate and size of each block assumed in the later calculations of complete services. Block sizes are quoted in terms of the number of bytes that will be transmitted after the data has been encoded for transmission (i.e. Hamming and parity protection bits have been added) and assembled into Teletext packets. A decoder is likely to remove the protection data prior to storing the database and the volume of stored data will be less than the transmitted volume.

Sample lengths have been chosen for the text strings that form part of each block under consideration. To a first approximation, block sizes with different text string lengths can be calculated by adding or subtracting one byte per character as required.

12.3.1 Bundle Information

The Bundle Information amounts to 14 bytes. It will be absorbed into the overall transmission without any noticeable effect despite having to be transmitted frequently. Consequently, it is omitted from the later calculations although it may well be considered to be part of the AI block as it should be transmitted at the same rate.

12.3.2 Application Information

The size of the AI block depends upon the number of channels supported by the guide. The following examples assume an EPG service name of 20 characters, and, for each channel, a network operator's name of 10 characters.

Channels	AI size (bytes)
1	103
2	140
4	212
10	427
20	786

When any type of decoder is turned on it needs to find the top level EPG data fairly quickly so that it can start collecting and processing the EPG specific data. This requires the AI and BI blocks to be transmitted every 3 to 4 s. Further, to ensure that decoders looking for information on the current programme display the correct information, the AI block has to be updated and re-transmitted when one programme finishes and the next one starts on ANY of the networks covered by the EPG.

12.3.3 Programme Information

The size of PI blocks is governed largely by the amount of text data they contain. In the following examples a PI block is assumed to have a title length of 32 characters, two themes and one sort criteria:

PI contents	PI size (bytes)	Abbreviation
Title only	69	Title PI
Title + Short Info of 80 characters (2 rows)	177	Mini PI
Title + recommended Short Info of 140 characters	243	Short PI
Title + maximum Short Info (256 characters)	361	
Title + Long Info of 960 characters (24 rows)	1 140	Long PI

The above abbreviations are used in clause 12.4 when discussing examples of services.

The transmission frequency of a PI block depends upon the channel it belongs to and how long before the associated programme will be broadcast. To enable a low-end decoder with limited memory to provide a *This Channel Now And The Next Four Programmes* service, the PI blocks for these items have to be transmitted every 10 s or faster and appear in *Stream 1*. The user can then be presented with the information soon after a channel change. However, this is also a requirement for more sophisticated decoders if they do not include non-volatile storage.

The remaining *Near Information* for *This Channel* has to be transmitted at least every 30 s maximum. The transmission rate for the remaining programme information is at the service provider's discretion but a maximum cycle time of 20 minutes is recommended.

12.3.4 OSD Information, Navigation Information and other blocks

The likely quantity of OSD, Navigation and Message Information is difficult to gauge as it depends on the editorially defined "look and feel". A figure of 15 to 25 kbytes is used later in the multi-channel examples. However, if the service provider wants his name to appear in the *Header Area* on all decoders he has to transmit an OSD Information block (with a block number of 0) in kbytes *Stream 1*. By way of example, an OI block containing a name of 30 characters will amount to 62 bytes.

The OSD Information in *Stream 1* should be transmitted no slower than the minimum PI rate, i.e. every 10 s. OSD and Navigation Information in Stream 2 can be much slower, perhaps every 4 to 5 minutes.

The sizes of the other *Housekeeping* blocks that will be present in the EPG are not evaluated here as they are very small compared to the total PI component.

12.4 Typical transmission decisions

It is recommended that the whole EPG should be transmitted once every 20 minutes.

The time between the transmission of the same information is important because:

- it determines the time that it will take a decoder starting from nothing to assemble an EPG;
- for the decoder that has a full EPG already in memory, it determines the maximum time (if no other updating techniques are employed) by which the decoder's database is out of step with the service provider's database;
- it is the minimum time that a decoder has to be tuned into that channel to obtain a refresh of the database.

A decoder that can make use of all the information in a *Full EPG* service is likely to be constantly updating the information and thus there is no need to send the information very frequently.

Assuming *This Channel Near* is carried in *Stream 1* then *Stream 2* will have three main constituents, *Other Channels Near*, *All Channels Far* and *Housekeeping* data such as OSD and Menu Information, messages, etc. It may be necessary to transmit these at different frequencies and this in turn leads to an increase in the data rate. The prioritization of this information can be very complex and so a fairly simple view is taken in the service examples in clause 12.5. It can also lead to a waste of transmission capacity and so should be used with caution.

The *Housekeeping* information depends upon the editorial style and "look-and-feel" adopted. Its overall size is not likely to be significant compared to the PI component and a transmission frequency of around 4 minutes should be acceptable as it is unlikely to change very often.

12.5 Service scenarios

How much information to include about each programme and how many programmes should be covered are likely to be the editorial matters of most concern and the greatest variability. This clause presents a number of different scenarios and calculates the volume of data for each. They are illustrations and show the method that can be used to work out the approximate amount of data within an EPG. Refresh rates are set and the transmission implications for each database, using two streams if necessary, are calculated accordingly.

The size of the data volumes for each category of information in a particular EPG should be calculated at the planning stage. These figures will give an indication of the total volume required for a particular service. Although the examples are generalizations they should be sufficiently accurate to give implementors a feel for a service and the size of the database required. The real test is to set up an EPG with the selected parameters, valid programme listings and other information, and then to check the volume it occupies.

Quite minor changes in the amount of data for each item, when multiplied by the large number of items in an EPG, can make noticeable changes to the data volume. In particular, including several *Long Information* fields can inflate the data volume considerably.

An EPG database is not static. It can go up and down in size, both in data volume for the same number of programmes, and also in the number of days covered. For example, a third day of listings in detail may be useful for the weekend (Friday, Saturday and Sunday). Thus on a Friday the database would contain an extra day's worth of detailed programme information compared to the rest of the week.

The following assumptions have been made and constraints imposed on the analysis of the example services:

- there are between 32 and 40 programme events per day (36 is assumed in the calculations);
- the total database for a *Multiple Channel EPG* or *Full EPG* should not exceed 256 kbytes once it has been encoded into Teletext packets. The PI component should amount to around 230 kbytes, leaving space for navigation and menu data. This also allows some extra space when programme listings for an extra day are required to cover a weekend or public holiday;
- for the multi-channel scenarios, each channel is placed in one of four categories on a day-by-day basis and a standardized volume of data is assumed:
  - the *Major Channel Near* category is quite detailed and 12 kbytes per day (24 kbytes in total) is allocated. This may comprise 32 events per day, each with a PI containing a Short Info of the recommended 140 characters, and 4 events where the PI has a Long Info of 24 rows;
  - the *Minor Channel Near* and *Channel Far* categories contain some programme detail and each is allocated 9 kbytes per day per channel. (Thus *Minor Channel Near* will total 18 kbytes.) This may be achieved with 33 events per day, each with a PI containing a Short Info of about two rows of text, and 3 events where the PI has a Long Info of 24 rows;
  - programmes in the *Titles Only* category do not have any additional information. 36 events per day amounts to 2 kbytes.
- AI and BI blocks are transmitted every 3 s;
- *This Channel Now and The Next Four Programmes* should be transmitted every 10 s (the minimum stated in the specification);
- the remaining *This Channel Near* information should be transmitted every 30 s (the minimum stated in the specification);
- the total EPG should have a maximum cycle time of 20 minutes;
- *Stream 1* should be limited to one page per second, if practical;
- the required EPG data and page rates are calculated individually for *Streams 1* and *2* and then combined into an overall figure as this may be more representative of the true rate in a parallel transmission system;
- the data broadcasting pages transmitted are used to carry EPG data only.

12.5.1 Minimum EPG service; This Channel Now and Next

The calculation assumes that each of the 5 PI blocks required in the minimum *This Channel Now and the Next Four Programmes* service has a *Short Info* of 140 characters. All this data has to be transmitted in *Stream 1*.

Component	Size (bytes)	Tx rate	Bytes/s	Pages/s
Short PI (243 × 5)	1 215	10 s	122	0,13
AI (single channel)	103	3 s	34	0,04
OI (service title only)	62	10 s	6	0
Total	1 380		162	0,18

Thus a minimum EPG service can be supplied using 0,18 pages per second in *Stream 1*.

12.5.2 This Channel Today

Programme information for one day for *This Channel;* 32 Short PI + 4 Long PI. This split of Short and Long PIs is chosen to achieve the PI size constraint of 12 kbytes per day for *This Channel Near*. All this data has to be transmitted in *Stream 1*.

Component	Size (kbytes)	Tx rate	kbyte/s	Pages/s
Short PI (32 × 243 bytes)	7,59	10 s	0,76	0,85
Long PI (4 × 1 140 bytes)	4,45	10 s	0,44	0,49
AI (single channel; 103 bytes)	0,10	3 s	0,03	0,04
OI (service title only)	0,06	10 s	0	0
Total	12,20		1,23	1,38

This has exceeded the one page per second target for *Stream 1* and so some of the data has to be transmitted at a slower rate. Assuming there is one Long PI within the first five programmes, the target rate is achieved if the PI data outside of the minimum EPG is transmitted over 15 s.

Component	Size (kbytes)	Tx rate	kbyte/s	Pages/s
Minimum EPG, Short PI (4 × 243 bytes)	0,95	10s	0,10	0,11
Minimum EPG, Long PI (1 × 1 140 bytes)	1,11	10s	0,11	0,12
Rest of today, Short PI (28 × 243 bytes)	6,64	15s	0,44	0,49
Rest of today, Long PI (3 × 1 140 bytes)	3,34	15s	0,22	0,24
AI (single channel; 103 bytes)	0,10	3s	0,03	0,04
OI (service title only)	0,06	10s	0	0
Total	12,20		0,90	1,00

12.5.3 This Channel Near

Two days worth of programme information for *This Channel*, each day with 32 Short PI and 4 Long PI. All this data has to be transmitted in *Stream 1*. The target of one page per second is achieved if the PI data outside of the minimum EPG is transmitted over 34 s.

Component	Size (kbytes)	Tx rate	kbyte/s	Pages/s
Minimum EPG, Short PI (4 × 243 bytes)	0,95	10s	0,10	0,11
Minimum EPG, Long PI (1 × 1 140 bytes)	1,11	10s	0,11	0,12
Rest of *Near*, Short PI (60 × 243 bytes)	14,24	34s	0,42	0,47
Rest of *Near*, Long PI (7 × 1 140 bytes)	7,79	34s	0,23	0,26
AI (single channel; 103 bytes)	0,10	3s	0,03	0,04
OI (service title only)	0,06	10 s	0	0
Total	24,25		0,89	0,99

Unfortunately, the figure of 34 s is just outside the specification maximum of 30 s. To achieve this the page rate would have to be 1,08.

This scenario defines the *Major Channel Near* category in the following multi-channel, multi-day examples.

12.5.4 Service A: This Channel Only for 14 days

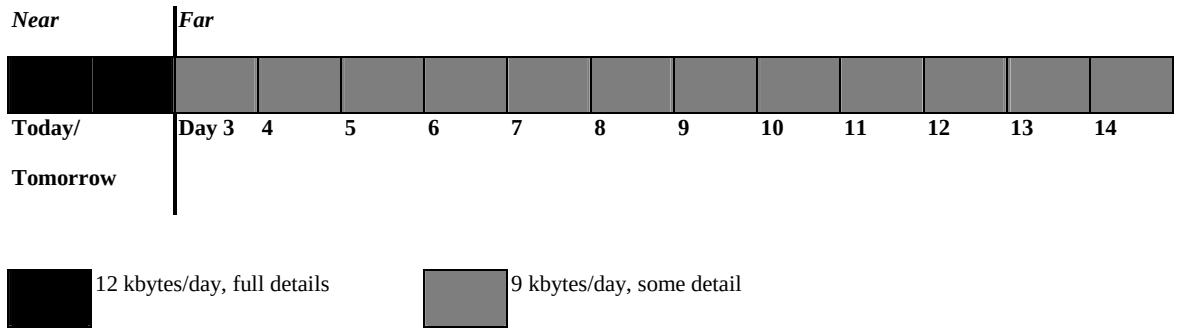
A guide to one channel over 14 days, with less detailed information after the first two days. The two *Near* days each comprise 32 Short PI and 4 Long PI, as in the previous example. The 12 days of *Far Information* comprises 33 Mini PI and 3 Long PI per day to achieve the PI size constraint for *This Channel Far* per day:

$$(33 \times 177) + (3 \times 1\ 140) = 9 \text{ kbytes}.$$

Leaving aside the transmission rate aspects, the data volume calculation based on the PI component alone amounts to:

Channels	Days	Component	Size	Near	Far
1	2	*Major Channel Near*	$1 \times 2 \times 12$ K	24 K	
1	12	*Channel Far*	$1 \times 12 \times 9$ K		108 K
			Sub-totals	24 K	108 K
			PI Total	132 K	

The service can be represented graphically in the following manner, with the number of days horizontally and the number of channels vertically:



As all of *Near Information* belongs to *This Channel*, it has to be transmitted in *Stream 1*. A cycle time of 10 minutes is chosen for the *Far Information* and the size of the navigation and menu components is estimated as 25 K, with a repetition rate of 4 minutes.

Component	Size	Tx Rate	Stream 1	Stream 2	Combined
AI	103	3 s	34		
This Channel Now and Next	2 K	10 s	205		
Rest of *This Channel Near*	22 K	30 s	751		
PI Far	108 K	10 m		184	
OI, etc,	25 K	4 m		107	
Total	157 K		990 byte/s	294 byte/s	1 284 byte/s
Page rate			1,08 pages/s	0,32 pages/s	1,40 pages/s

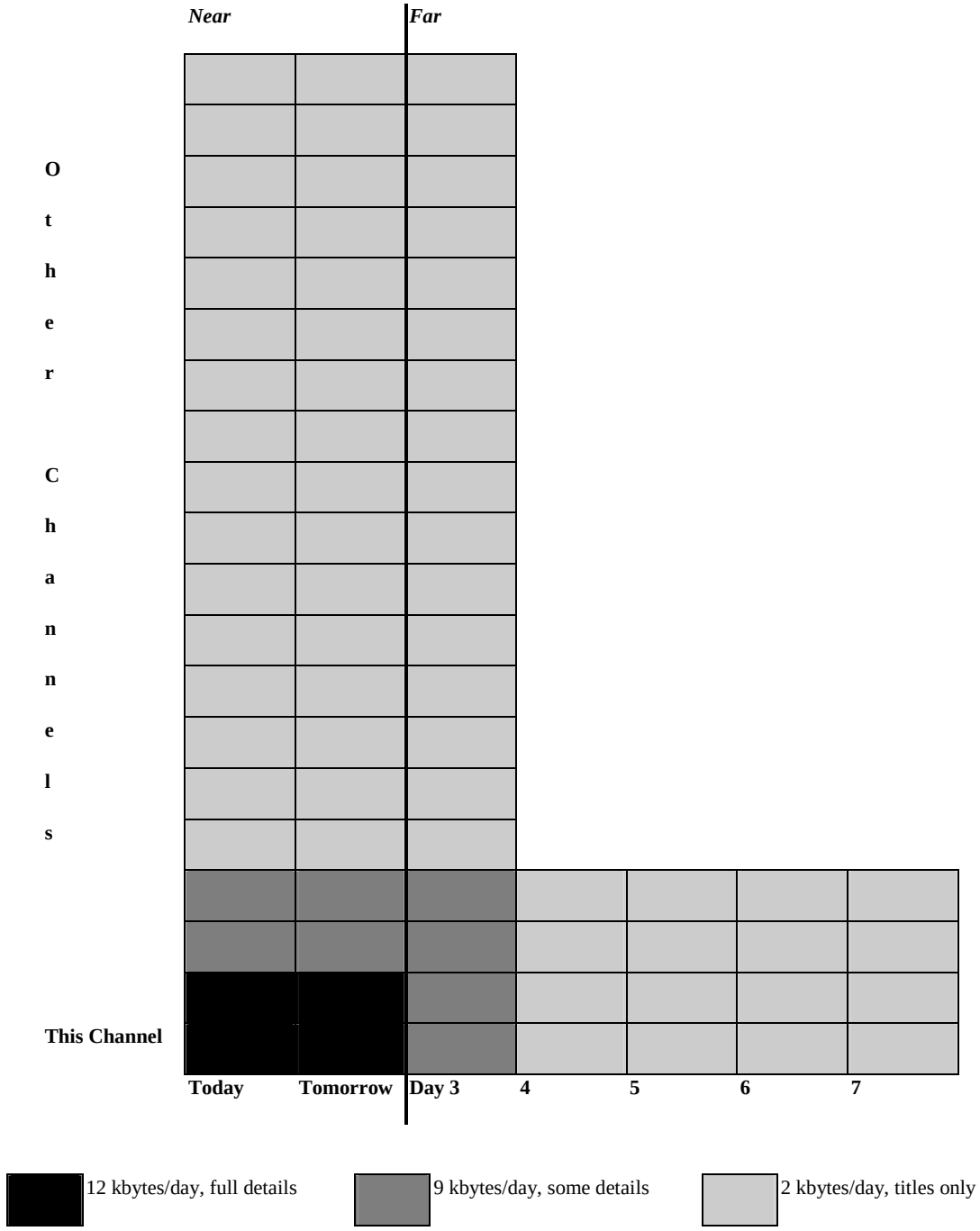
12.5.5 Service B: 4 channels for 7 days in some depth, plus 16 channels for 3 days, titles only

During the *Near* period, two channels are presented in detail and two others are covered to a lesser extent. On the third day, all 4 channels are treated equally and for the rest of the week only titles are included. For the first three days, the programmes titles on 16 other channels are included.

Channels	Days	Component	Size	Near	Far
2	2	*Major Channel Near*	$2 \times 2 \times 12$ K	48 K	
2	2	*Minor Channel Near*	$2 \times 2 \times 9$ K	36 K	
16	2	*Titles Only*	$16 \times 2 \times 2$ K	64 K	
4	1	*Channel Far*	$4 \times 1 \times 9$ K		36 K
16	1	*Titles Only*	$16 \times 1 \times 2$ K		32 K
4	4	*Titles Only*	$4 \times 4 \times 2$ K		32 K
			Sub-total	148 K	100 K
			Total	248 K	

The original intention was to present four channels in some detail and the titles only for 16 other channels for a week. However, this accumulates to almost 500 kbytes. The compromise adopted would allow the listings for a weekend to be transmitted from late on a Thursday night.

The service can be represented graphically in the following manner:



The menu and navigation components are estimated at 20 kbytes. A 5 minute rate is chosen for the *Near Information* from other channels, and a 20 minute rate for all *Far Information*.

Component	Size	Tx Rate	Stream 1	Stream 2	Combined
AI (20 channels)	786	4 s	197		
This Channel Now and Next	2 K	10 s	205		
Rest of *This Channel Near*	22 K	30 s	751		
Other PI *Near*	124 K	5 m		423	
PI *Far*	100 K	20 m		85	
OI, etc.	20 K	4 m		85	
Total	268 K		1 153 byte/s	593 byte/s	1 746 byte/s
Page rate			1,25 pages/s	0,64 pages/s	1,89 pages/s

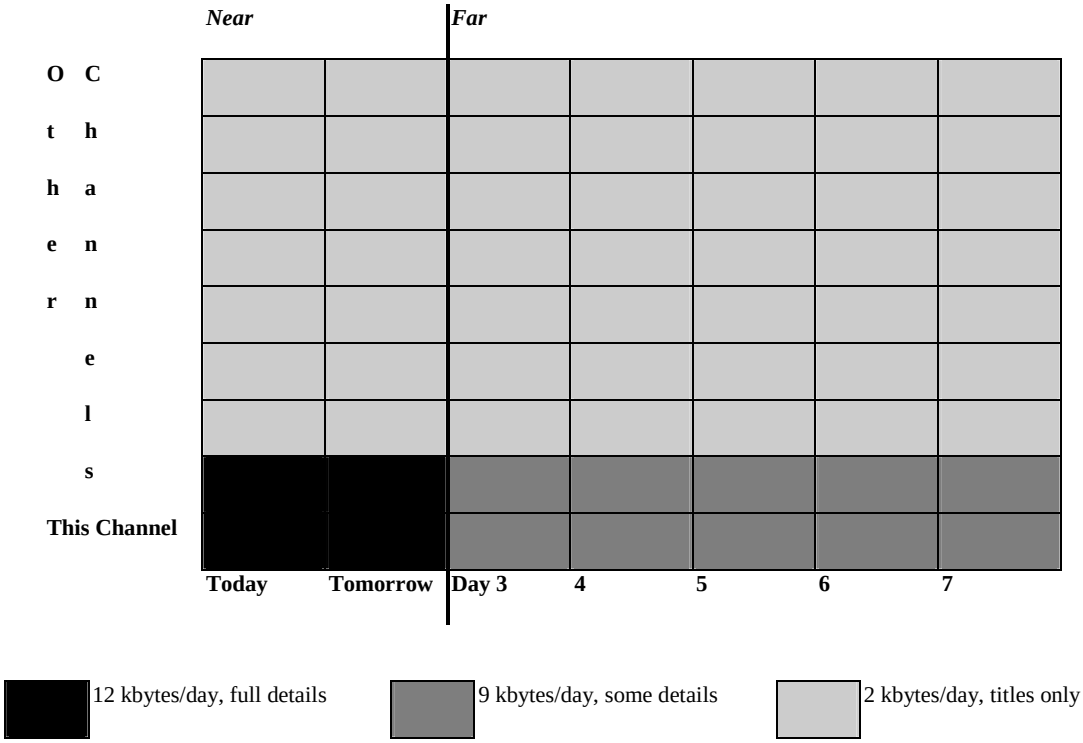
Note how the 20 channel AI component in *Stream 1* has become comparable with the *This Channel Now and Next* component.

12.5.6 Service C: 2 channels in detail plus 9 other channels, titles only, for 7 days

Nine channels are covered for one week. Two channels are presented in some depth and only titles are provided for the remainder.

Channels	Days	Component	Size	Near	Far
2	2	*Major Channel Near*	$2 \times 2 \times 12$ K	48 K	
7	2	*Titles Only*	$7 \times 2 \times 2$ K	28 K	
2	5	*Channel Far*	$2 \times 5 \times 9$ K		90 K
7	5	*Titles Only*	$7 \times 5 \times 2$ K		70 K
			Sub-total	76 K	160 K
			Total	236 K	

The service can be represented graphically in the following manner:



The menu and navigation components are estimated at 25 kbytes. A 3 minute rate is chosen for the *Near Information* from other channels, and a 20 minute rate for all *Far Information*.

Component	Size	Tx Rate	Stream 1	Stream 2	Combined
AI (9 channels)	393	4 s	98		
This Channel Now and Next	2 K	10 s	205		
Rest of *This Channel Near*	22 K	30 s	751		
Other PI *Near*	52 K	3 m		296	
PI *Far*	160 K	20 m		137	
OI, etc.	25 K	4 m		107	
Total	261 K		1 054 byte/s	540 byte/s	1 594 byte/s
Page rate			1,15 pages/s	0,59 pages/s	1,74 pages/s

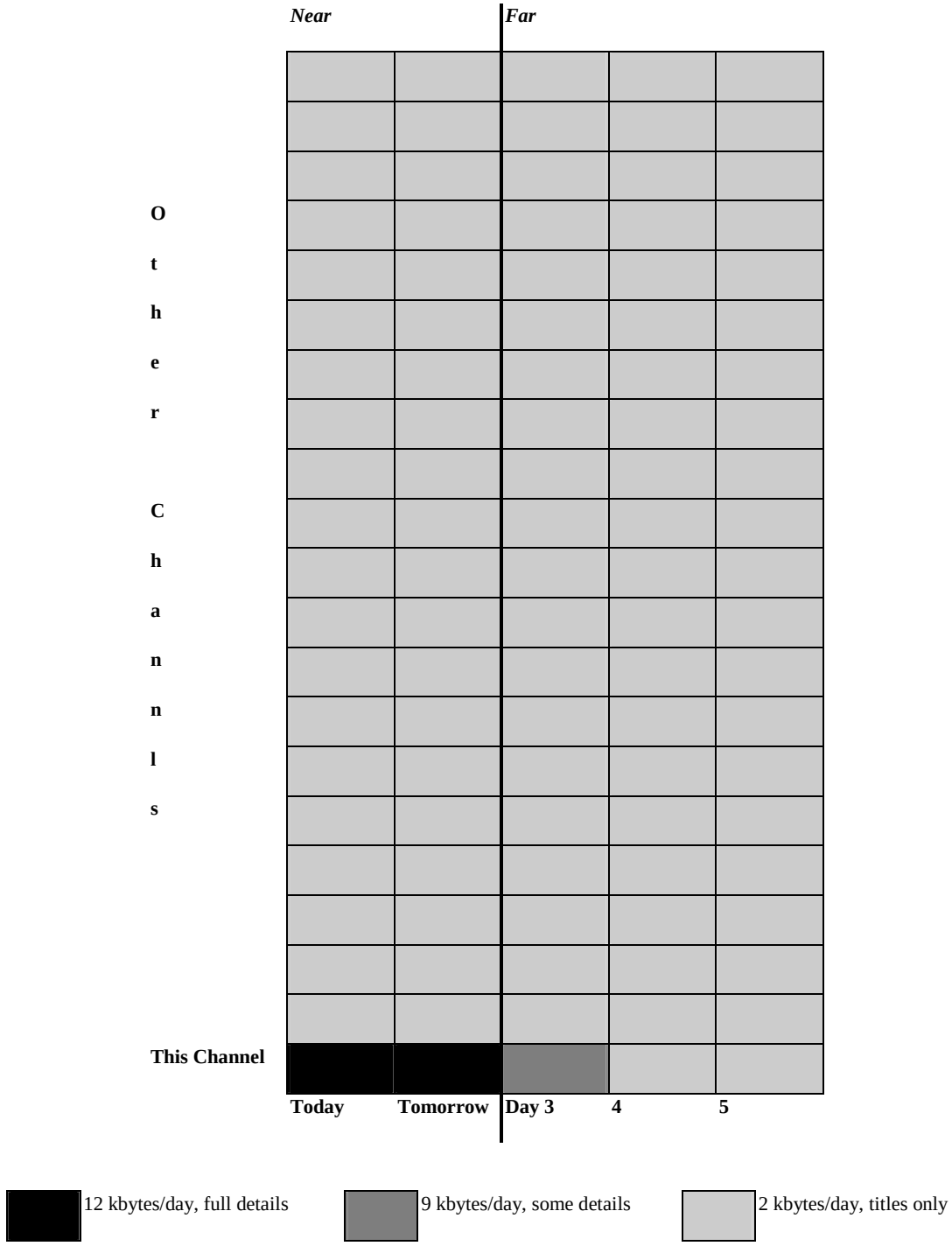
12.5.7 Service D: 1 channel in some depth plus 20 other channels, titles only, for 5 days

Twenty-one channels are covered over 5 days. The *This Channel* coverage gets progressively less detailed. Only titles are presented for the remaining channels.

Channels	Days	Component	Size	Near	Far
1	2	*Major Channel Near*	$1 \times 2 \times 12$ K	24 K	
20	2	*Titles Only*	$20 \times 2 \times 2$ K	80 K	
1	1	*Channel Far*	$1 \times 1 \times 9$ K		9 K
1	2	*Titles Only*	$1 \times 2 \times 2$ K		4 K
20	3	*Titles Only*	$20 \times 3 \times 2$ K		120 K
			Sub-total	104 K	133 K
			Total	237 K	

It should be noted that if one week's worth of information was required, the number of other channels would have to be reduced from 20 to about 12.

The service can be represented graphically in the following manner:



The menu and navigation components are estimated at 15 kbytes. A 5 minute rate is chosen for the remaining *Near Information*, and a 20 minute rate for all *Far Information*.

Component	Size	Tx Rate	Stream 1	Stream 2	Combined
AI (21 channels)	822	4 s	206		
This Channel Now and Next	2 K	10 s	205		
Rest of *This Channel Near*	22 K	30 s	751		
Other PI *Near*	80 K	5 m		273	
PI *Far*	133 K	20 m		113	
OI, etc.	15 K	4 m		64	
Total	252 K		1 162 byte/s	450 byte/s	1 612 byte/s
Page rate			1,26 pages/s	0,49 pages/s	1,75 pages/s

12.5.8 Conclusions and impact on the normal Teletext service

Based on the multi-channel, multi-day examples (services A, B, C and D), the following conclusions can be drawn:

- *Stream 1* is going to require between 1 and 1,25 pages per second for any type of service other than the bare minimum;
- on the basis of the figures shown here, it is possible to transmit *Stream 2* at less than 600 byte/s and thus majority of serial mode services will have enough filler space for both EPG and enhanced Teletext;
- a database of around 256 kbytes, with the repetition rates chosen here, is going to require at least 1,75 pages per second when transmitted in parallel mode, assuming that no filler packet space is available;
- even if *Stream 1* was allowed to be transmitted without obeying the *20 ms* rule, it can NOT be guaranteed that sufficient filler packet space would be available over 30 s to ensure it was transmitted at the required rate. Thus its transmission would need to be scheduled and the capacity would still be taken from the normal Teletext service.

To put the minimum one page per second requirement for *Stream 1* into some kind of perspective, table 3 shows the approximate number of pages transmitted per second in normal Teletext services by mapping the average number of rows per page against the number of VBI lines in use. Table 4 shows the percentage reduction as a result of allocating one page per second to the EPG service.

Table 3: Pages per second in normal Teletext services

Average number of rows per text page

VBI lines	30	29	28	27	26	25	24	23	22	21	20	19	18
1	1,6	1,7	1,7	1,8	1,9	1,9	2,0	2,1	2,2	2,3	2,4	2,5	2,6
2	3,1	3,2	3,3	3,4	3,6	3,7	3,8	4,0	4,2	4,3	4,5	4,8	5,0
3	4,5	4,7	4,8	5,0	5,2	5,4	5,6	5,8	6,0	6,3	6,5	6,8	7,1
4	5,9	6,1	6,3	6,5	6,7	6,9	7,1	7,4	7,7	8,0	8,3	8,7	9,1
5	7,1	7,4	7,6	7,8	8,1	8,3	8,6	8,9	9,3	9,6	10,0	10,4	10,9
6	8,3	8,6	8,8	9,1	9,4	9,7	10,0	10,3	10,7	11,1	11,5	12,0	12,5
7	9,5	9,7	10,0	10,3	10,6	10,9	11,3	11,7	12,1	12,5	13,0	13,5	14,0
8	10,5	10,8	11,1	11,4	11,8	12,1	12,5	12,9	13,3	13,8	14,3	14,8	15,4
9	11,5	11,8	12,2	12,5	12,9	13,2	13,6	14,1	14,5	15,0	15,5	16,1	16,7
10	12,5	12,8	13,2	13,5	13,9	14,3	14,7	15,2	15,6	16,1	16,7	17,2	17,9
11	13,4	13,8	14,1	14,5	14,9	15,3	15,7	16,2	16,7	17,2	17,7	18,3	19,0
12	14,3	14,6	15,0	15,4	15,8	16,2	16,7	17,1	17,6	18,2	18,8	19,4	20,0
13	15,1	17,1	19,0	20,6	22,1	23,5	24,7	25,9	27,0	28,1	29,2	30,3	31,4
14	15,9	17,7	19,4	20,9	22,3	23,6	24,8	25,9	27,0	28,1	29,2	30,3	31,4
15	16,7	18,2	19,7	21,1	22,4	23,6	24,8	25,9	27,1	28,2	29,2	30,3	31,4
16	17,4	18,7	20,0	21,3	22,5	23,7	24,8	26,0	27,1	28,2	29,2	30,3	31,4

Table 4: Percentage reduction in the normal page transmission rate through allocating one page per second to the EPG service

	Average number of rows per text page												
VBI lines	**30**	**29**	**28**	**27**	**26**	**25**	**24**	**23**	**22**	**21**	**20**	**19**	**18**
1	62,0	60,0	58,0	56,0	54,0	52,0	50,0	48,0	46,0	44,0	42,0	40,0	38,0
2	32,0	31,0	30,0	29,0	28,0	27,0	26,0	25,0	24,0	23,0	22,0	21,0	20,0
3	22,0	21,3	20,7	20,0	19,3	18,7	18,0	17,3	16,7	16,0	15,3	14,7	14,0
4	17,0	16,5	16,0	15,5	15,0	14,5	14,0	13,5	13,0	12,5	12,0	11,5	11,0
5	14,0	13,6	13,2	12,8	12,4	12,0	11,6	11,2	10,8	10,4	10,0	9,6	9,2
6	12,0	11,7	11,3	11,0	10,7	10,3	10,0	9,7	9,3	9,0	8,7	8,3	8,0
7	10,6	10,3	10,0	9,7	9,4	9,1	8,9	8,6	8,3	8,0	7,7	7,4	7,1
8	9,5	9,3	9,0	8,8	8,5	8,3	8,0	7,8	7,5	7,3	7,0	6,8	6,5
9	8,7	8,4	8,2	8,0	7,8	7,6	7,3	7,1	6,9	6,7	6,4	6,2	6,0
10	8,0	7,8	7,6	7,4	7,2	7,0	6,8	6,6	6,4	6,2	6,0	5,8	5,6
11	7,5	7,3	7,1	6,9	6,7	6,5	6,4	6,2	6,0	5,8	5,6	5,5	5,3
12	7,0	6,8	6,7	6,5	6,3	6,2	6,0	5,8	5,7	5,5	5,3	5,2	5,0
13	6,6	6,5	6,3	6,2	6,0	5,8	5,7	5,5	5,4	5,2	5,1	4,9	4,8
14	6,3	6,1	6,0	5,9	5,7	5,6	5,4	5,3	5,1	5,0	4,9	4,7	4,6
15	6,0	5,9	5,7	5,6	5,5	5,3	5,2	5,1	4,9	4,8	4,7	4,5	4,4
16	5,8	5,6	5,5	5,4	5,3	5,1	5,0	4,9	4,8	4,6	4,5	4,4	4,3

12.6 Technical tailoring

This clause is intended for technical staff who wish to minimize the effect of an EPG service on existing Teletext services.

The major concern of Teletext service providers will be the loss of the page transmission space taken by the *Stream 1* pages. The use of such pages will enable low-end decoders to acquire a very simple EPG, typically *This Channel* only, or, by scanning a number of channels, a composite EPG. As these low-end decoders will have little memory, the information will be displayed when it is received*;* rather like an existing Teletext service. Even when a decoder has the 24 kbytes of memory required to store *This Channel Near* it is unlikely to be non-volatile and so all the data will have to be acquired from the point at which the decoder is tuned to the channel.

Considering the various parameters, the following actions are possible:

- reduce the amount of PI data*;* but this is unlikely to be acceptable as it is very limiting editorially. It is recommended to have full information for at least two days;

- increase the time between sending AI, etc. (and decrease the amount of data in the AI, etc.). This means that it will take longer for a decoder to start to acquire the EPG (and the size of AI is determined by the number of channels);

- increase the time between sending *Now and Next Four Channels* information. Again, an editorial point, and similar information on the text service is often transmitted as frequently (but is only a few hundred bytes).

So it can be seen that there is little that can be done with the data in *Stream 1* to reduce the amount of capacity consumed by the EPG.

The operation of a composite EPG decoder should also be considered. It tunes to the first channel, waits, say, a maximum of 4 s to acquire the AI, etc., to identify that an EPG is present, then waits about 45 s to acquire *This Channel Near*. It then scans the next channel. Overall, it takes almost a minute per channel which is probably too slow.

However, a small saving can be made at the Teletext transport layer by preventing the insertion of EPG pages from creating additional filler packet space, as shown by the following example. Assuming the Teletext service is operating on 10 VBI lines per field, a *Stream 1* page comprising the full 24 packets will require 3 VBIs to transmit packets 1 to 23. However, it is occupies only 23 of the 30 lines available. If the page was only 20 packets long, it would take only 2 VBI to transmit, thus saving the capacity of one VBI per second.

This very efficient transmission reduces the overall data rate at one page a second from 920 bytes to 760 bytes. As a consequence, the page rate has to increase to 1,2 per second.

Over 5 s we have either:

$5 \times 1 \times 920$ bytes/page = 4 500 bytes, taking $5 \times 3 = 15$ VBI periods; or

$6 \times 1 \times 760$ bytes/page = 4 560 bytes, taking $6 \times 2 = 12$ VBI periods.

Thus in 5 s there is the saving of 3 VBI periods, the equivalent of ONE normal Teletext page. Thus the EPG is displacing 4 pages rather than 5 every 5 s.

Table 5 shows the optimum number of rows for an EPG page (including the page header) and the saving in filler packet space that results. When the number of rows is less than 24 it is necessary to send two separate pages in order to transmit the 920 data bytes (23 rows) and meet the required data rate. Thus an extra page header is required and one packet is deducted from the number of filler packets shown for a 24 row page in table 1 when calculating the saving in filler packets.

Implementation of this concept should be easy to achieve in the origination equipment.

Table 5: Optimum number of rows for an EPG page

VBI Lines	Optimum number of rows for EPG page	Saving in filler packet space
1	24	0
2	24	0
3	24	0
4	24	0
5	20	0
6	24	0
7	21	3
8	24	0
9	18	2
10	20	5
11	22	8
12	24	0
13	13	1
14	14	3
15	15	5
16	16	7

12.7 Other operational issues

12.7.1 Numbering, scheduling and transmission of Programme Information blocks

It is informative to consider the rules for the numbering, scheduling and transmission of Programme Information blocks. However, some detailed knowledge of the coding of AI and PI blocks is required, see EN 300 707 [1] clauses 11.2 and 11.3.

Each PI block contains a block_number that is unique to a given network. PI block_numbers within one network are continuous over the whole range of transmitted PIs and over the *Stream 1* and *Stream 2* boundary as shown in figure 8.

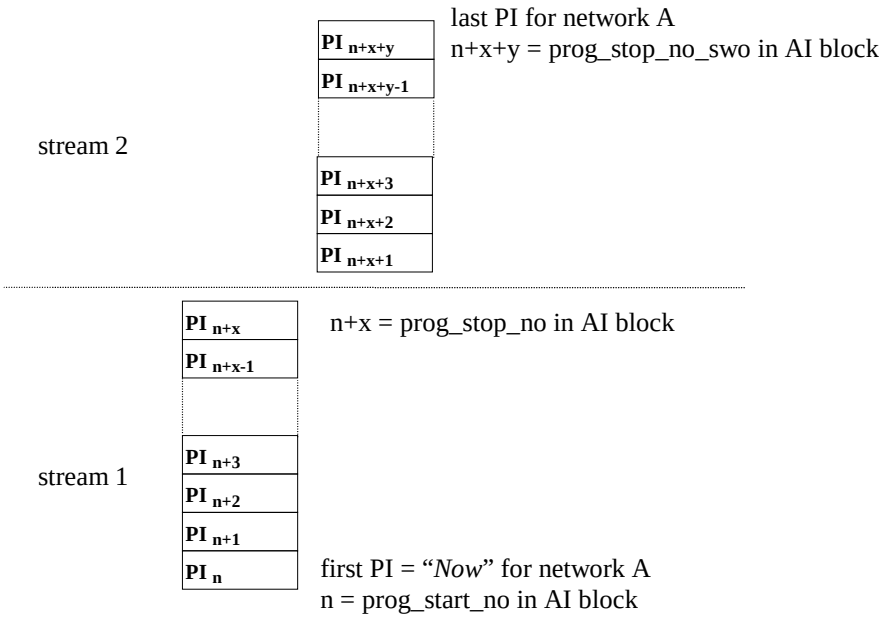


Figure 8: PI numbering in *Streams 1* and *2*

PIs are transmitted sequentially in ascending order, i.e. PI_1, PI_2, PI_3,... PI_n, PI_{n+1}. Updates of individual PIs or PIs with a higher repetition rate, e.g. *Near* PIs or PIs from *Stream 1*, may interrupt any other PI sequence with a lower repetition rate, e.g. PIs from *Stream 2*.

In operating a real service the following situations are likely to occur which will necessitate changes to the AI block and a number of PI blocks:

a) A current programme finishes:

All PI block_numbers on the network concerned remain unchanged. In the AI block the prog_start_no value used to indicate the current (i.e. *Now*) programme on the network concerned is incremented.

b) One programme becomes longer or shorter than originally scheduled:

Some or all of the following programmes on the network concerned will be shifted in time. Changes to the contents of PI blocks will occur (i.e. start/stop times) but PI block_numbers will remain the same. It is necessary to set a new version number in the AI block in order to force decoders to reload the entire database.

c) A new programme is inserted:

With reference to figure 8, assume that a new programme is inserted between PI(n) and PI(n + 1). The new PI becomes PI(n + 1) and all the following PI block_numbers are incremented by one. Start/stop times within the following PI blocks are modified accordingly. In the AI block the progr_stop_no and/or progr_stop_no_swo values (for *Streams 1* and *2* respectively) are incremented and a new version number is entered in order to force decoders to reload the entire database.

d) A programme is cancelled:

With reference to figure 8, assume that the programme PI(n + 2) is cancelled. PI(n + 3) becomes PI(n + 2) and all the following PI block_numbers are decremented by one. Start/stop times within the following PI blocks are modified accordingly. In the AI block the progr_stop_no and/or progr_stop_no_swo values (for *Streams 1* and *2* respectively) are decremented and a new version number is necessary in order to force the decoder to reload the entire database.

e) Changing attributes or feature flags in an existing PI block:

It is assumed here that network, time and date of transmission are NOT being altered and that other PI blocks are not affected by the change. Either a new version number is set in the AI block in order to force the decoder to reload the whole database or an Update block is transmitted to identify the single PI block that has been changed. The latter approach is not recommended, see clause 12.7.4.

12.7.2 Operations at the end of a programme

At the end of a programme the AI block is updated to indicate the new current programme. Assuming that the service provider does this at the end of the programme, the decoder would have responded within perhaps 10 s. *This channel and the Next Four Programmes* feed will have changed as well within, say, 20 s and the main body of the EPG within, say, a minute. For other channels the information for that channel will be updated every 20 minutes at the outside. However, the EPG decoder can identify the current programme from the AI block because it is transmitted frequently. Consequently, the EPG decoder can provide very rapidly a "What's on now" display across all channels.

Thus the database changes required at the end of programmes should be handled by the usual refresh cycle.

In addition, the "current programme" data in the packet 8/30 format 2 will be changed by the PDC system.

12.7.3 Major event rescheduling

Rescheduling at short notice has to be taken into account when providing an EPG service. For instance, the live football match has gone to extra time and so the schedule for the rest of the evening is different. For *This Channel* the revised schedule can be output immediately as part of the normal *Stream 1* refresh cycle. (Note this is still slower than an immediate page transmission on the normal Teletext service.) For other channels, either their information is prioritized in the *Stream 2* transmission to reflect the changes or the update mechanism is used, see clause 12.7.4. Then, the new schedule should be transmitted via the usual refresh cycle, or as soon as possible.

12.7.4 Update mechanism

There is an update mechanism allowed for within the specification whereby a single PI can be addressed and altered. It is felt that this will be rarely invoked as in practice a section of the EPG for that channel will be transmitted, either as part of the normal refresh cycle or with some prioritization. Even if an update is transmitted the decoder has to be tuned to the EPG channel for it to be received, thus it is possible, or likely, that the decoder will not receive an isolated Update data block.

12.7.5 Diagrammatic representation of refreshing

The refreshing of PI and all the *Housekeeping* information is shown diagrammatically in figure 9. It is extremely simplified as there can be many more circles of information being refreshed, each with different cycle times. This shows each component of the *Housekeeping* data in *Stream 2* being updated at the same time; this may not be the case in practice. Likewise, the editorial divisions of *Stream 2* are not shown in detail.

12.7.6 Bits in each field

There are instances where the number of bits for a particular field is different in different structures. At all times the value of the field shall be the same.

The Block numbers in each structure should be contiguous to aid the memory management in the decoder.

The broadcaster should note that if a decoder has insufficient memory to store all the blocks of a structure, the highest block numbers will be disregarded. Thus high block numbers should be used for the least used structures.

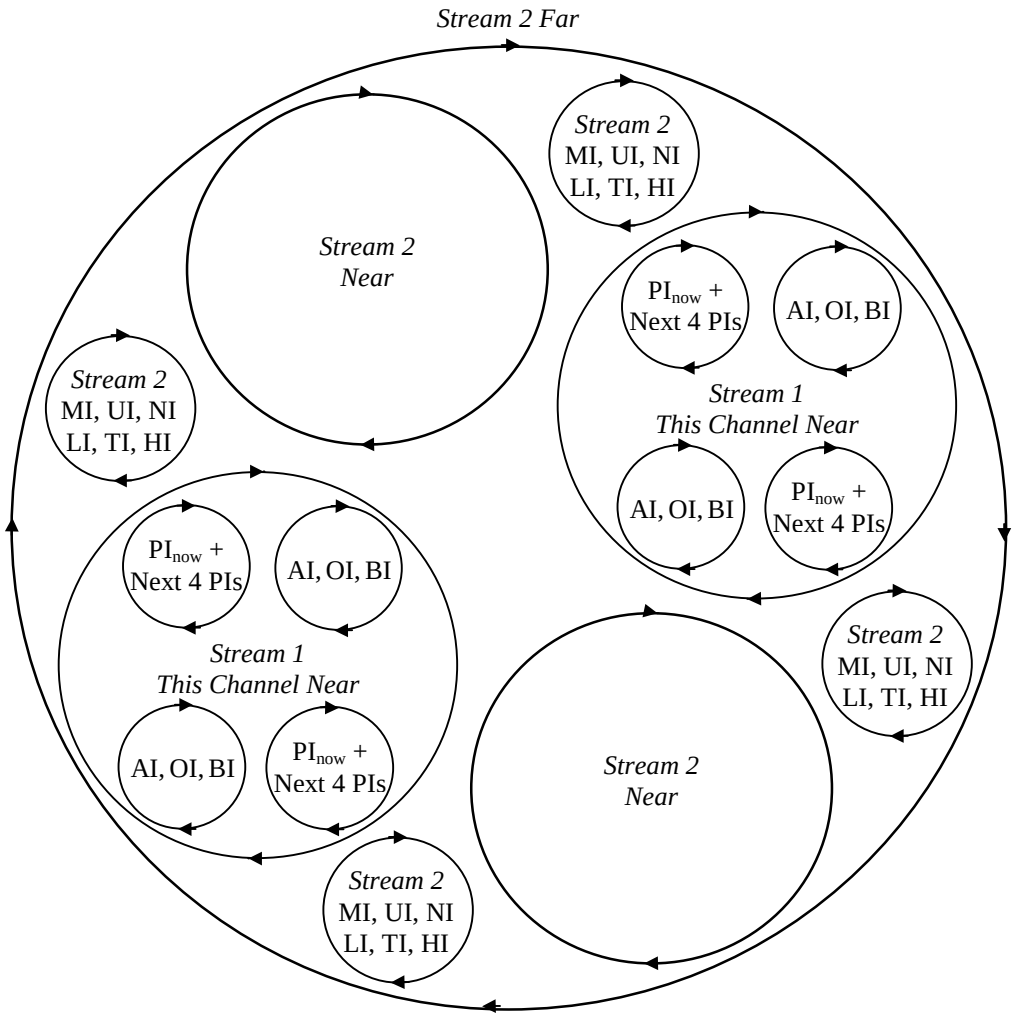


Figure 9: Representation of refreshing

13 Default EPG operation using the TV-related pages of a Teletext service

13.1 General

Teletext is a well-established medium for the distribution of TV programme information. The TV-related pages in existing services are very popular and can be regarded as a simple form of Electronic Programme Guide (EPG). Channels broadcasting true EPG data may be few and far between, at least in the early days, and not all decoders will be capable of storing data across a channel change. Not unreasonably, the viewer might still expect some level of programme information on his EPG equipped TV regardless of the channel he is watching.

If a broadcaster does not wish to provide a proper EPG service for whatever reason, he may be sympathetic to the idea of making his Teletext service more "usable" for very little overhead. This clause indicates the additional data that would need to be transmitted as part of the Teletext service to allow an EPG decoder designed to EN 300 707 [1] to display programme information from the Teletext service in the absence of any valid EPG data. The extra data is necessary to provide the confidence that the decoder has selected the correct page(s) and to eliminate the need for any user action to configure the system.

Through the combination of true EPG transmissions and a small amount of additional information within a Teletext service, it should be possible to provide some form of EPG functionality on the majority of TV channels.

13.2 TV-related Teletext pages

13.2.1 Content

The TV-related pages in normal Teletext services generally carry the following information:

- single and multi-channel programme listings for at least "today", some including VCR programming data (PDC or VPS);
- "Now and Next" programme information;
- previews and synopses;
- programme back-up information, for example contact addresses, recipes and URLs;
- subtitles.

The information can be updated very rapidly to reflect schedule changes. At the editor's discretion, a listing can be limited to the programme title and time of transmission, or include a short description. The more comprehensive services allocate a complete Teletext page per programme in order to provide further details. The "Now and Next" page defines the current and pending programmes for one or more channels. It is often presented in "subtitle" format, with the text inset into the TV picture.

13.2.2 Access issues

Page identification and access is not always that easy for the viewer. The relevant pages are likely to have different page numbers on each channel, making them difficult to remember. However, it is not reasonable to expect broadcasters to agree on common page numbers for Europe as some Teletext service providers are allocated a limited number of pages or restricted to using certain magazines. The viewer may find it necessary to consult an index page on route to the TV-related pages, increasing the time the receiver is in Teletext mode and during which the viewer is unable to watch the TV picture. Some decoders allow the viewer to enter their favourite page numbers for each channel and priority is given to their capture. Even if the page numbers are those of the TV-related pages, the viewer may have to press several buttons on his remote control handset to make, for example, the "Now and Next" page appear on the screen.

Some TV receivers already have a *Subtitle* key on the handset for immediate access to the subtitle page. This is relatively easy to implement as there is unique data within the page header packet to enable such pages to be identified.

Many EPG receivers will have a dedicated key on the remote control handset to select the EPG feature. As a default mode of operation in the absence of any true EPG data, pressing the key could cause an appropriate Teletext page to be displayed. Unless any extra knowledge could be derived from the transmission, it would be necessary for the viewer to define a relevant page number for each channel. These would be stored in non-volatile memory. However, the design of a simple to use programming interface could be difficult, deterring viewers from using the feature. Further, if a broadcaster rearranges his database, the page number may no longer be valid and would require updating.

These problems can be overcome if the Teletext broadcast includes additional information as described in the following clause.

13.3 Magazine Inventory Page (MIP)

13.3.1 General principles

EN 300 706 [3] defines a special page which conveys the function or content of each page in a magazine. This is known as a Magazine Inventory Page (MIP). The page number is fixed at MFD, where M defines the magazine to which the contents apply. Each page in the Teletext magazine is defined by a two byte code at a fixed location within the MIP. A number of TV-specific categories are defined. Clause 8.6 asks that a Teletext service carrying EPG data should include a MIP to ensure a decoder can identify the EPG data transport page.

Ideally, if a given page is being broadcast the relevant packet of the MIP would be transmitted to define the function of that page. However, this is not mandatory and EN 300 706 [3] states that the absence of a packet within the MIP does not necessarily imply that the pages covered by that packet are not being broadcast. This approach was adopted to minimize transmission capacity, for example if the sole reason for transmitting a MIP is to define the EPG data transport page. Under these circumstances only two packets (the page header and the packet containing the definition of the relevant page) need to be transmitted. To implement the default EPG scheme proposed here it is also necessary to transmit the packets covering the TV-related pages. If these page are not in the same magazine as the EPG data transport page they will be in a different MIP, requiring an additional page header. It is unlikely that more than three packets will be required.

Because a MIP is potentially useful to all Teletext decoders, it has to be transmitted obeying the 20 ms rule.

The MIP can be updated at any time, for example if the Teletext database is re-organized.

13.3.2 TV-related categories

The TV-related categories listed below have explicit entries in the coding scheme used by the MIP. The hexadecimal code value is given in brackets. For some types it is possible to indicate that there is more than one sub-page and, for some, the number of sub-pages in a multi-page set.

TV Index page, single page (7F);
TV Index page, multi-page set (7E)
TV schedule page, single page (81)
TV schedule page, multi-page set, number of sub-pages in the range 2 to 79 (82 - CF)
TV schedule page, multi-page set, number of sub-pages in the range 80 to 2^{12} -1 (D0)
TV schedule page, multi-page set, number of sub-pages in the range 2^{12} to 2^{13} -2 (D1)
Current TV programme information page, single page (7C)
Current TV programme information page, multi-page set (7B)
Current TV programme warning page (7A)
"Now and Next" TV programme (7D)
Subtitle page (70 - 77)

13.4 Operational aspects

13.4.1 Default operation of decoders

The transmission of a MIP in which the TV-related Teletext pages were indicated would enable manufacturers to offer some EPG functionality in the absence of valid EPG data. The actual interpretation is at the discretion of the decoder manufacturer. For example, pressing the *EPG* key could result in the "*Now and Next"* page from the Teletext service being displayed automatically. The decoder will have interpreted the MIP data and requested the relevant page with a high degree of confidence in the validity of the page number and the contents of the page. The viewer does not have to remember specific page numbers, nor has he had to pre-programme the system.

13.4.2 Page-type definitions

To ensure uniformity of approach by both broadcasters and decoder manufacturers, the expected content of the TV-related Teletext pages that can be indicated by the MIP are defined in this clause. With one exception (Subtitle Page) the format of each page, i.e. normal or subtitle style, is at the discretion of the editor. There is sufficient information in the page header packet of a Teletext page for a decoder to choose the most appropriate method of display.

13.4.2.1 TV index page

A single index page, or multiple sub-pages, carrying the page numbers of the most important TV-related pages in the service.

13.4.2.2 Current TV programme information page

This page contains details of the current TV programme on that channel. This may include warning information as to the programme's content, or recommend a minimum viewing age. Ideally it contains sufficient supplementary information regarding start and finish times, date and channel (i.e. PDC or VPS codes) to enable a suitably equipped video recorder to be programmed to record the event. The page, or sub-pages, should remain in the transmission throughout the duration of the programme.

13.4.2.3 Current TV programme warning page

The primary function of this page is to convey warning information as to the current programme's content, or to recommend a minimum viewing age. It should remain in the transmission throughout the duration of the programme.

13.4.2.4 "Now and Next" TV programme

This page contains simple details (perhaps only start/finish times and programme title) about the programmes showing now on one or more channels. It may also include details of the following programme items. The page should be updated at every programme junction.

13.4.2.5 TV schedule page

This type of page includes TV programme listings for one or more channels. Ideally it contains sufficient supplementary information regarding start and finish times, date and channel (i.e. PDC or VPS codes) to enable a suitably equipped video recorder to be programmed to record each event, especially where the information is not for the current day or for the current channel. It is unlikely that a page will be updated to remove a single programme entry when that programme finishes. This type of page is very likely to occur as a multi-page set.

13.4.2.6 Subtitle page

A page providing subtitles for the current programme. The C6 bit in the page header can be assumed to be set to "1". The 3 LSBs of the actual Subtitle code value inserted in the MIP should match the value for the C12 - C14 control bits in the page header. These bits are used for selecting a set of national option characters. In the event of subtitle in different languages being transmitted on different pages, a decoder could offer the viewer a choice of subtitle by language rather than page number. Ideally the relevant code(s) would only appear in the MIP while genuine subtitles were being broadcast and not while a "placeholder" or apology message was present.

13.4.2.7 NexTView Transport Page

If a Magazine Inventory Page is transmitted which does not correctly indicate the NexTView Transport Page; certain receivers will fail to receive NexTView even if it is transmitted on the default page number of 1DF.

13.4.2.8 NexTView Network Identification

Broadcasters should set the Network Identification field in the Application Information structure to the actual value transmitted by the TV channel being referenced. In the event of a TV channel transmitting more than one code (i.e. transmitting two or more of Packet 8/30 Format 2 PDC, VPS or Packet 8/30 Format 1 Network Identification) the priority of the codes used should be; first that from the Packet 8/30 Format 2 (CNI) then VPS service (shortened CNI) or if VPS is not transmitted the code in the Packet 8/30 Format 1 (NI).

In the case there is no Network Identification code defined for a TV channel EN 300 707 [1] specifies the use of the value 0 to indicate an unknown TV channel. There are TV sets in the market that will not work correctly with the value 0. In this case the EPG service provider should use an identification code that is currently not allocated for any TV channel: Preferred are codes in the range 0xFFF0..0xFFFF. For each channel for which such a code is used to indicate that there is no identification defined a different value should be used.

14 Encoding and decoding transparent strings

14.1 General

This clause provides guidelines on how to implement the transparent string component of EPGs.

The aim is to bring together all the relevant information, some of this appears in EN 300 707 [1] and the present document.

Other items have been noted during first attempts at implementing the specification. Consideration is given to the required performance of decoders with lower display capabilities when presented with enhanced strings (i.e. those coded to Teletext display Levels 2.5 and 3.5).

14.2 Transparent strings

Transparent strings are sequences of data defining text, graphics and attributes for display. They occur in their generic form in many EPG data structures.

All strings consist of sequences of 7-bit data (the MSB of each byte has no meaning as it is used as an odd parity indicator when the data is encoded for transmission via Teletext). The data values represent spacing attributes (0x00 to 0x1F) and G0 characters or G1 graphics (0x20 to 0x7F).

The strings in some data structures can be accompanied by an optional escape sequence. Each escape command within an escape sequence comprises a 10-bit (insert) position value, a 6-bit escape_mode value and an 8-bit escape_data value. Such commands can select alternative characters to those defined at certain positions within the string. In addition, a Carriage Return command (effectively a combined carriage return AND line feed command) is available to alter the display format of the string. In EPG services with enhanced displays, a wider range is available to select further alternative characters and graphics, non-spacing attributes and objects.

14.3 Code of practice

1) A length value is an element of the definition for all forms of transparent string. Values greater than 0 define the number of bytes in the string. A value of 0 indicates that a string is empty, i.e. no characters or attributes are defined. There cannot be an escape sequence where a string is empty.

2) Transparent strings are processed in groups of up to 40 characters or spacing attributes, starting with the first item in the string. Each group forms one display row and is mapped onto the display from left to right. Each subsequent group is displayed on the row immediately below the row most recently addressed, beginning at the same column start position as the row above.

3) The starting position of a string intended for display in the Header or Message Area is column 0 in the top most row of the target area. However, if the number of rows of text of a string to be displayed in the Message Area is less than the number of rows available, the manufacturer is free to reposition the text vertically within the area.
The manufacturer has full control over the vertical position and spacing of programmes title strings and navigation strings from NI blocks in the Event Area.

4) If a Carriage Return escape mode command is encountered within an accompanying escape sequence before a group of 40 characters has been assembled, the current group is considered to have been terminated and the remainder of that row is to be displayed as if the character "space" had been transmitted for each column position. The string character, or valid escape sequence character, at the point where the Carriage Return attribute was inserted becomes the first character of a new group to be displayed on the following row at the same start column as the row above.

5) The last group may contain less than 40 characters in which case the remainder of the row is to be displayed as if the character "space" had been transmitted for each column position. Similarly, if string data is not defined for some or all of the display rows available within the target area, the rows not addressed should be displayed as if the character "space" had been transmitted for each column position.

6) When the number of characters in the processed string exceeds the number of display locations within the target area, the decoder is under no obligation to make the extra characters visible.

7) At the beginning of each display row all attributes adopt their default state unless the new row was started as a result of a Carriage Return escape mode command, see point 15. The default attribute settings in the absence of any spacing attributes are: alphanumeric mode, black background, white foreground, normal height, steady and contiguous graphics.

8) String codes 0x00 to 0x1F select spacing attributes according to table 26 in EN 300 706 [3]. The Teletext functions End Box (0x0A), Start Box (0x0B), Double Width (0x0E), Double Size (0x0F), Conceal (0x18) and ESC (0x1B) are not valid for use in transparent strings and their codes should not be transmitted. A decoder should interpret the remaining attributes in the same way as for Level 1 Teletext. Each will occupy a column position and will normally be displayed as a "space" unless hold graphics mode is in effect. However, a decoder may ignore spacing attributes within strings intend for display in the Event Area.

9) In alphanumeric mode, string codes 0x20 to 0x7F select characters from a G0 character set specified by the 4 MSBs of the default_alphabet value (defined in the AI block) for the network to which the string applies. The default_alphabet value defines an entry in table 32 of EN 300 706 [3]. In graphics mode, these codes select characters from the G1 character set.

10) In alphanumeric mode, string codes 0x23, 0x24, 0x40, 0x5B, 0x5C, 0x5D, 0x5E, 0x5F, 0x60, 0x7B, 0x7C, 0x7D and 0x7E select national option characters. For a given network, the set to be used is specified by the 3 LSBs of the default_alphabet value. In graphics mode, only codes 0x40, 0x5B, 0x5C, 0x5D, 0x5E, 0x5F have this function.

11) An element of an escape command is the insert_pos value to indicate the position to be addressed within the string. This is a pointer to the string data. As it is not a reference to a screen position its meaning is not affected or modified by the Carriage Return command. A value of 0 refers to the first character in the string. Escape commands shall be coded in ascending order of insert_pos.

12) A service limited to Level 1.5 display features should only transmit the escape_mode values shown below. A decoder with Level 1.5 display capabilities should respond to these codes and no others when receiving display enhanced transmissions. Apart from the Carriage Return command there are direct equivalents in the Level 1.5 extensions of Teletext as defined in EN 300 706 [3]. They allow diacritical marks to be added to G0 characters and the display of some characters from the G2 supplementary character set. A character inserted in this manner should only be used to overwrite a G0 character within the string and not spacing attributes or G1 graphics characters (i.e. codes 0x20 to 0x3F and 0x60 to 0x7F). A service provider should try to include a suitable fallback character in the transparent string in case a decoder is unable to display the character specified in the escape command (see table 6).

13) Escape sequences which insert characters at locations where serial attributes already exist could cause display differences between Level 1.5 and Level 2.5 decoders. If a serial attribute has to be overwritten by a character, for the benefit of a Level 2.5 decoder the attribute should be restored by transmitting an escape sequence to insert it as parallel attribute. Thus a Level 1.5 decoder will give priority to the text rather than display enhancement.

14) Where there are multiple escape commands at a particular string position, the order of coding will determine the final display. No more than one character carried by an escape sequence is allowed for each position In the string. If Present a Carriage Return should always be coded first.

15) The Carriage Return escape mode command can be used to enhance transmission efficiency but only if the command is used before column 35. It should not be used in the Title string of a PI block.

16) Some early decoders and all those employing Level 1.5 display generators do not fulfil the EN 300 707 [1] requirement that states that the attributes current at the point where the Carriage Return was inserted should be preserved at the first position on the following row. Therefore, it is recommended to use this command only when all the attributes are at their default state to ensure consistency of display by all decoder types. Repeating the spacing attributes required to give the desire display effect at the start of the new row may be sufficient under some circumstances but cannot be guaranteed for all. If consistent displays cannot be achieved the Carriage Return command should not be used and sufficient instances of the character "space" should be inserted in the string to complete a 40 character group.

17) When a double height spacing attribute (0x0D) is used, any Carriage Return shall be preceded by a normal height attribute or the transparent string shall be padded to complete a 40 character group before data for the following row is defined. It is only permitted to terminate the group early with a Carriage Return command if all the attributes have their default state. Any characters in the following group will not be displayed by Level 1.5 decoders as the displayed row will show the bottom half of the double height text. It is permitted to inserted one Carriage Return command in place of a full group for the lower row.

18) The maximum recommended sizes for specific strings in a PI block are as follows (see clause 8.3.1):

Title: 40 characters;
Short Info: 255 characters;
Long Info: 1 000 characters.

19) Double Width (0x0E) and Double Size (0x0F) spacing attribute can be inserted but may only be interpreted correctly by Level 2.5/3.5 decoders. Other decoders may ignore both commands or interpret Double Size as Double Height only. The rules applying to Double Height also apply to Double Size. Once horizontal expansion has been enabled, each character that is intended to be displayed at twice its normal width should be followed by a space character to ensure compatibility with decoders which ignore these commands.

20) In a Full EPG transmission, up to 15 individual strings can be defined an NI block for display in the Event Area. Each string should be a maximum of 40 displayable characters to ensure it fits on one display row. However, some decoders may still have to truncate such strings.

Table 6

Escape_mode	Function	Action	Valid range for escape_data
0x09	G0 alphanumeric character	Overwrite string character	0x20 - 0x7F (notes 1 and 2)
0x0A	Carriage Return	Retain string character	Reserved for future use
0x0F	G2 alphanumeric character	Overwrite string character	0x20 - 0x7F (notes 1 and 2)
0x10 - 0x1F (notes 1 and 3)	G0 character with diacritical mark	Overwrite string character	0x20 - 0x7F (notes 1 and 2)

NOTE 1: The values used should fall within the limits specified. However, local alphabet and language requirements, and to some extent decoder capabilities, will determine the subset of these values that will be used in practice.
NOTE 2: If a decoder cannot display the character specified, it should display the fallback character from the transparent string where possible.
NOTE 3: This command adds a diacritical mark to a character from the G0 set. The diacritical mark is defined by the 4 LSBs of escape_mode referencing an entry in column 4 of the G2 set. The G0 character is defined by escape_data. This function is only valid for the Latin alphabet.

Annex A:
Commercial name for EPG services

The term "NexTView" is to be adopted as the commercial name for EPG services and decoding products compliant with EN 300 707 [1], EN 300 708 [2] and the present document.

Annex B:
List of programme attributes

The following attributes and other parameters may be defined for each programme event. They can all, in theory, be used within a suitable decoder, either singularly or in combination, to sort the database.

Channel (network operator)

Date

Start-time

Stop-time

Editorial rating

Parental rating

Theme*;* pre-defined categories (see annex C)

Theme*;* service provider defined categories (*Full EPG* service only)

Mono/2 channel sound/Stereo/Surround sound

Widescreen format

PALplus

Digital

Encrypted

Live programme

Repeat programme

Teletext subtitles

Sound track language

Language of in-vision subtitles

Annex C:
Pre-defined programme theme categories

The programme categories defined in EN 300 707 [1] for use in EPG services are listed in table C.1.

Table C.1: Pre-defined programme theme categories

Code	Description
0x00 ... 0x0F	undefined content
	Drama and Films
0x10	movie (general)
0x11	detective/thriller
0x12	adventure/western/war
0x13	science fiction/fantasy/horror
0x14	comedy
0x15	soap/melodrama/folklore
0x16	romance
0x17	serious/classical/religious/historical drama
0x18	adult movie
0x19 ... 0x1E	reserved for future use
0x1F	user defined
	News/Current Affairs/Social
0x20	news/current affairs (general)
0x21	news/weather report
0x22	news magazine
0x23	documentary
0x24	discussion/interview/debate
0x25	social/political issues/economics (general)
0x26	magazines/reports/documentary
0x27	economics/social advisory
0x28	remarkable people
0x29 - 0x2E	reserved for future use
0x2F	user defined
	Show/Game Show/Leisure hobbies
0x30	show/game show (general)
0x31	game/show/quiz/contest
0x32	variety show
0x33	talk show
0x34	leisure hobbies (general)
0x35	tourism/travel
0x36	handicraft
0x37	motoring
0x38	fitness and health
0x39	cooking
0x3A	advertisement/shopping
0x3B ... 0x3E	reserved for future use
0x3F	user defined
	Sports
0x40	sports (general)
0x41	special events (e.g. Olympic games, World Cup etc.)
0x42	sports magazines
0x43	football/soccer
0x44	tennis/squash
0x45	team sports/excluding football
0x46	athletics
0x47	motor sports

Code	Description
	Sports (continued)
0x48	water sports
0x49	winter sports
0x4A	equestrian
0x4B	martial arts
0x4C	local sports
0x4D ... 0x4E	reserved for future use
0x4F	user defined
	Children/Youth/Education/Science
0x50	children's youth programmes (general)
0x51	pre-school children's programmes
0x52	entertainment programmes for 6 to 14
0x53	entertainment programmes for 10 to 16
0x54	informational/educational/school
0x55	cartoons/puppets
0x56	educational/science/factual topics (general)
0x57	nature/animals/environment
0x58	technology/natural sciences
0x59	medicine/physiology/psychology
0x5A	foreign countries/expeditions
0x5B	social/spiritual sciences
0x5C	further education
0x5D	languages
0x5E	reserved for future use
0x5F	user defined
	Music/Ballet/Dance
0x60	music/ballet/dance (general)
0x61	rock/pop
0x62	serious music/classical music
0x63	folk/traditional music
0x64	jazz
0x65	musical/opera
0x66	ballet
0x67 ... 0x6E	reserved for future use
0x6F	user defined
	Arts/Culture (without music)
0x70	Arts/Culture (without music, general)
0x71	performing arts
0x72	fine arts
0x73	religion
0x74	popular culture/traditional arts
0x75	literature
0x76	film/cinema
0x77	experimental film/video
0x78	broadcasting/press
0x79	new media
0x7A	arts/culture magazines
0x7B	fashion
0x7C ... 0x7E	reserved for future use
0x7F	user defined
0x80 ... 0xFE	series codes
0xFF	reserved

Annex D:
Editorial committee

The present document was compiled on behalf of the EBU and EACEM by the following:

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