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Code of practice for an Electronic Programme Guide (EPG)

ETSI

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Foreword

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

ETRs are informative documents resulting from ETSI studies which are not appropriate for European Telecommunication Standard (ETS) or Interim European Telecommunication Standard (I-ETS) status. An ETR may be used to publish material which is either of an informative nature, relating to the use or the application of ETSs or I-ETSs, or which is immature and not yet suitable for formal adoption as an ETS or an I-ETS.

NOTE: The EBU/ETSI JTC was established in 1990 to co-ordinate the drafting of ETSs in the specific field of broadcasting and related fields. Since 1995 the JTC 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

This ETSI Technical Report (ETR) is intended as a companion document to the full specifications, ETS 300 707 [1] and ETS 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.

This ETR 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 television channel.

It should be noted that this ETR was compiled in advance of any first-hand experience in operating an EPG service. It is anticipated that a subsequent version will be able to draw upon the knowledge and experience that operating real services will bring.

2 References

This ETR incorporates by dated and undated reference, provisions from other publications. These references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this ETR only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies.

[1] ETS 300 707: "Electronic Programme Guide (EPG); Protocol for a TV-guide using electronic data".

[2] ETS 300 708: "Data transmission within Teletext".

[3] ETS 300 706: "Enhanced Teletext Specification".

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

3 Definitions and abbreviations

3.1 Definitions

For the purposes of this ETR, the following definitions apply:

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

bundle information: A 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: The content of a programme event; e.g. "News", "Sport", "Drama".

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

conditional access: A 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: A continuous sequence of EPG-related data. 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: An EPG decoder collects and decodes the transmitted EPG data. It processes and stores the data and under user control selects the information for display. 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: The 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 (compare with *Near information*).

feature flags: See "Attributes".

filler packets: Dummy packets inserted onto otherwise unused VBI lines which exists as a result of obeying the 20 ms rule.

full EPG: A 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: The part of the EPG display screen where text messages defined by the EPG service provider are displayed. Normally the text will be linked to a highlighted event in the Event Area.

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

navigation: The 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: A 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 television programme (or programmes in the case of a multiple channel service), plus the programme(s) that follow on immediately.

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

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

refresh procedure: The constant transmission of the complete EPG database. 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: The 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 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.

3.2 Abbreviations

For the purposes of this ETR, 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
UI	Update Information
VBI	Vertical Blanking Interval
VCR	Video Cassette Recorder
VPS	Video Programming System

4 Introduction

Electronic Programme Guides (EPGs) are a new way of broadcasting information about television 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 this ETR is the EPG standard conceived by the European Association of Consumer Electronic Manufacturers (EACEM). The full coding details are specified in ETS 300 707 [1]. This ETR also covers the transmission of the data as one form of data broadcasting via page-format Teletext. These aspects are dealt with in ETS 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 television programmes. As a consequence, it may improve the attractiveness of a broadcaster's programmes as well as the products of a television or VCR manufacturer who chooses to implement an EPG decoder. In addition, it can be implemented in a multi-media 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 television 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 ETS 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 multi-media 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 ETS 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 television 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 television 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 television 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.

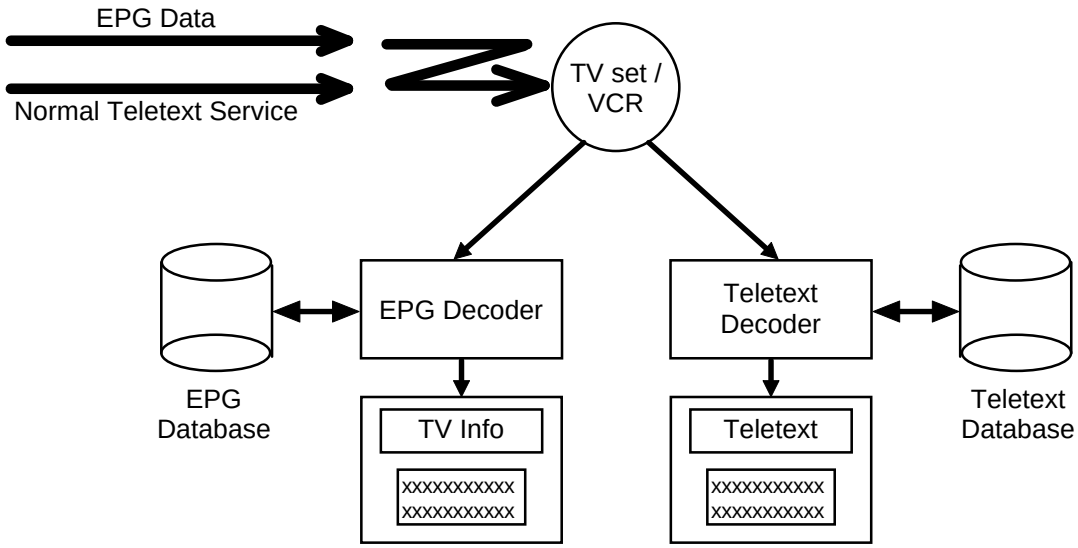


Figure 1: Basic system concept

5 Fundamentals of an EPG

5.1 A non-proprietary and non-discriminatory system

The ETSI standard 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.

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 television receiver or VCR and when the information is re-transmitted, 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 television 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 television 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 television programme), the *This Channel / Near Information* within 30 seconds, *This Channel Now and Next Four Programmes* within 10 seconds. 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 television 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;
- 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 EPGs 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 dependant 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 subclause 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 television 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 television channel on which the EPG service is broadcast.

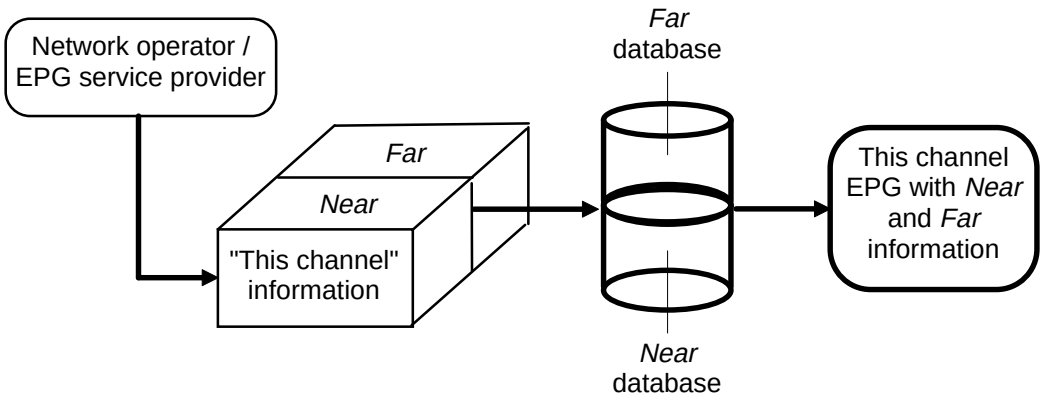


Figure 2: This channel EPG

Recommendation:

Ideally, all broadcasters should transmit at least This channel / Near Information on all of their channels every 10 seconds, 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.

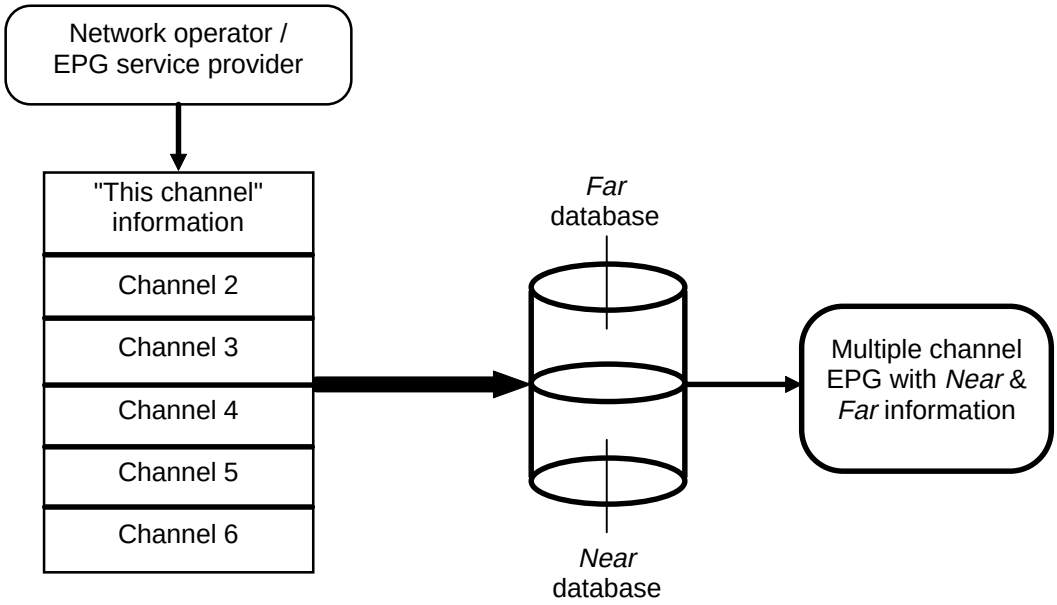


Figure 3: Multiple channel EPG

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.

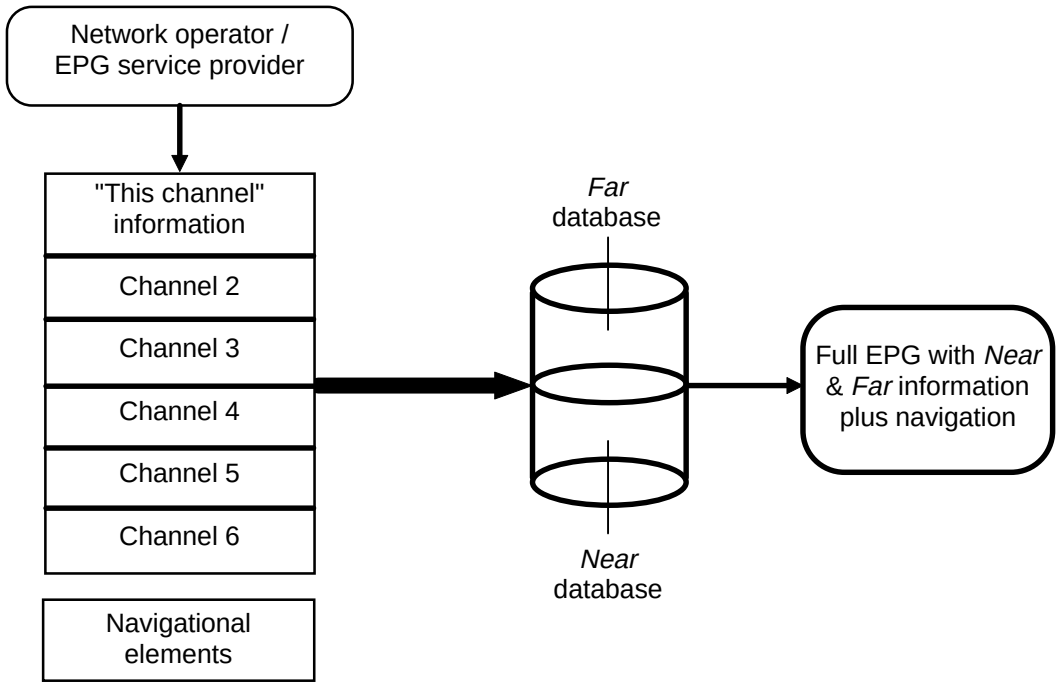


Figure 4: Full EPG with navigation

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 subclause 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.

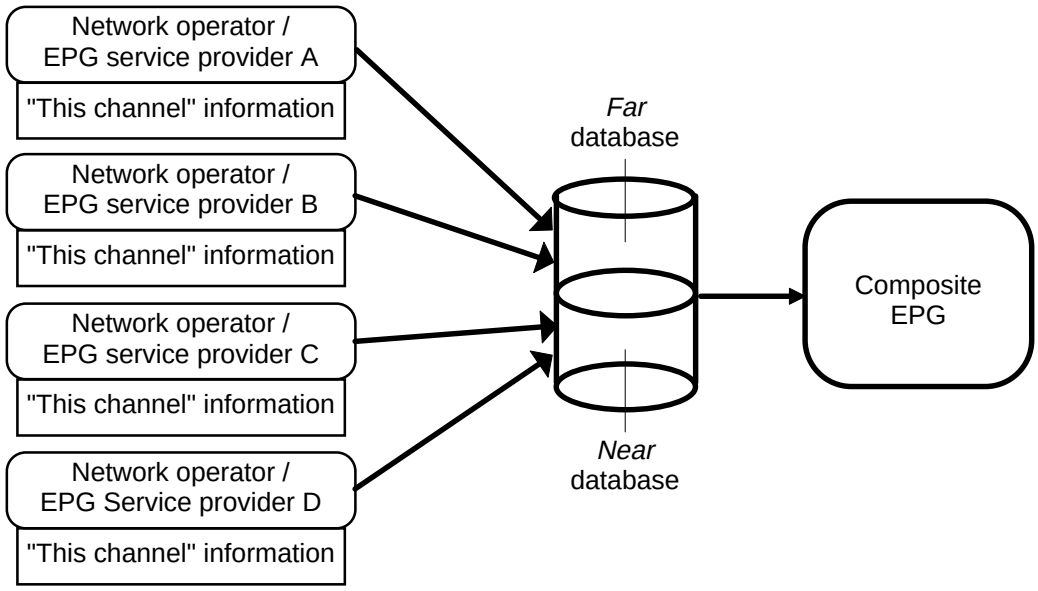


Figure 5: Composite EPG decoder

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 seconds for *Near Information.*
Decoder manufacturer.	**Screen layout**	EPG provider.
Very limited - decoder defined.	**Navigation**	Flexible - Defined by the EPG service provider.
Themes defined in ETS 300 707 [1], if supported by the decoder.	**Programme categories**	Themes defined in ETS 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 television 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**	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:

- The Bundle Information block;
- The Application Information block;
- The programme database comprising a number of Programme Information blocks;
- The database for display structures;
- The 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.

8.1 The Bundle Information block

EPGs are but one form of data broadcasting and the Teletext pages used to transmit a 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 principle contents of the AI block are:

- 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 subclause 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. A broadcaster should transmit a CNI code, either via packet 8/30 format 2 or VPS, to identify his channel to enable the decoder to tune automatically.

Otherwise one of the aims of the EPG - namely to enable the viewer to select a programme easily - will not be possible.

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 256 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 ETS 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 ETS 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.

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 ETS 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 seconds 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 ETS 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 if page 1DF is not used.*

If a MIP is required it should be transmitted at the same rate as the Bundle Information and Application Information blocks.

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.

A real-time clock, generated by the decoder, may be defined as part of a text sequence and displayed in any area.

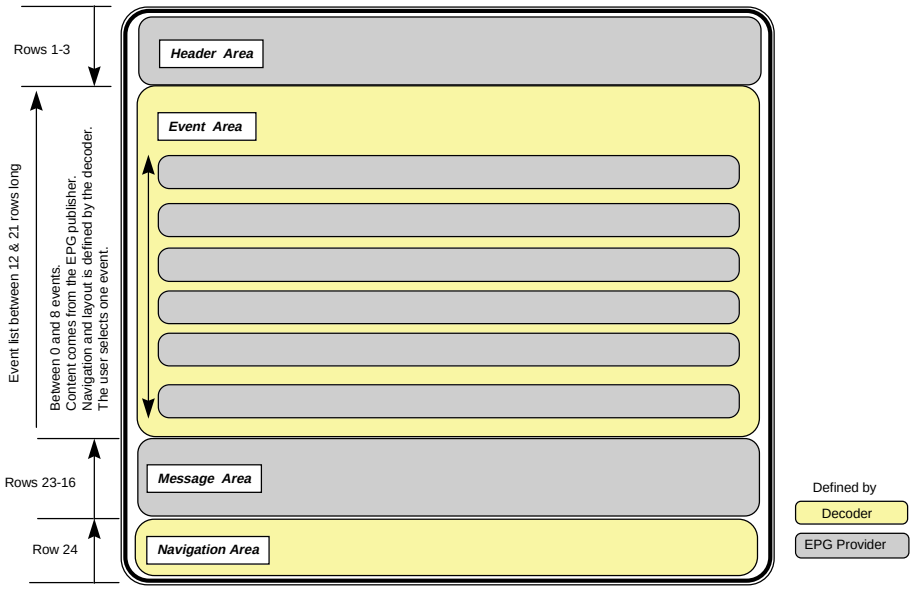


Figure 6: Screen layout

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 MUST 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.

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 subclause 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.

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.

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 ETS 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 subclause 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. Subclauses 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. By sending information more frequently, 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 dependant 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

Recommendations:

Think very hard about the actual update rates required. Normally 20 minutes, which was determined to be shorter than most television programmes, is ample time to update the whole EPG.

Updating will start within a few seconds of the EPG signal being recognized by the decoder. The decoder does not have to wait for the start of the cycle.

Prioritizing certain information will increase the data rates - there is limited capacity even in Stream 2.

The benefits of prioritizing on a regular basis may be minimal, a good response to changes may be better 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 ETS 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 ETS 300 706 [3] annex 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 ETS 300 708 [2] clause 5).

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 subclause 12.2.4) in a similar manner to Level 2.5 Teletext enhancement data (see ETS 300 706 [3] annex 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 seconds = 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 ETS 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 (Kbytes/s)

	Number of rows per text page												
VBI lines	**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 ETS 300 706 [3] annex 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 subclause 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 seconds. 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 subclause 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 seconds 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 seconds 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 *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 seconds. 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 subclause 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 subclause 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 seconds.

- *This Channel Now and The Next Four Programmes* should be transmitted every 10 seconds (the minimum stated in the specification).

- The remaining *This Channel Near* information should be transmitted every 30 seconds (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 x 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	Kbytes/s	Pages/s
Short PI (32 x 243 bytes)	7,59	10 s	0,76	0,85
Long PI (4 x 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 seconds:

Component	Size (Kbytes)	Tx rate	Kbytes/s	Pages/s
Minimum EPG, Short PI (4 x 243 bytes)	0,95	10s	0,10	0,11
Minimum EPG, Long PI (1 x 1 140 bytes)	1,11	10s	0,11	0,12
Rest of today, Short PI (28 x 243 bytes)	6,64	15s	0,44	0,49
Rest of today, Long PI (3 x 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 seconds.

Component	Size (Kbytes)	Tx rate	Kbytes/s	Pages/s
Minimum EPG, Short PI (4 x 243 bytes)	0,95	10s	0,10	0,11
Minimum EPG, Long PI (1 x 1 140 bytes)	1,11	10s	0,11	0,12
Rest of *Near*, Short PI (60 x 243 bytes)	14,24	34s	0,42	0,47
Rest of *Near*, Long PI (7 x 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 seconds is just outside the specification maximum of 30 seconds. 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.

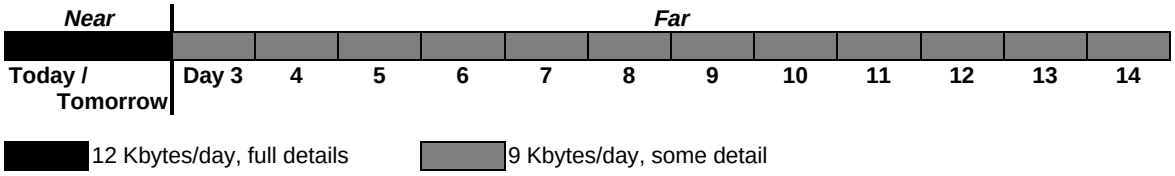
12.5.4 Service A - This Channel Only for 14 days

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 x 177) + (3 x 1 140) = 9 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 x 2 x 12 K	24 K	
1	12	*Channel Far*	1 x 12 x 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 bytes/s	1 284 bytes/s
Page rate			1,08 pages/s	0,32 pages/s	1,40 pages/s

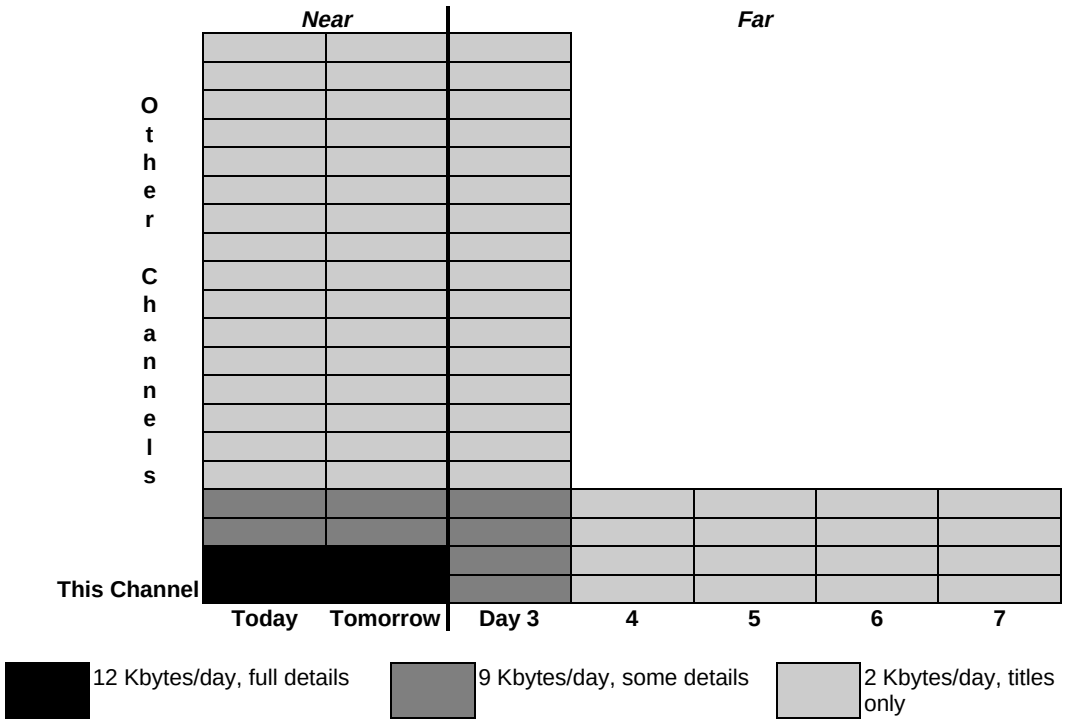
12.5.5 Service B - 4 channels for 7 days in some depth, plus 16 channels for 3 days, titles only

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 x 2 x 12 K	48 K	
2	2	*Minor Channel Near*	2 x 2 x 9 K	36 K	
16	2	*Titles Only*	16 x 2 x 2 K	64 K	
4	1	*Channel Far*	4 x 1 x 9 K		36 K
16	1	*Titles Only*	16 x 1 x 2 K		32 K
4	4	*Titles Only*	4 x 4 x 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 bytes/s	1 746 bytes/s
Page rate			1,25 pages/s	0,64 pages/s	1,89 pages/s

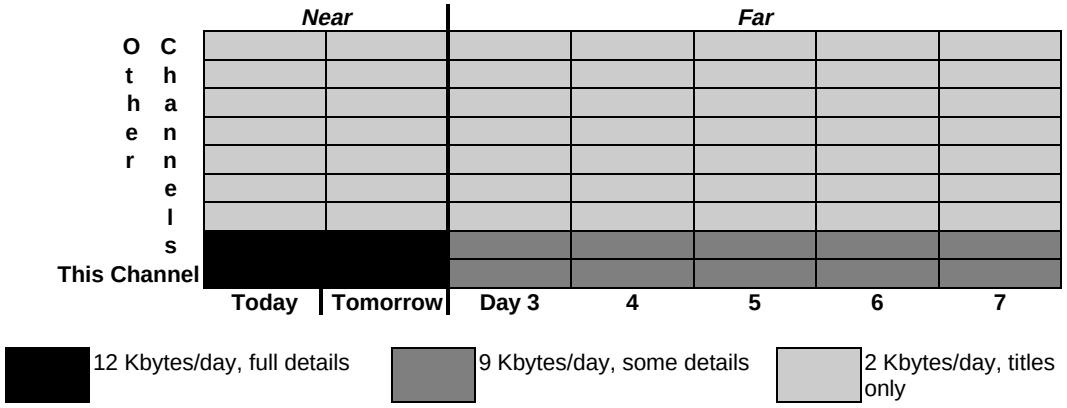
Note how the 20 channel AI component in *Stream 1* has become comparable with the *This Channel Now and Next* component.

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 x 2 x 12 K	48 K	
7	2	*Titles Only*	7 x 2 x 2 K	28 K	
2	5	*Channel Far*	2 x 5 x 9 K		90 K
7	5	*Titles Only*	7 x 5 x 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 bytes/s	1 594 bytes/s
Page rate			1,15 pages/s	0,59 pages/s	1,74 pages/s

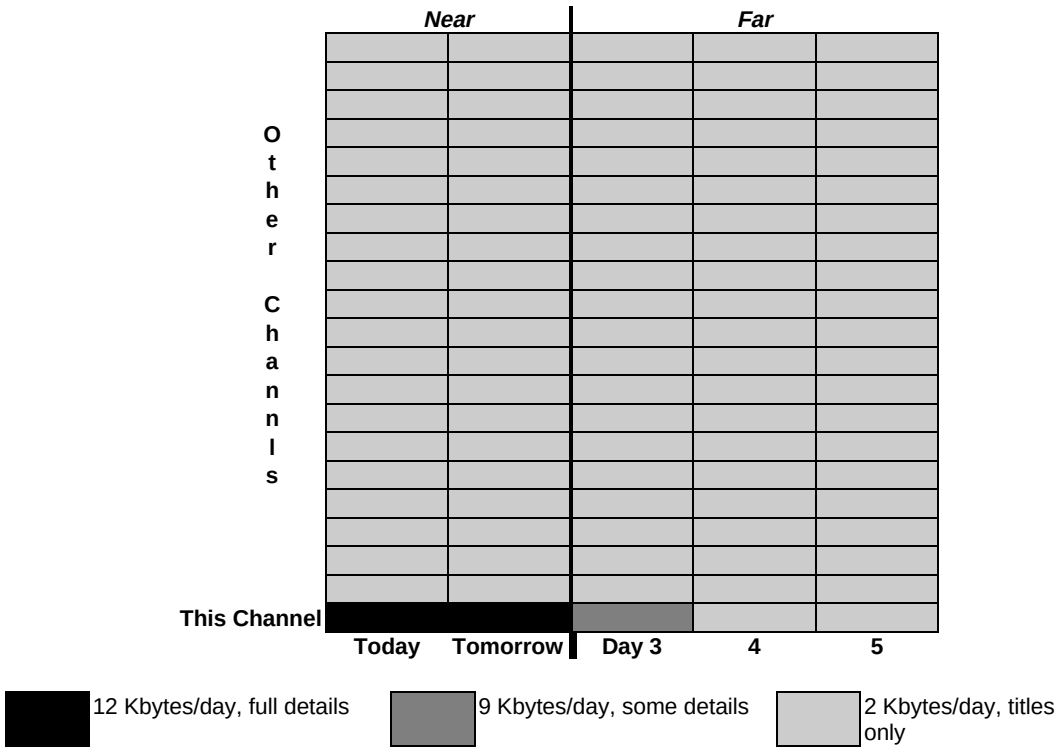
12.5.7 Service D - 1 channel in some depth plus 20 other channels, titles only, for 5 days

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 x 2 x 12 K	24 K	
20	2	*Titles Only*	20 x 2 x 2 K	80 K	
1	1	*Channel Far*	1 x 1 x 9 K		9 K
1	2	*Titles Only*	1 x 2 x 2 K		4 K
20	3	*Titles Only*	20 x 3 x 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 bytes/s	1 612 bytes/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 bytes/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 seconds 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 subclause 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 seconds to acquire the AI, etc., to identify that an EPG is present, then waits about 45 seconds 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 seconds we have either:

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

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

Thus in 5 seconds 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 seconds.

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 ETS 300 707 [1] subclauses 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.

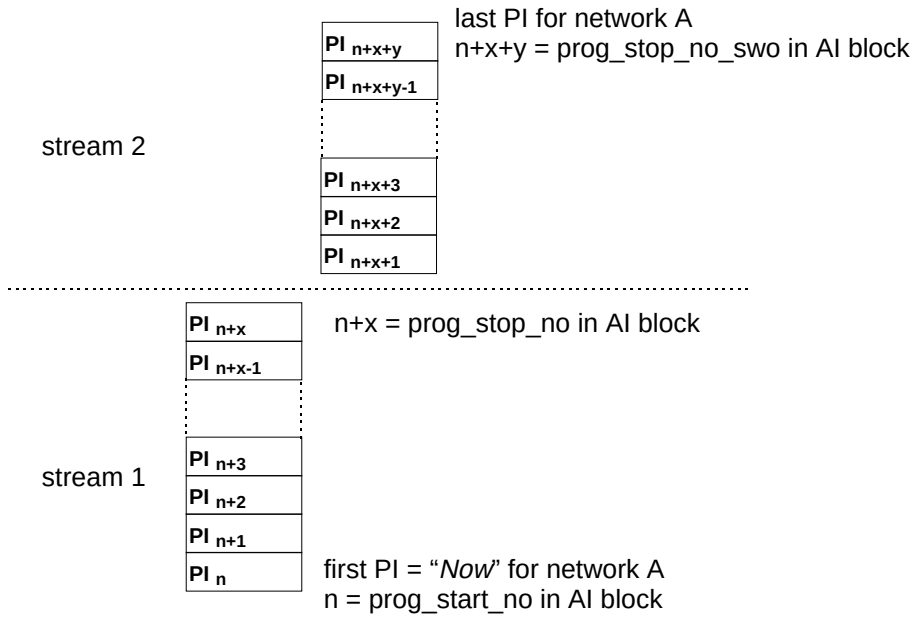


Figure 8: PI numbering in *Streams 1* and *2*

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 subclause 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 seconds. *This channel and the Next Four Programmes* feed will have changed as well within, say, 20 seconds 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 subclause 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 diagramatically 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.

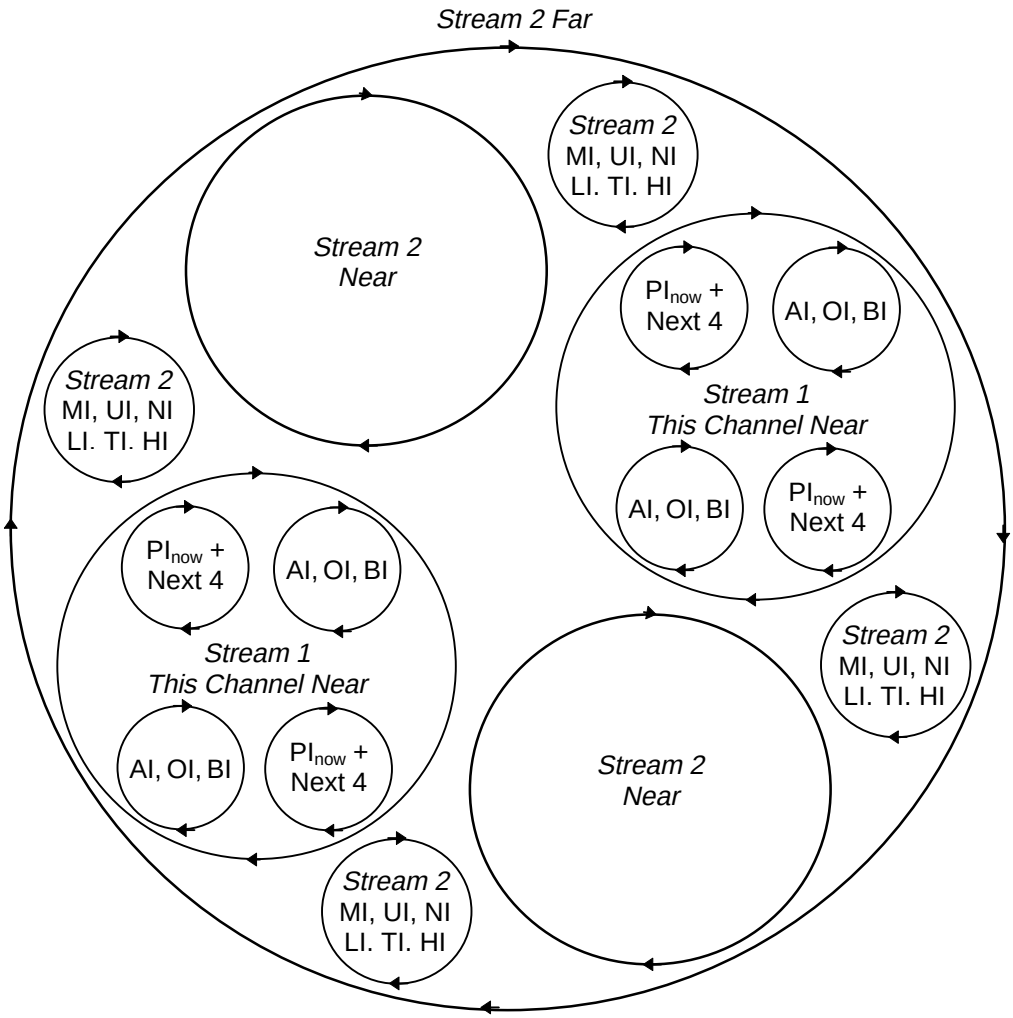


Figure 9: Representation of refreshing

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 ETS 300 707 [1], ETS 300 708 [2] and this ETR.

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 ETS 300 707 [1] for use in EPG services are listed in table 6.

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

(continued)

Table C.1: Pre-defined programme theme categories (concluded)

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

Annex D: Editorial committee

This ETR was compiled on behalf of the EBU and EACEM by the following:

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