

TRANSMISSION RULES

FOR THE

DVB-T (Terrestrial)

NETWORK

For New Zealand Free to Air Digital Broadcasting

Version 2.1

Date: 30th August 2011

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2 General

Freeview is the name given to the hybrid digital satellite and digital terrestrial free-to-air platforms for New Zealand. The digital satellite network forms an umbrella-like coverage over the whole country using an Optus satellite positioned at 160 degrees east longitude. The digital terrestrial network will service high density population centres. Visit Freeviews' consumer website at <http://freeviewnz.tv> for a full overview of the service offering.

The digital terrestrial network will be restricted to H.264 (AVC) services whereas the satellite network currently transmits only MPEG 2 (MP&ML) services (this may change in the future).

Both networks conform to DVB broadcast rules and standards and require MHEG-5 middleware for interactive application (including the Freeview EPG - http://freeviewnz.tv/index.php?section_id=7).

The specified requirements in this document are requirements and clarifications to DVB and ETSI international standards that describe the operational rules for a Freeview DTT receiver operating in New Zealand. All receivers which operate in the NZ Freeview DTT network must adhere to these international standards.

This document therefore describes which SI / PSI tables and descriptors will be transmitted on the Freeview DTT network and a guideline for how the digital receiver manufacture should interpret this data.

The major references for this document are;-

ETSI EN 300 468 [7] and ETR 101 211 [8]

Sections 7 and 8 of the UK D Book (ver 6.2.1). ~~and work currently undertaken by the UK DTG SI and HD D Book groups who are revising the UK D Book to encompass AVC services and HD Formats.~~

This document fully adheres to ETSI and DVB standards.

2.1 Document History

Table 2.1 Version History

Version	Date	Author	Details
0.7	15 th May 07	S.McBride	This is the first draft of the DTT Freeview Transmission Rules in New Zealand.
0.8	8 th June 07	S.McBride	Update with comments from Kordia and S&T
0.9	20 th June 07	S.McBride	Freeview Management review and first distribution to manufacturers.
1.0	15 th August 07	S.McBride	Updated with feedback from STB manufactures.
1.1	20 th December 07	S.McBride	Update with further manufacture feedback.
1.2	12 th September 09	S.McBride	New Revision to encompass new SI descriptors (all highlighted), HD MHEG Profile and MHEG Interaction Channel for 2010 receiver models
2.0	1 st July 2010	SMcBride	Official Release to Manufactures Includes further clarification on the new SI descriptors and PVR operations. References the new D-Book 6.2.1 MHEG ICEncryptedStreamExtension and LifecycleExtension and the MHEG InputMaskExtension
2.1	30 th August 2011	T.Diprose	Updated Network Interface requirement. All changes from ver 2.0 have been highlighted in green.

2.2 Abbreviations

AC-3	Dolby Digital (5.1 Channel)
AFD	Active Format Descriptor
API	Application Programming Interface
AIT	Application Information Table
BAT	Bouquet Association Table
CA	Conditional Access
CAT	Conditional Access Table
CharacterSet	MHEG term defined as: Identification of the character set, or set of character sets, that shall be used by default for Text rendering. This Integer shall be encoded with a value representing the character set. The application domain shall define a range of CharacterSet and its semantics.
CID	Content Identifier Descriptor
ContentHook	MHEG term defined as: Determine the encoding format of the data included or referenced by the Content attribute.

CRID	Content Reference Identifier
DAD	Default Authority Descriptor
DII	Download Info Indication
DSI	Download Server Initiate
DSM-CC	Digital Storage Media – Command and Control
DTT	Digital Terrestrial Television
DVB	Digital Video Broadcasting organisation
DVB-S	DVB – Satellite
DVB-T	DVB-Terrestrial
EBU	European Broadcasting Union
EIT	Event Information Table
EPG	Electronic Programme Guide
ESG	Event Schedule Guide
ETSI	European Telecommunication Standards Institute
FTA	Free To Air
GUI	Graphical User Interface
HD	High Definition
HDCP	High-Bandwidth Digital Content Protection
HDMI	High-Definition Multimedia Interface
HDTV	High Definition Television
IRD	Integrated Receiver Decoder
iDTVs	Integrated Digital Televisions
ISO	International Organisation for Standardisation
LCN	Logical Channel Number
LSN	Local Service Network
MAY	Indicates an event or provision which is permitted, but not mandatory
MPEG	Moving Pictures Expert Group
MHEG-5	Multimedia and Hypermedia information coding Expert Group
MFN	Multiple Frequencies Network
NIT	Network Information Table
OSD	On Screen Display
OUI	Organisation Unique Identifier
PAT	Program Association Table
PMT	Program Map Table
PSI	Program Specific Information
p/f	present / following
RST	Running Status Table
SD	Standard Definition
SDT	Service Description Table
SFN	Single Frequency Network
SI	Service Information
SIT	Selection Information Table
Shall	Indicates a mandatory provision
Should	Indicates a desirable, but not mandatory, provision
STB	Set-Top-Box
SSU	System Software Update
ST	Stuffing Table
STB	Set-top-box, or domestic satellite receiver, or IRD
TS	Transport Stream
Uimsbf	unsigned integer most significant bit first

UNT	Update Notification Table
UTC	Universal Time, Co-ordinated
UTF	Unicode Transformation Format
VBI	Analogue video vertical blanking interval

3 General DVB-T Network Structure

The New Zealand Digital Terrestrial Network was launched in April 2008. It currently covers approximately 75% of the population in the main urban areas of New Zealand. Please refer to http://freeviewnz.tv/index.php?section_id=3 for full coverage details.

The video services as carried throughout the network are AVC only, there are NO and there will not be any MPEG 2 services carried on the network. ~~For the initial launch the majority of the services will be SD with possibly 1 or 2 HD services. As the network matures it is expected that some of the SD services will migrate to an HD format.~~

The network has been split into seven regions (see Appendix D). Each region is considered independent from each other. Each region is common to all broadcasters. The SI for each region shall originate from a central SI source based in Auckland.

There is a mix of national and regional services. For each region, RF coverage is achieved through the use of SFN and MFN transmitters, transposes or repeaters. Currently the transmitters for each multiplexer in each particular region are situated in the same geographical location and hence each multiplexer has the same RF coverage.

There are currently 3 multiplex operators – TVNZ, Kordia and TVWorks with a provision for a further 2 as the network matures.

The TVWorks Multiplex shall deliver one transport stream from a central SI source in Auckland to all regions. It shall carry national services.

Due to different advertorial content in different regions TVNZ ~~will~~ delivers' individual and independent transport streams from a central SI source located in Auckland to 4 regions – Auckland, Waikato, Wellington and South Island. From the network map in Appendix D the Wellington region is an amalgamation of the Wellington, Manawatu and the Hawkes Bay region. The South Island region is an amalgamation of the Christchurch and Dunedin Regions.

Each Transport Stream delivered to each region may deliver different content and will be allocated a different transport_stream_ID.

The Kordia Multiplex ~~shall~~ delivers' one transport stream from a central SI source in Auckland to all regions. It carries both national and regional services. The multiplex will reference all national and regional services in its SDT, PAT and PMT tables. From the central Auckland SI source each of the regional services shall have the same video and audio PID of a 'placeholder' service. At the regional service insertion points the 'placeholder' video and audio PIDs shall be replaced with the regional broadcaster's video and audio PIDS. The Kordia Transport stream shall include the service_availability_descriptor in its SDT table to identify the services which are available or not available to the receiver depending on which cells_ids the receiver can reference.

The future multiplexes (four and five) which may be added to the DTT network shall be configured to one of the above scenarios.

Each multiplexer shall be transmitted in an 8 MHz channel in the UHF frequency range covering Bands IV to V. (see Appendix C for NZ UHF Channel allocations).

4 Freeview DTT Network SI – Overall Summary

4.1 Scope

The SI overall summary is to distil aspects of the Transmission Rules document and provide an overall summary of the network topology.

It does not describe the detail of individual tables or associated descriptors which are referenced in the appropriate sections of this document.

4.2 Network Information Table and associated descriptors

NIT Actual shall be carried. NIT Other shall not be carried.

A network is defined as a number of Transport Streams that share the same value of Original Network ID and the same value of Network ID. Note: The value of Original Network ID and Network IDs may be different.

The NIT Actual shall carry details of all Transport Streams in the current network as defined by the value of the Network ID.

A single Frequency List Descriptor shall be carried in *each* Transport Stream loop of the NIT Actual. Each instance of the Frequency List Descriptor shall describe all frequencies on which *this* Transport Stream may be received.

A single Terrestrial Delivery Descriptor shall be used in *each* Transport Stream Loop of the NIT Actual. Each instance of the Terrestrial Delivery Descriptor shall describe the transmission properties for *this* Transport Stream. The frequency field within the Terrestrial Delivery Descriptor shall be set to zero in all cases. The Frequency List Descriptor defines the frequency on which Transport Streams are broadcast.

A single Logical Channel Number Descriptor shall be carried in *each* Transport Stream loop of the NIT Actual. The LCN Descriptor shall be used to describe the LCN and the availability of each service carried within *this* Transport Stream.

The Private Data Specifier Descriptor shall be carried in the NIT Actual to specify private descriptors, such as the LCN descriptor.

4.3 Event Information Table and associated descriptors

EIT Present/Following Actual shall be carried for all services listed in the SDT Actual in which the EIT_present_following flag is set.

EIT Present/Following Other shall be carried for all services listed within the SDT Other in which the EIT_present_following flag is set.

EIT Schedule Actual/Other shall be carried containing limited CID data for all services for the dedicated use of PVR devices.

4.4 Service Description Table and associated descriptors

SDT Actual shall be carried for all services in the Actual Transport Stream

SDT Other shall be carried for all services within the scope of the current network, as defined by the value of the Network ID.

The Service Descriptor shall be carried in the SDT Actual and Other to define the service name of every service available within the scope of this network.

The Service Availability Descriptor shall be carried in SDT Actual and Other to describe the availability of services on a cell-by-cell basis. See also TPS bits.

4.5 TPS bits

The TPS bits shall be used to inject the Cell_ID at each transmitter site. Each transmitter shall be allocated a unique Cell_ID within the scope of the network except in a SFN region, where all the transmitters for a particular multiplex shall be allocated identical Cell_IDs values.

4.6 Network and Service Acquisition

The NZ DTT platform shall use a single Network ID across the whole platform.

Two Transport Streams received from different transmitter sites shall be deemed as being identical if they have the same Original Network ID and the same Transport Stream ID regardless of the value of the Network ID. The receiver shall discard the Transport Stream with the lesser signal quality.

Two services shall be deemed to be identical if the Original Network ID and the Service ID for the first service is the same as the Original Network ID and Service ID for the second service. This distinction is made regardless of the value of the Network IDs. The service with the lesser signal quality will be discarded and will not form part of the service line-up. It will not be possible to navigate to the discarded service using the remote control or access the discarded service or any of its components from within an MHEG-5 application.

If two services request the same LCN through the use of the LCN Descriptor the service with the lesser signal quality will be discarded and will not form part of the service line-up. It will not be possible to navigate to the discarded service using the remote control or access the service or any of its components from within an MHEG-5 application.

5 PSI/SI

5.1 General – DVB-T

This document is dedicated to providing the detail of how a fixed DVB-T receiver is to interpret DVB SI streams, MPEG, and MHEG-5 parameters operating within the Freeview DTT network. It does not constrain the receiver manufacture from including additional features such as favourite lists, programme timers, etc.

It does not describe the operational behaviour of mobile or handheld DVB-T receivers, Separate extensions to this document will be required for these features as and when they have been defined by Freeview. It does define the SI extensions required for PVRs' and return path functionality.

This section defines which SI tables and which descriptors in these SI tables shall be broadcast on the Freeview DTT network. It outlines the use of these tables and descriptors but does not provide complete details, such as the syntax and the number of times the descriptor is allowed in the loop. For this detailed information the relevant DVB documents are to be referenced principally EN 300 468 [7] and TR 101 211 [8]. Where private descriptors such as the logical_channel_number_descriptor are to be used on the Freeview network detailed explanations and structures are stated. Where certain DVB descriptors are utilised on the network but their particular use by the broadcasters requires further explanation, these clarifications are detailed in the appropriate section.

5.2 Descriptors

The table that follows identifies the standard descriptor set that will be present in Freeview DVB-T Transport Streams.

Table 5.1 Freeview DVB-T Descriptor List

Descriptor	Tag Value	NIT	BAT	SDT	EIT	TOT	PMT	Loop
Reserved	0x00-0x01	-	-	-	-	-	-	
Video_stream_descriptor	0x02	-	-	-	-	-	Ob Or	ES loop
Audio_stream_descriptor	0x03	-	-	-	-	-	Ob Or	ES loop
ISO 639_language_descriptor	0x0A	-	-	-	-	-	Mb Mr	ES loop
System_clock_descriptor	0x0B	-	-	-	-	-	Ob Or	Program loop
Smoothing_Buffer_descriptor	0x10	-	-	-	-	-	Ob Or	Program loop
Carousel_ID_descriptor	0x13	-	-	-	-	-	Mb	ES loop

Descriptor	Tag Value	NIT	BAT	SDT	EIT	TOT	PMT	Loop
							Mr	
ISO/IEC 13818-1 Reserved	0x14-0x3F	-	-	-	-	-	-	
Network_name_descriptor	0x40	Mb Mr	-	-	-	-	-	Network loop
Service_list_descriptor	0x41	Ob Or	-	-	-	-	-	TS Loop
Service_descriptor	0x48	-	-	Mb Mr	-	-	-	Service loop
Linkage_descriptor	0x4A	Ob Mr	-	-	-	-	-	Network loop
Short_event_descriptor	0x4D	-	-	-	Mb Mr	-	-	Event loop
Extended_event_descriptor	0x4E	-	-	-	Ob Or	-	-	Event loop
Component_descriptor	0x50	-	-	-	Mb Mr	-	-	Event loop
Stream_identifier_descriptor	0x52		-	-	-	-	Ob Mr	ES loop
Content_descriptor	0x54	-	-	-	Ob Mr	-	-	Event loop
Parental_Rating_Descriptor	0x55	-	-	-	Ob Or ¹	-	-	Event loop
Teletext_descriptor	0x56	-	-	-	-	-	Mb Mr	ES loop
Local_time_offset_descriptor	0x58	-	-	-	-	Mb Mr	-	TOT loop
Subtitling_descriptor	0x59	-	-	-	-	-	Mb Mr	ES loop
Terrestrial_delivery_system_descriptor	0x5A	Mb Mr	-	-	-	-	-	TS loop
Private_data_specifier_descriptor	0x5F	Mb Mr	-	-	-	-	-	TS loop
Frequency_list_descriptor	0x62	Mb Or	-	-	-	-	-	TS loop
Cell_list_descriptor	0x6C	Ob Or	-	-	-	-	-	Network loop
Cell_frequency_link_descriptor	0x6D	Mb Or	-	-	-	-	-	TS loop
Data_broadcast_id_descriptor	0x66	-	-	-	-	-	Ob Mr	ES loop
AC-3_descriptor	0x6A	-	-	-	-	-	Mb Mr	ES loop
Service_availability_descriptor	0x72	-	-	Ob Mr	-	-	-	Service loop
AAC_descriptor	0x7C	-	-	-	-	-	Mb Mr	ES loop

Descriptor	Tag Value	NIT	BAT	SDT	EIT	TOT	PMT	Loop
Default_authority_descriptor	0x73	-	-	Mb Or ^{#1}	-	-	-	Service Loop
Content_identifier_descriptor	0x76	-	-	-	Mb Or ^{#1}	-	-	Event Loop
FTA_content_management_descriptor	0x7E	-	-	Mb Or ^{#2}	Mb Or ^{#2}	-	-	Service Loop / Event Loop
Supplementary_audio_descriptor	0x7F/06	-	-	-	-	-	Mb/ Mr	ES Loop
Network_change_notify_descriptor	0x7F/07	Mb Or ^{#3}	-	-	-	-	-	TS Loop
Message_descriptor	0x7F/08	Mb Or ^{#3}	-	-	-	-	-	TS Loop
logical_channel_number_descriptor	0x83	Mb Mr	-	-	-	-	-	TS loop
Forbidden	0xFF	Fb	Fb	Fb	Fb	Fb	Fb	

Note 1 Mandatory for PVR type Device

Note 2 Mandatory for DTT devices which can copy or transfer content

Note 3 Mandatory for Receivers which do not automatically process the NIT for Network changes as detailed in sections 8.7, 8.8 and 8.9.

Definition of Acronyms Used In Table

-	Descriptor not applicable
Mb	Mandatory to Broadcast
Ob	Optional to Broadcast, but recommended if applicable
Fb	Forbidden to Broadcast (may cause misrepresentation)
Mr	Mandatory to receive and interpret if Broadcast
Or	Optional to receive and interpret (if Broadcast)

5.2.1 Field Sizes of the Descriptors

In the Freeview network, text strings shall be coded using the Character code table 00 – Latin Alphabet) as specified in ISO 6937 (see EN 300 468 [7] Annex A). It is required that the receivers embedded character set is Character code table 00 – Latin Alphabet. It is not required for receivers to support any other character sets.

Broadcasters will not exceed the maximum field lengths for text fields as defined in the table below.

Table 5-2 Field Lengths

Name Field	Name Length	Comments and Examples
Network Name	24	Example: "Freeview"
Service Provider Name	20	Example: "Maori Television"
Full Service Name	22	Example: "The NZ Racing Channel"
Short Service Name	12	Example: "NZ Racing"

Name Field	Name Length	Comments and Examples
Event Name	40	Example: "The Rugby World Cup 2011"
Short Event Description	200	
Extended Event Description	255	
Component Description	32	
Application Name	32	
Network Change Information	200	

All "Name" fields shall contain meaningful data.

"Description" fields may be left empty at the broadcasters description.

Text string formatting of name and description fields as described in TR 101 211 [8] section 4.6 may be used by broadcasters and shall be supported by receivers.

5.3 Program Association Table (PAT)

Table_id 0x00 PAT is mandatory and shall always be transmitted on PID 0x0000. PAT provides a link between the program_number (service_id) and the corresponding PMT PID.

The PAT for Freeview Transport streams shall be transmitted at least every 200ms. Receivers should continually monitor the PAT for change.

5.4 Conditional Access Table (CAT)

Table_id 0x01 At present there is no Freeview service that is currently scrambled. The CAT shall be broadcast if CA is applied to any service on the network.

5.5 Program Map Table (PMT)

Table_id 0x02 – for each service in a transport stream there shall be a corresponding Program Map Table. The PMT shall be encoded according to ISO/IEC 13818-1 [1]. There shall be a separate program_map_PID for each service.

The number and type of components signalled via the PMT may change at either the programme or service boundaries or may remain quasi-static depending upon individual broadcaster's operational constraints. In the quasi static configuration the PMT shall list a super set of components that may be used in the broadcast of any programme. Consequently some of these components may not be carrying useful content for a particular programme.

The EITp/f component_descriptor signalling shall always accurately describe the valid components of the programme. For static PMTs' the receiver is to use the EITp/f to determine the active component where there is ambiguity in the component selection based on the PMT Elementary stream alone.

The PMT for Freeview Transport streams shall be transmitted at least every 200ms.

Receivers should continually monitor the PMT for change.

5.5.1 Mandatory Descriptors

ISO_639_language
_descriptor

Descriptor_tag 0x0A This descriptor shall be inserted for every audio component defined. Each Character is coded into 8-bits as defined by ISO/IEC 13818-1 [1] and inserted into a 24 bit field. When the audio type is set to "Undefined" it shall be assumed to be English. NZ Freeview DTT Network shall support the languages in Table 5.3

Table 5.3 Language Support

Language	3-Character Language Code
English	'eng'
Maori	'mao'
French	'fre'
German	'ger'
Italian	'ita'
Spanish	'spa'
Korean	'kor'
Chinese (Mandarin)	'cmn'
Chinese (Cantonese)	'yue'
Japanese	'jpn'
Hindi	'hin'

Undefined	'und'
-----------	-------

Content identified as undefined shall be assumed to be English

Stream_identifier_descriptor	Descriptor_tag 0x52. Shall be included when required by TR 101 211 [8]
Teletext_descriptor	Descriptor_tag 0x56 Mandatory whenever a teletext component is defined. The syntax shall be according to ETR 300 468 [7].
Subtitling_descriptor	Descriptor_tag 0x59 Mandatory whenever DVB bitmap subtitles are transmitted. Refer to section 13.2 for DVB subtitles to be included within a service.
Data_broadcast_id_descriptor	Descriptor_tag 0x66 Mandatory whenever associated MHEG-5 applications are transmitted or when the DVB bootloader –(system Software update – SSU) is used or about to be used. When used for the purposes of an SSU it shall be used in conjunction with Data_broadcast_id of 0x0A The OUI value in the PMT shall match the OUI value in the NIT in the NIT linkage to bootloader descriptor. Refer to section 9 for its inclusion in a multiplexer.
AC-3_Descriptor	Descriptor tag 0x6A. The AC-3 Descriptor identifies an AC-3 audio in the elementary stream. For its inclusion in a service PMT refer to Annex D of EN 300 468 [7].
AAC_descriptor	Descriptor tag 0x7C. The AAC Descriptor identifies an AAC audio in the elementary stream. For its inclusion in a service PMT refer to Annex H of EN 300 468 [7]
Private_data_specifier	Mandatory whenever private defined descriptors are used, as specified in TR 101 211 [8].
Supplementary_audio_descriptor	Descriptor Tag 0x7F / Tag Extension Value 0x06. The supplementary_audio_descriptor provides additional information about the audio streams which allows the receiver to present the appropriate stream, or mix of streams, to the user. It shall be signalled on a audio component which transmits a audio description broadcast mix on a Freeview service. For further explanation on the supplementary_audio_descriptor use on the DTT network see section 6.5

5.5.2 Optional Descriptors

Audio_stream_descriptor Descriptor_tag 0x03

5.5.3 MHEG-5 Data Carousel Descriptors within the PMT

The transport protocol for the purposes of data carousel and object carousel is as defined in the specification DVB EN 301 192; DVB specification for data broadcasting. For detailed reference please refer to this document.

Every service on the DTT platform shall reference an MHEG-5 object carousel.

The following mandatory descriptors shall be transmitted in the elementary stream loop of the PMT to indicate that the component contains the Download Server Initiate message in the object carousel and that applications carried on this component are conformant to MHEG-5 UK Profile1.06.

Carousel_ID_descriptor	descriptor_tag 0x13 The Carousel id descriptor is mandatory when associated MHEG-5 Carousel data is transmitted.
Stream_identifier_descriptor	Descriptor_tag 0x52 Mandatory whenever associated MHEG-5 applications are transmitted.
Data_broadcast_id_descriptor	Descriptor_tag 0x66 Mandatory whenever associated MHEG-5 applications are transmitted. When used for the purposes of MHEG-5 it shall be used in conjunction with Data_broadcast_id of 0x0106.

Table 5.4 Freeview DTT MHEG-5 structure syntax example

```

ElementaryStream {
  streamType   = 0x0b
  elementaryPID = 0xnnn
  ESInfoLength = 0xnnnn
  ESInfo {

    StreamIdentifierDescriptor {
      tag       = 0xnn
      length    = 0x01
      componentTag = 0x0b
    }
  }
}

```

```
}  
  
DataBroadcastIdDescriptor {  
    tag          = 0x66  
    length       = 0x06  
    dataBroadcastId = 0x0106  
    {  
        applicationTypeCode = 0x0505 (*note 1)  
        bootPriorityHint    = 0x00 (*note2)  
        appSpecificDataLength = 0x00  
    }  
}  
  
CarouselIdentifierDescriptor {  
    tag          = 0x13  
    length       = 0x05  
    carouselId   = 0xn timer  
    formatId     = 0x00  
}
```

n – arbitrary value

Note 1: Signify's MHEG-5 NZ Profile ver. 1.06 which is based on the UK MHEG-5 profile ver 1.06 with NZ extensions (see Appendix D).

Note 2 : Will change when supplementary MHEG applications in addition to the MHEG EPG application are referenced on the platform. See D-BOOK [23] section 17.4.2.1 for updated signaling requirements

5.6 Network Information Table

The NIT (actual) shall be transmitted in each transport stream in the network. The NIT shall be encoded according to ISO/IEC 13818-1 [1], EN 300 468 [7] and ETR 101 211 [8].

The NIT (actual) will normally be quasi-static. The NIT (actual) shall accurately reflect all the transport streams on the DTT Freeview Network. It shall detail the transmission parameters of the multiplexes being radiated from Main and (where present) Slave transmitters. There will normally be a new version of the NIT payload only in one of the following circumstances:

- a new multiplex or transmitter is added or removed from the network
- when the service make-up changes
- when transmission parameters are changed

NIT_actual table_id 0x40 shall be transmitted.

NIT_other table_id 0x41 shall not be supported.

NIT shall always be transmitted on PID 0x0010.

The NIT shall be transmitted at least every 10sec.

5.6.1 Mandatory Descriptors

Linkage_descriptor	Descriptor_tag 0x4A (with the linkage type 0x09) shall refer to a transport stream carrying a system software update service (SSU). It shall be inserted into the primary NIT loop. It shall only be broadcast when a SSU update takes place. These private data bytes will provide the identity of the organisation that is providing the system software update service and may also provide additional information that identifies the update as being specific to a particular manufacturer's model.
Network_name_descriptor:	A network_name_descriptor (0x40) shall be inserted for each NIT sub-table.
Terrestrial_delivery_system_descriptor	A Terrestrial_delivery_system_descriptor (0x5A) shall be inserted for each transport stream in a terrestrial network. All transport streams in a network shall be defined in the appropriate NIT section
Frequency_list_descriptor	Descriptor Tag 0x62; gives the complete list of additional frequencies for a multiplex which is

transmitted on multiple frequencies. It shall be fully populated and shall be ordered to the rules set out in TR 101 211 [8] which defines a constant ordering of transmitters.

If there are one or more slave transmitter sites the other_frequency_flag in the terrestrial_system_descriptor shall be set to '1' indicating other frequencies are in use.

Private_data_specifier_descriptor	Descriptor Tag 0x5F . This is mandatory to whenever private descriptors are used. For the Freeview logical channel descriptor then the private_data_specifier_value shall be 0x0000 0037.
Freeview_Logical_channel_descriptor	A Freeview_logical_channel_descriptor (tag 0x83) shall be inserted in the second descriptor loop of the NIT. This descriptor shall list all services from that transport stream that are contained within the multiplex and specify the logical channel that is assigned to each of those services. For a detailed explanation see section 6.1.
Network_change_notify_descriptor	Descriptor Tag 0x7F Tag / Tag Extension Value 0x07. This descriptor shall be used on the Freeview DVB-T network to signal network change events to receivers. Receivers shall be able to store and process multiple network changes within the same network_change_notify descriptor to allow multiple stage engineering works to be signalled in one descriptor. Receivers shall only react to network changes signalled to occur in transmitter cells which match the cell_id in the broadcast signal relating to any service stored by the receiver. It will predominately be used to signal to receivers the presence or a new cell or multiplex. Change type 0xA shall indicate the addition or removal of a new cell. Change type 0xB shall indicate the additional of a multiplex. For all these change types if the change is signalled to a cell matched by the receiver – the receiver shall perform a rescan at the date and time within start_change_of_change field. The syntax of the descriptor is detailed in ETSI EN 300 468 [7]. For further explanation of the network_change_notify_descriptor particular use on the Freeview DTT network see section 6.3
Message_descriptor	Descriptor Tag 0x7F Tag Extension Value 0x08. The message descriptor shall provide receivers with a textual message which the receiver shall display to the user at the appropriate time. It may be used in

to detect and update network changes as detailed in section 8.7. – 8.9.

in conjunction with the Network_change_notify_descriptor to provide a message to users that a network change is about to occur in their area. It will not be used by broadcasters to impart information of an advertising nature. The syntax of the descriptor is detailed in ETSI EN 300 468 [7]. For further explanation of the message_descriptor particular use on the Freeview DTT network see section 6.4

5.6.2 Optional Descriptors

Service_list_descriptor	A service_list_descriptor (0x41) may be inserted for each transport stream defined in each NIT section. All services targeted for the network in a transport stream shall then be listed. Due to the inclusion of the service_availability_descriptor on the Freeview network the receiver should use the SDT to build up the service list
SSU Scan Linkage_descriptor	Descriptor Tag 0x4A; (when used in conjunction with the linkage type 0x09.) The linkage descriptor shall be signalled within the NIT when a DVB-SSU data broadcast is to be delivered. It is optional for the receiver to interpret this linkage descriptor. If the descriptor is used it will quickly identify the transport_stream_id of the transport stream that contains the system software update. It shall only be broadcast when a SSU update takes place and only if requested by the manufacturer . It differs from the linkage descriptor type 0x09 as it does not contain any OUI specific data.
Cell_frequency_link_descriptor	Descriptor Tag 0x6D; The descriptor provides a link between a cell and the frequencies that are used in this cell for the transport stream described. The descriptor shall be signalled and it is optional for receivers' to make use of the descriptor for example to perform a fast initial scan or to discriminate if changes to the network effect only the particular cell the receiver is resident in.
Cell_list_descriptor	Descriptor Tag 0x6C: is reserved for possible future mobile DTT receiver purposes.

5.7 Bouquet Association Table (BAT)

Initially the Freeview DTT network will not transmit a BAT. The use of the BAT is reserved for future expansion of the Freeview network. It is not required that receivers interpret the BAT.

5.8 Service Description Table –Actual (SDT-Actual)

Table_id 0x42 – An SDT_actual table is mandatory for each individual transport stream in the network. The SDT shall describe all services within the multiplex. It shall change when any of the services within the multiplex change status.

It is advisable for receivers to use the SDT to determine services that may be included in the channel list due to the use of the service_availability_descriptor on the network rather than the service_list_descriptor in the NIT.

All sections of the SDT_actual table shall be transmitted at least every 2 seconds.

5.8.1 Mandatory Descriptors

Service_descriptor A service_descriptor (0x 48) provides the name of the service provider and the service in text form together with the service_type. It shall be inserted for each service as defined in the SDT.

The service types that could be used on the Freeview DTT Network are as listed in Table 5.5.

Table 5.5 Service Types available on the Network

Service Type	Description
0x02	Digital Radio Service
0x03	Teletext Service
0x0A	Advanced Codec digital radio service
0x0C	Data Broadcast Service
0x16	Advanced codec SD digital television service
0x19	Advanced codec HD digital television service
Note#1 0x01 – digital television service shall not be used as refers to MPEG2 SD material	

Service_availability_descriptor A Service_availability_descriptor (0x72) Any transport stream referenced in the SDT actual table must include a service_availability_descriptor when it includes services that are not broadcast over the whole network. The descriptor shall reference the service list against the services which are available in the cells the receiver is able to decode.

FTA_Content_Management_Descriptor

A FTA_Content_Management_Descriptor

(0X7E) as defined in ETSI EN 300 468 [7] shall be broadcast to convey the content management policy for the delivered HD content. The expected behaviour is defined in Section 6.2 Initially the descriptor shall be signalled in the SDT of any channel broadcasting original source HD material so all delivered content shall subject to the same content management policy. After an upgrade to the SI system the descriptor may be relocated in the EITp/f.

5.8.2 Mandatory Descriptors for PVR type devices

Default_Authority_descriptor

A Default_Authority_Descriptor (0x73) is used on the network to shorten the CRIDs carried within the EIT by defining an appropriate CRID authority over a defined scope. It shall match the value of the Default_Authority_Descriptor as transmitted in the MHEG EPG application. Every service on the network shall be allocated a Default_Authority_Descriptor. See section 7 for PVR signalling

5.9 Service Description Table –Actual (SDT-Other)

Table_id 0x46 – An SDT_other shall describe all other services on transport streams on the Freeview network. It shall change when any of the services within any of the multiplexes change status.

It is advisable for receivers to use the SDT(other) to determine services that may be included in the channel list due to the use of the service_availability_descriptor on the network rather than the service_list_descriptor in the NIT.

All sections of the SDT_other table shall be transmitted at least every 10 - 15 seconds.

Service_descriptor	A service_descriptor (0x 48) provides the name of the service provider and the service in text form together with the service_type. It shall be inserted for each service as defined in the SDT.
Service_availability_descriptor	A Service_availability_descriptor (0x72) Any transport stream referenced in the SDT other table must include a service_availability_descriptor when it includes services that are not broadcast over the whole network. The descriptor shall reference the service list against the services which are available in the cells the receiver is able to decode.

5.9.1 Mandatory Descriptors for PVR type devices

Default_Authority_descriptor

A Default_Authority_Descriptor (0x73) is used on the network to shorten the CRIDs carried within the EIT by defining an appropriate CRID authority over a defined scope. It shall match the value of the Default_Authority_Descriptor as transmitted in the MHEG EPG application. Every service on the network shall be allocated a Default_Authority_Descriptor. See section 7 for PVR signalling

5.10 Event Information Table

Table_id 0x4E – EIT_actual_p/f – It is mandatory to transmit EIT p/f sections for all “visible” services in the actual transport stream and for each service where there is a reference to that service in an SDT (actual or other) in the multiplex for which the EIT_present_following_flag is set.

Visible services are those services which are listed within the Logical Channel Descriptor with the visible_service_flag set to “1”.

The EIT_actual_p/f shall be transmitted at least every 2 seconds.

5.10.1 Mandatory Descriptors – EIT_actual_p/f

Short_event_descriptor;	Descriptor tag 0x4D. Contains title and possibly short (less than 200 characters) text information about the event.
Content_descriptor;	Descriptor tag 0x54, classifies the event according to certain content (genre) classes specified by the DVB SI specification (EN 300 468 [7]) currently table 28. If there is no content coding in conformance with table 28 in EN 300 468 [7] present for an event, the default content description “unclassified” applies. Only support for content_nibble_level_1 is mandatory, content_nibble_level_2 is optional.
Component_descriptor	<p>A Component_descriptor (0x50) identifies the type all component streams of an event and may be used by the receiver to provide a text description of the elementary stream. . These can show whether a current or future event has any additional components which may be of interest to the consumer, such as subtitles or audio description. Any component signalled in a component descriptor must appear in the relevant PMT. The absence of a component descriptor in EIT for a particular component must not prevent user access to that component if present in the PMT.</p> <p>Data components shall not be signalled via this mechanism. The data broadcast descriptor provides a mechanism for indicating interactively enhanced services or events. Any channel banner, info and now/next information that displays the valid components of the active programme should use the EIT component descriptor and not the PMT.</p>

Table 5.6 Service_type and Component_types which may be used on the Freeview DTT network.

Stream Content	Component Type	Description
0x02	0x00	reserved for future use
0x02	0x01	MPEG-1 Layer 2 audio, single mono channel
0x02	0x02	MPEG-1 Layer 2 audio, dual mono channel
0x02	0x03	MPEG-1 Layer 2 audio, stereo (2 channel)
0x02	0x04	MPEG-1 Layer 2 audio, multi-lingual, multi-channel
0x02	0x05	MPEG-1 Layer 2 audio, surround sound
0x02	0x06	To 0x3F reserved for future use
0x02	0x40	MPEG-1 Layer 2 audio description for the visually impaired
0x02	0x41	MPEG-1 Layer 2 audio for the hard of hearing
0x03	0x00	reserved for future use
0x03	0x01	EBU Teletext subtitles
0x03	0x02	associated EBU Teletext
0x03	0x04	to 0x0F reserved for future use
0x03	0x10	DVB subtitles (normal) with no monitor aspect ratio criticality
0x03	0x11	DVB subtitles (normal) for display on 4:3 aspect ratio monitor
0x03	0x12	DVB subtitles (normal) for display on 16:9 aspect ratio monitor
0x03	0x13	DVB subtitles (normal) for display on 2.21:1 aspect ratio monitor
0x03	0x14	to 0x1F reserved for future use
0x03	0x20	DVB subtitles (for the hard of hearing) with no monitor aspect ratio criticality
0x03	0x21	DVB subtitles (for the hard of hearing) for display on 4:3 aspect ratio monitor
0x03	0x22	DVB subtitles (for the hard of hearing) for display on 16:9 aspect ratio monitor
0x03	0x23	DVB subtitles (for the hard of hearing) for display on 2.21:1 aspect ratio monitor
0x03	0x24 to 0xAF	reserved for future use
0x03	0xB0 to 0xFE	user defined
0x03	0xFF	reserved for future use
0x04	0x00 to 0x7F	reserved for AC-3 audio modes (refer to En 300 468 [7] table D.1)
0x05	0x00	reserved for future use
0x05	0x01	H.264/AVC standard definition video, 4:3 aspect ratio, 25 Hz
0x05	0x02	reserved for future use
0x05	0x03	H.264/AVC standard definition video, 16:9 aspect ratio, 25 Hz
0x05	0x04	H.264/AVC standard definition video, > 16:9 aspect ratio, 25 Hz

0x05	0x06	reserved for future use
0x05	0x09 to 0x0A	reserved for future use
0x05	0x0B	H.264/AVC high definition video, 16:9 aspect ratio, 25 Hz
0x05	0x0C	H.264/AVC high definition video, > 16:9 aspect ratio, 25 Hz
0x05	0x0D	to 0x0E reserved for future use
0x05	0x11 to 0xAF	reserved for future use
0x05	0xB0 to 0xFE	user-defined
0x05	0xFF	reserved for future use
0x06	0x00	reserved for future use
0x06	0x01	HE-AAC audio, single mono channel
0x06	0x02	reserved for future use
0x06	0x03	HE-AAC audio, stereo
0x06	0x04	reserved for future use
0x06	0x05	HE-AAC audio, surround sound
0x06	0x06	to 0x3F reserved for future use
0x06	0x40	HE-AAC audio description for the visually impaired
0x06	0x41	HE-AAC audio for the hard of hearing
0x06	0x42	HE-AAC receiver-mixed supplementary audio as per annex G of TR 101 154 [10]
0x06	0x47	HE-AAC receiver mix audio description for the visually impaired
0x06	0x48	HE-AAC broadcaster mix audio description for the visually impaired
0x06	0x43	HE-AAC v2 audio, stereo
0x06	0x44	HE-AAC v2 audio description for the visually impaired
0x06	0x45	HE-AAC v2 audio for the hard of hearing
0x06	0x46	HE-AAC v2 receiver-mixed supplementary audio as per annex G of

5.10.2 Mandatory Descriptors for PVR type devices (optional for other receiver types)

Parental_rating_descriptor

Descriptor tag 0x55, provides the recommended age rating and identifies the country (New Zealand).

DVB Rating	NZ Translation
0x00	Undefined
0x06	G (upto 9 Years)
0x08	PGR (upto 11Years)
0x0C	AO (upto 15Years)

For values not defined in this table the rating level above should be used e.g. if 0 x 07 was broadcast then it should be treated as 0 x 08. Therefore only a user setting of 0 x 08 or higher would allow the

	access to that programme
FTA_Content_Management_Descriptor	A FTA_Content_Management_Descriptor (0X7E) as defined in ETSI EN 300 468 [7] shall be broadcast to convey the content management policy for the delivered HD content. The expected behaviour is defined in Section 6.2 Initially the descriptor shall be signalled in the SDT of any channel broadcasting original source HD material so all delivered content shall subject to the same content management policy. After an upgrade of the SI system the descriptor may be relocated in the EITp/f to convey content management policy on a <i>original source HD</i> programme by programme basis.
Content_identifier_descriptor	The content identifier descriptor (CID) (0x76) shall be broadcast to associate a CRID to an event and is placed in the event loop of the EIT. Its value of the CRID shall exactly match the CRID value as broadcast in the MHEG EPG application. The behaviour of the CRID is detail in section 7.0 A receiver shall constantly monitor the CRID in the EITp/f for accurate start and duration times.

5.10.3 Optional Descriptor

Extended_event_descriptor;	Descriptor tag 0x4E, provides a detailed text description of an event, which may be used to provide supplementary information to that described in the short_event_descriptor field.
----------------------------	--

5.11 Event Information Table - Other (EITp/f-other)

Table_id 0x4F – EIT_other_p/f – It is mandatory to transmit EIT p/f sections for all “visible” services in ‘other’ transport streams that form part of the Freeview service. Visible services are those services which are listed within the Logical Channel Descriptor with the visible_service_flag set to “1”.

Transmission of EIT present /following information for ‘other’ transport streams is mandatory for the Freeview service, but is optional on a service ID by service ID basis, (i.e. channel by channel basis).

The EIT_other_p/f shall be transmitted at least every 20 seconds.

5.11.1 Mandatory Descriptors – EIT_other_p/f

Short_event_descriptor;	Descriptor tag 0x4D, contains title and possibly short (less than 200 characters) text information about the event.
Content_descriptor;	Descriptor tag 0x54, classifies the event according to certain content classes specified by the DVB SI specification EN 300 468 [7]. Only support for content_nibble_level_1 is mandatory, content_nibble_level_2 is optional.
Component_descriptor	A Component_descriptor (0x50) identifies the type all component streams of an event and may be used by the receiver to provide a text description of the elementary stream Any channel banner, info and now/next information that displays the valid components of the active programme shall use the EIT component descriptor and not the PMT.

5.11.2 Mandatory Descriptors for PVR type devices (optional for other receiver types)

Parental_rating_descriptor	Descriptor tag 0x55, provides the recommended age rating and identifies the country (New Zealand).
FTA_Content_Management_Descriptor	A FTA_Content_Management_Descriptor (0X7E) as defined in ETSI EN 300 468 [7] shall be broadcast to convey the content management policy for the delivered HD content. The expected behaviour is defined in Section 6.2 Initially the descriptor shall be signalled in the SDT of any channel broadcasting original source HD material so all delivered content shall subject to the same content management policy. After an upgrade of the SI system the descriptor may be relocated in the EITp/f to convey content management policy on a programme by programme basis.

Content_identifier_descriptor

The content identifier descriptor (CID) (0x76) shall be broadcast to associate a CRID to an event and is placed in the event loop of the EIT. Its value of the CRID shall exactly match the CRID value as broadcast in the MHEG EPG application. The behaviour of the CRID is detailed in section 7.0. A receiver shall constantly monitor the CRID in the EITp/f for accurate start and duration times.

5.11.3 Optional Descriptor

Extended_event_descriptor;

Descriptor tag 0x4E, provides a detailed text description of an event, which may be used to provide supplementary information to that described in the short_event_descriptor field.

5.12 EIT Schedule *actual and other*

~~The DTT Freeview network will not transmit EIT schedule (*actual or other*) information.~~

The EPG data will be handled by an MHEG-5 EPG application, however due to the introduction of MHEG enabled PVR devices, the Freeview DVB-T Network now does carry limited CRID data in the EITSchedule actual and other tables.

To limit the EITSchedule bandwidth broadcast on each multiplexer, EITSchedule_actual and EITSchedule_other tables are activated on Transport_streams:-

0x19 TVNZ Auckland multiplexer,
0x1d TVWorks multiplexer
0x21 Kordia multiplexer.

The TVNZ regional multiplexers transport_stream_ids 0x1a, 0x1b and 0x1c are deemed identical to transport_stream_id 0x19 since they are made up from exactly the same service_ids, event_ids and associated CID data, differing in advertorial content only. EITSchedule_actual data is not activated on these multiplexers.

For a PVR device to fully populate its event information database with every Freeview services event_ids, irrespective of its' current active multiplexer it must parse both the EITSchedule **actual** and **other** tables. If the database includes duplicate service_ids irrespective of their transport_stream_ids it shall discard the service_id with the lesser signal quality.

5.12.1 Mandatory Descriptors for PVR type devices

Content_identifier_descriptor

The content identifier descriptor (CID) (0x76) shall be broadcast to associate a CRID to an event and is placed in the event loop of the EIT. Its value of the CRID shall exactly match the CRID value as broadcast in the MHEG EPG application. The behaviour of the CRID in associated with the MHEG EPG application is detailed in section 7.0.

Short_event_descriptor;

Descriptor tag 0x4D. The short_event_descriptor is broadcast in the EITschedule data only to comply with EN 300 468 [7]. It contains only 1 byte of arbitrary data. It does not detail any useful information about the event.

5.13 Time Date Table (TDT)

Each multiplex shall carry the TDT and TOT, from which the receiver may determine the current time (in local time). The TOT changes when the offset of local time from UTC changes (normally twice per year).

Table_id 0x70 – TDT is mandatory in each transport stream in the network. The time accuracy shall be within ± 2 seconds from UTC.

Each section of the TDT shall be transmitted at least once every 15 seconds.

5.14 Time Offset Table (TOT)

Table_id 0x73 – TOT is mandatory in each transport stream in the network. The time accuracy shall be within ± 2 seconds from UTC.

Each section of the TOT shall be transmitted at least once every 15 seconds.

The receiver is to interpret the TOT table or alternatively the receiver may perform a 'DST' Computation to calculate the local time. The receiver is to display the time to the user in local time.

5.14.1 Mandatory Descriptors

Local_time_offset_descriptor Descriptor tag 0x58; The local_time_offset_descriptor shall be transmitted and will operate in the range of UTC +11 to UTC + 13, depending upon whether New Zealand is operating within daylight saving time.

The parameter country_code shall be defined as 'NZL' within this descriptor.

The parameter country_region_id shall be set to zero for country_code NZL.

Alternatively the receiver may perform its own 'DST' Computation to calculate the local time

6 Use of Specific SI Descriptors

6.1 Freeview_logical_channel_descriptor

The private Freeview_logical_channel_descriptor is based on the Australian Logical Channel Descriptor “Free TV Australia Operational Practice OP-41” and the French Logical_channel_number_descriptor (Services Et Profil De Signalisation Pour La Diffusion de La TV Numerique De Terre section 4.18.1). Both these documents are a variation to the UK D Book specification.

All services within Freeview shall be assigned a logical channel number using the logical_channel_descriptor 0x83.

The Freeview_logical_channel_descriptor shall be used in the second descriptor loop in the NIT.

All services which are defined as unique on the network will be assigned a unique LCN. Some services, which differ in regional advertising interstitials only, will be assigned the same LCN.

The receiver shall dynamically update any change to the LCN assignments. iDTVs may alternatively update any change to the LCN assignments in standby.

6.1.1 Logical Channel Number Syntax

The proposed new syntax and semantics of the Freeview_logical_channel_descriptor is indicated in Table 6.1, as follows;

Table 6.1. Logical Channel Descriptor Syntax

Syntax	No. of bits	Identifier
Identifier		
logical_channel_descriptor(){		
descriptor_tag	8	uimsbf
descriptor_length	8	uimsbf
for (i=0; i<N;i++){		
service_id	16	uimsbf
visible_service_flag	1	bslbf
reserved	5	bslbf
logical_channel_number	10	uimsbf
}		
}		

descriptor_tag: This shall be assigned to be 0x83.

service_id: This is a 16-bit field which serves as a label to identify this service from any other service within the Transport Stream. The service_id is the same as the program_number in the corresponding program_map_section. Services shall be included irrespective of their running status.

visible_service_flag: This 1-bit field when set to '1' indicates that the service is normally visible and be selectable (subject to the service type being suitable etc.) via the receiver service list. When set to '0' this indicates that the receiver **shall not expected to offer the service to the user in normal navigation modes or service lists however the service shall be selectable by numeric entry.**

reserved: All "reserved" bits shall be set to "1".

logical_channel_number: this is a 10-bit field which indicates the broadcaster preference for ordering services. Table 16.2 provides an allocation of the LCNs currently agreed between New Zealand broadcasters.

6.1.2 Allocation of LCNs'

Freeview shall allocate every service on the network a unique LCN in the range of 1 – 799.

If a service is found which is not allocated an LCN, then the receiver should allocate the next available channel number from 800. The assignment of LCNs in the 800 – 999 range (1000+ shall not be assigned) is to be managed by the receiver. This is not a condition expected on the live platform and is not covered by this specification

6.1.3 Conflicts due to Coverage Overlaps

Regional variants of a service shall be allocated the same Logical Channel Number. In coverage overlap areas two or more received services with the same service_ids (the transport_stream_ids may be the same or different) are not regional variants but identical instances of the same service. In these coverage overlap area the receiver is to interpret the services are identical and discard the service(s) from the transmitter with the weaker signal.

Freeview shall allocate every service on the network a unique LCN in the range of 1 – 799.

6.1.4 LCN conflicts due to Parent Transmitters and Translators

Within a broadcaster's UHF licensed service area, a parent transmitter may be augmented by additional translator channels to provide satisfactory coverage. Inevitably, there will overlaps between the parent transmitter and the translator albeit on different frequencies and bands. Broadcasters shall indicate the use of additional

translator frequencies for the same service multiplex by listing the translator frequencies in the frequency_list_descriptor of the Network Information Table sections (NIT) (refer ETSI EN 300 468 [7]). Consequently, the receiver may discriminate between services and LCNs intentionally duplicated by examining the link between parent and translator in the frequency list descriptor of the NIT. Intentionally duplicated services of lower received quality may be discarded by the receiver in favour of the best quality service instance.

6.1.5 Signal Quality Matrix

If duplicate services (i.e. those that have the same LCN allocated) are received from different transmitters, then a receiver should place the service with the highest received quality in the correct LCN position and the other(s) should be discarded.

Table 6.2 provides a logical set of coverage overlap scenarios and recommended receiver behaviour.

Table 6.2 LCN Receiver Behaviour

Scan Action	Overlap Case 1 Translator fed by Parent Transmitter		Overlap Case 2 Overlapping regional services from same broadcaster			
	Parent Channel	Translator Channel	Parent Channel	Other Transmitter	Parent Channel	Other Transmitter
Example Channel	6	34	x	Any Other Channel	6	Any Other Channel
NIT Frequency_list_desc	Listed	Listed	x	Not Listed	x	Not Listed
Example Transport_stream_id	0xAAAA	0xAAAA	0xAAAA	0xB BBB	0xAAAA	0xB BBB
Example Service_id	0xDDDD	0xDDDD	0xDDDD	0xDDDD	0xDDDD	0xEEEE
Example Duplicated LCN	5	5	5	5	5	6
Receiver Assumption	SAME SERVICE		Same Service		Different Service	
RF Level	Choose strongest signal		Choose strongest signal			
Receiver Action 1	Discard Channel with weakest signal		Discard Channel with weakest signal			

6.2 FTA Content Management Descriptor

6.2.1 Content Management signalling

The Content Management policy for high definition content is signalled to receivers through the DVB FTA_content_management_descriptor. The descriptor may be carried within the SDT or EIT. The order of precedence and scope is defined in EN 300 468 [7].

There is no requirement to protect standard definition broadcasts, standard definition outputs or standard definition copies of high definition content, which it is always permissible to make. Furthermore, there is no requirement to implement Macrovision or CGMS-A on analogue standard definition receiver outputs. Receivers which provide analog definition outputs shall be restricted to SD resolutions only.

Receivers shall respond to the content management signalling in accordance with the measures defined in Table 6.4. When content is signalled with protection, it shall not be possible to export the content in high definition without using one of the technologies specified below:-

- HDCP (High-bandwidth Digital Content Protection) on HDMI outputs.
- DTCP (Digital Transmission Content Protection) on network interfaces.
- AACS (Advanced Access Content System) on removable media.
- Encryption and binding to the receiver using AES128 or Triple DES.

NOTE: Other technologies, in addition to DTCP and AACS, may be added in future versions of this document. The content management system supports the copying and distribution of HD content between a range of (compatible) devices within the home, including portable devices and the wider sharing of certain content over the internet.

All content may be “time-shifted”. This means that receivers are allowed to record the content in such a way that it is bound to it by physical or electronic means. For content signalled with content protection it shall not be possible (using reasonable methods available to a user) to access such time-shifted content on any other device at any time in a usable form (except as explicitly allowed in this section).

NOTE: Reasonable methods are deemed to include, but not be limited to, changing a user accessible setting in the receiver, changing a user accessible setting in the recording device (if separate, e.g. removable flash device) or using commonly available software on another consumer device (either software delivered as standard with the device or downloadable via the internet after discovery by a search engine).

Content may be recorded onto “removable media” (e.g. Blu-Ray disc) for more general use that allows play back on any compatible device, subject to the restrictions in Table 6.4.

Should receivers be technically or legally unable to implement a signalled state, they shall disable the export of HD content on that interface or media.

“Managed Domains”, as described by DVB, are not defined in this specification. States signalled by the broadcaster as *control_remote_access_over_internet* = “01” and *control_remote_access_over_internet* = “10” shall be treated by the receiver as *control_remote_access_over_internet* = “11”.

Receivers may output certain content over a network to “local” and “remote” devices according to Table 6.4. Receivers shall determine if they are “local” to the device being output to by using the DTCP-IP “Additional Localization via RTT” protocol. At the time of writing, this protocol deems devices to be “local” if the RTT (Round Trip Time) is less than or equal to 7 ms. All other devices shall be considered “remote”.

Subject to the DTCP licence conditions any “local” high definition network copy may subsequently be moved or copied to removable media, secondary device or portable media player.

DVB has not yet defined the carriage of System Renewability Messages (SRMs). Once defined, support for DTCP and HDCP device revocation will be included in this specification. Until that time, the *do_not_apply_revocation* bit carried within the *FTA_content_management_descriptor* may be ignored.

	FTA Content Management Descriptor		Local Environment (e.g. within a single household)						Wider Sharing		
Content Management State	Do_not_scramble	Control_remote_access_over_internet	Record on DTR	View on secondary display	Copy to blu-ray	Copy to Secondary devices	Copy to HD PMP	SD copy to other devices or media	Duplication of HD Blu-ray copies	Duplication of SD copies	Upload HD to internet
Free Access – No Encryption	1	00	Yes	Yes	Unlimited Copies – with no encryption	Unlimited Copies – encryption optional	Unlimited Copies – encryption optional	Unlimited Copies – with no encryption	Second-generation copies possible (with no encryption)	Unrestricted and to any device	Unrestricted
Free Access – EPN	0	00	Yes	Yes	Unlimited Copies – but with encryption	Unlimited Copies – but with encryption	Unlimited Copies – but with encryption	Unlimited Copies – with no encryption	Second-generation copies possible - but these retain encryption	Unrestricted and to any device	Not permitted
Managed Copy (with Encryption)	0	11	Yes	Yes	One additional HD format copy permitted on one other device or to a removable media (protected by AAC3) (in addition to original DTR recording)			Unlimited Copies – with no encryption	Second generation copies not permitted	Unrestricted and to any device	Not permitted

Table 6.3 Content Management Summary

6.2.2 Content Management Measures

1. DTR = Digital Television Recorder where the storage is bound (physically or electronically) to the receiver
2. With a suitable home network consumers are able to view any content stored on their DTR or Blu-ray recorder on secondary (network-connected) displays.
3. HD PMP = HD-capable Personal Media Player – e.g. an HD-capable ‘iPod’-type device.
4. Protected by a content protection technology approved by DTCP. Other technologies may be added in the future.

Table 6.4 - Content Management Signalling¹

			FTA Content Management Descriptor		Display (HDMI)	Storage Bound to Receiver (Time-shifting - e.g. internal HDD, encrypted USB HDD and Flash cards)	Removable Media (General use e.g. Blu-Ray)							Networks					
														Local				Remote	
State	Short Name	Description	Do_not_scramble	Control_remote_access_over_Internet	HDCP	Content Encryption AES-128 or Triple DES	Permitted Operations	AACs Encryption						Permitted Operations	DTCP-IP				Permitted Operations
								CCI	EPN	ICT	Trusted Input	Digital Only Token	APS		CCI	EPN	ICT	APS	
0	Free Access - EPN	Unrestricted Local Access with Encryption (Encryption Plus Non-assertion).	0	00	On	Encrypted and bound to receiver.	MOVE and COPY, Encryption On (EPN).	'00" Copy Control Not Asserted	'0" Asserted	'0" Constrained Image	'0" Not Trusted	'0" Analog & Digital Outputs Enabled	'000" APS off	VIEW, MOVE and COPY, Encryption On (EPN).	Copy-freely	'0" Asserted	'0" Constrained Image	'00" Copy Free	No remote access.
1	Free Access - No Encryption	Unrestricted Local and Remote Access without Encryption.	1	00	on	Encryption and binding recommended but not required ¹ .	MOVE and COPY, Encryption Off (No AACs).	AACs not required						VIEW, MOVE and COPY, Encryption Off.	DTCP not required				No restriction
2	Managed Copy (With Encryption)	Local Access between devices only, plus single removable copy.	0	11	On	Encrypted and bound to receiver.	MOVE and COPY ² Encryption On. Once content item copied, item and the copy shall be marked "Copy No More".	'01" No More Copy	'1" Unasserted	'0" Constrained Image	'0" Not Trusted	'0" Analog & Digital Outputs Enabled	'000" APS off	VIEW, COPY, MOVE, Encryption On.	Copy One Generation	'1" Unasserted	'0" Constrained Image	'00" Copy Free	No remote access.

1. Content stored unencrypted on external devices (e.g. USB drives) is not considered a "time-shift" recording as it is not bound to the receiver. Instead it is available for general use as "removable media".

2. DVB permits "transfer" (i.e. MOVE) onto removable media. A single COPY is permitted here.

3. DTCP cannot distinguish between copies on removable media and copies on "devices", so "Copy One Generation" is specified as it is the closest match to the DVB intent.

4. DVB signalling indicates that encryption should be disabled in this state. But in order to view this critical content, both HDCP and DTCP shall be enabled.

¹ Consumer Receiver Equipment manufacturers cannot agree to the proposed content management proposal whilst there are still legal and commercial issues to be resolved.

6.3 Use of Network Change Notify Descriptor

The interpretation of the Network Change Notify Descriptor is mandatory to receivers which are unable to detect the addition/deletion of Multiplexers and Transmitters based on the NIT signalling as detailed in section 8.7, 8.8 and 8.9. Receivers which comply with sections 8.7 – 8.9 the use of the network change notify descriptor is optional.

Broadcasters intend to start signalling the network change notify descriptor for all major and some minor changes network changes as listed in Table 6.5.

Use of this descriptor may lead to a NIT section in which zero transport stream loops reside. The total number of changes which can be signalled at any one time within the network_id shall be limited to 20.

On the Freeview DVB-T Network usage, a cell is used to identify a particular multiplex at a geographical transmitter location. The cell_id is set on the multiplexers modulator. All modulators belonging to a particular multiplex in an SFN region shall be set to the same cell_id.

In using the change_type, the MSB is set to “1” when the signalled network change is classified as major, i.e. cannot be evaluated using SI alone.. “Default” is to be used when another category does not adequately describe the current scenario, or when multiple categories would describe the current scenario. “Coverage change” is used when power and/or modulation parameter changes may change the coverage of a transmitter.

This signalling is designed to allow the receiver to select a suitable algorithm to evaluate the change_type signalled. For example, a Major network change may require a full network rescan whilst a Minor change may only require re-evaluation of the received SI. See table 6.4 for the expected receiver behaviour on the signalling change type.

Table 6.5 Change Network Types

Change Type	Description	Receiver Action
0x0	Message Only	Display Message
0x1	Minor - Default	None
0x2	Minor – Multiplex Removed	Perform Rescan
0x3	Minor – Service change	No Change (receiver will automatically added/delete new service based on section 7.5.
0x4 to 0x7	Reserved for future Use	None
0x8	Major Default	Perform Automatic Rescan at start_time_of_change
0x9	Major – multiplex frequency changed	Perform Automatic Rescan at start_time_of_change

0xA	Major – multiplex coverage changed. May also be used on the Freeview Network to signal an addition or removal of a cell	Perform Automatic Rescan at start_time_of_change. If used to signal a new or removal of a cell, only cells on the network which may be effected by this network change shall be listed in the cell_id of the network change notify descriptor syntax.
0xB	Major – Multiplex Added	Perform Automatic Rescan at start_time_of_change

The invariant_tsid may be used for example when a receiver is powered on and cannot tune to the last used service. In this case, the receiver may tune to the multiplex with the invariant_tsid, using its stored tuning parameters, where it may find the current time and the latest version of the network_change_notify descriptor.

Broadcasters shall endeavour to provide an invariant_tsid for each network change, however it cannot be guaranteed to be present for all changes. Broadcasters shall endeavour to minimise the durations signalled. Each period of engineering works must be signalled separately (e.g. works on Main and Relay stations are separate events if the Relay work is not concurrent with work on the Main transmitter).

If a message_only change_type is signalled, the same mechanism for displaying the message used for other change_types shall be used. This change_type results in no changes i.e. the receiver displays the message appropriately and takes no further action.

If a change type which is reserved for future use is signalled, the MSB shall be used to evaluate whether it shall be treated as ‘_Major – Default’ or ‘_Minor – Default’. If a receiver_category unknown to the receiver is encountered, the network change event shall be ignored.

Broadcasters shall use this descriptor for all relevant service changes. Broadcasters shall not signal change events for the same cell_id with overlapping periods defined by their start_time_of_change and change_duration. Broadcasters shall endeavour to ensure that at the time of start_time_of_change + change_duration, the network shall be stable. Broadcasters shall endeavour to broadcast notifications of changes at least 1 week prior to the change. A change shall continue to be signalled for 1 month after the network change event.

6.4 Use Of the Message Descriptor

The interpretation of the Message Descriptor is mandatory to receivers which are unable to detect the addition/deletion of Multiplexers and Transmitters based on the NIT signalling as detailed in section 8.7, 8.8 and 8.9. Receivers which comply with sections 8.7 – 8.9 the use of the Message descriptor is optional.

The message descriptor shall be used in conjunction with the network change notify descriptor on the Freeview network.

Broadcasters shall signal the message descriptor for any network change types as detailed in table 6.5.

Use of this descriptor may lead to a NIT section in which zero transport stream loops reside. Due to the length of text required to accurately impart information, only one string is carried per descriptor. Zero, one or multiple descriptors may be carried concurrently. Multiple network changes may refer to the same message_id, which implies that the message may be re-used.

Multiple message descriptors may be broadcast with the same message_id provided that each carries a different ISO_639_language_code.

As the message descriptor is referenced by a message_id within the network_change_notify descriptor, all message_ids are scoped within the network_id.

If the broadcaster wishes to change the content of a message, the old message shall cease to be broadcast and the new message, with a new message_id, shall be broadcast instead. Note that this will result in a change to the message_id and network_change_version_number for the relevant network change in the network_change_notify descriptor.

6.4.1 Notes For Receiver Manufacturers

Receivers shall store all relevant messages referenced by the network_change_notify descriptors.

The message should be presented using a sans-serif font designed for readability and use on television and at sizes suitable for normal viewing distances. Italic, underlined, oblique or condensed fonts should be avoided.

Text should be displayed with good contrast. Colours should be limited to an absolute maximum of 85% saturation. Pure red and white and combinations of red and green should be avoided.

Generous inter-linear spacing should be provided. Words should have a clear space around them. Flashing and scrolling text should be avoided. Left-aligned text should be used rather than centred or right-aligned. Justified paragraphs should be avoided.

Left-aligned text should be used rather than centred or right-aligned. Justified paragraphs should be avoided

Messages should be displayed at these times:

On first suitable user interaction after initial receipt of the network_change e.g. channel change, power on.

On first suitable user interaction 48 hrs prior to the start_time_of_change.

Either, 1 hr prior to the start_time_of_change or, on commencement of any EIT event being viewed which will finish exactly at or after the start_time_of_change.

It may also be appropriate to display the message during the network change, or if a recording is scheduled to occur during this period.

Access to the current active messages and other details (e.g. start time and date) may be displayed via the receiver's menu system.

When displaying a message, receivers shall clearly indicate on screen to the end user how the message may be removed from the display. Receivers may remove a message without user acknowledgement after an appropriate period.

Example Messages

Major –Default: example DSO

A new multiplex is shortly to be introduced on the Freeview|HD Network , this device will automatically re-tune on 30th Dec. For more information go to www.freeviewnz.tv

Minor – Service changes: example new channel launch

Xxxx is a new and free entertainment channel launching on Freeview on 30th Sept at channel number xx. This device will update automatically. For more information go to www.freeviewnz.net.nz

6.5 Supplementary Audio Descriptor

Freeview broadcasters may provide an ancillary audio component on their services, which delivers a verbal description of the visual scene as an aid to the understanding and enjoyment for particularly but not exclusively for viewers who have visual impairments.

The descriptive voice content will be mixed with the programme main audio at the broadcaster end and broadcast in addition to the main audio component as an ancillary stereo audio component rather than utilise the receiver-mix method as described in the D-Book [23] section 4.5 to provide an Audio Description service. This specification does not preclude the possibility that receiver-mix Audio Description may be activated on a Freeview service in the future, but will remain optional for receivers to support this method.

This ancillary audio component shall be referenced with the supplementary_audio_descriptor which will provide the relevant information describing the audio component.

The receiver is to interpret completely the supplementary_audio_descriptor as per EN 300 468 ver 1.11.1 [7] section 6.4.9 and Annex J.

6.5.1 Proposed Broadcaster Signalling

Table 6.6 Supplementary_audio_signalling

Syntax	Value
ES#1: Primary	(0x100)
ISO_language_descriptor	0xa
ISO_language	eng
Audio_type	0 (undefined)
AAC_descriptor	0x7c
profile_and_level	0x58 HE AAC Profile Level 2
Stream_identifier_descriptor	0x52
component_tag	0x10
ES#2: AD Audio channel	(0x101)
ISO_language_descriptor	0xa
ISO_language	xxx (#1)
Audio_type	0 (undefined)
AAC_descriptor	0x7c
profile_and_level	0x58
Stream_identifier_descriptor	0x52
component_tag	0x11
Supplementary_audio_descriptor	
Mix_type	1 (complete)
editorial_classification	1 (Audio description)
language_present_code	1
iso_639_language_code	eng

#Note 1 : TB Assigned ISO language Code

The signalling is configured to work in a backwards way with existing receivers and not to cause any issue with legacy receivers in the field.

Since a broadcast mix of Audio Description was not specified in the original New Zealand Profile (NZ Transmission Rules ver 1.2) then a different language code which is not represented in section 5.5.1 shall be signalled in the ISO_language_descriptor for the broadcast mix AD audio component. i.e. Dutch ("nld"). For users of legacy receivers which do not parse the supplementary audio descriptor may select "nld" as their language preference in order to receive the AD audio component when available.

Before the commencement of broadcasting the Audio Description component, Freeview will inform users of legacy receivers that the assigned ISO_language for the supplementary Audio Stream is carrying Audio Description.

Freeview will only signal editorial classification 00001 Audio description for the visually impaired in the supplementary_audio_description.

Editorial classifications;- 00000 main Audio
 00010 Clean Audio for the hearing impaired
 00011 Spoken subtitles for the visually impaired

will be signalled by setting the audio type to the appropriate classification in the ISO_639_language_descriptor.

6.5.2 Receivers' Supplementary Audio Settings Menu

For receivers which support the Supplementary_audio_descriptor shall provide within a menu structure of the receiver, an audio settings sub-menu to provide an additional audio selection option for user selection.

The audio selection set-up is suggested as;-
 Supplementary (or Additional) Audio Selection –
 None (Default)
 Audio Description
 Clean audio for the hearing impaired
 Spoken Subtitles

Table 7.7 Editorial Classifications

Editorial_Classification	Description	Proposed Receiver Behaviour
00000	<p>This Classification will not be signalled on the Freeview Network.</p> <p>Main audio (contains all of the main audio components and can be presented on its own or mixed with a supplementary audio stream).</p>	<p>This Classification will not be signalled. There would not be an option for main audio in the receivers menu.</p>

00001	Audio description for the visually impaired (contains a spoken description of the visual content of the service).	<p>In system menu - there is a setting for switching audio description - on/off.</p> <p>If the user selects Audio Description ON (the default is to be off) then if a service has an audio PID with an associated supplementary_audio_descriptor editorial_classification 00001</p> <p>- the receiver is to present that audio to the user.</p> <p>If there is no audio with an supplementary_audio_descriptor or if the supplementary_audio_descriptor does exist but the editorial classification does not match the users preference then the receiver is present the audio as per its' current audio selection priorities.</p>
00010	<p>This Classification will not be signalled on the Freeview Network.</p> <p>Clean audio for the hearing impaired (the dialogue is concentrated on the centre channel). -</p>	<p>In system menu - there is a setting for switching ' Clean audio for the hearing impaired ' - on/off.</p> <p>If the user selects Clean audio for the hearing impaired ' ON (the default is to be off) then if a service has an audio PID with an associated audio type =0x1 in the ISO_639_language_descriptor</p> <p>- the receiver is to present that audio to the user.</p>
00011	<p>This Classification will not be signalled on the Freeview Network.</p> <p>Spoken subtitles for the visually impaired (contains the main audio with a spoken rendition of the subtitles)</p>	<p>In system menu - there is a setting for switching 'Spoken Subtitles for the visually impaired' - on/off.</p> <p>If the user selects Spoken Subtitles for the visually impaired' ON (the default is to be off) then if a service has an audio PID with an associated audio type =0x3 in the ISO_639_language_descriptor</p> <p>- the receiver is to present that audio to the user</p>

7 Use of PVR Recording Signalling

This section provides additional information for the use and interpretation of the Content_identifier_descriptor and default_authority_descriptor used in conjunction with the private data stream as carried in the DSMCC sections for the recording of content by MHEG enabled PVR devices.

7.1 Overview

Since the Freeview DVB-T Network does not broadcast EITschedule data to provide viewer-facing data for the purposes of populating an EPG it is not possible for PVRs based on this systems to operate on the NZ DVB-T network.

To combat the viewer facing EPG data by EITschedule data inefficiencies all of the viewer-facing data has been removed from EITschedule and instead is carried using DSMCC sections. The EPGapplication that decodes and displays this data is also delivered to the receiver via DSMCC sections.

The existing open standards based mechanisms for the control of PVRs are based on systems that use SI for the carriage of accurate timing information for the purpose of triggering recordings in a timely manner. The delivery of timing information via this method works well and can make use of existing broadcast SI structures.

SI continues to be used for the delivery of accurate timing information to the PVR. Each piece of programme content in the broadcast schedule is associated with a Content Reference Identifier (CRID). One or more CRID of type Programme, Series or Recommendation may be carried in each a Content Identifier Descriptor (CID), which are carried in the event loop of Event Information Tables.

- The CRIDs are not in human readable form since they are used at the system level only and are not presented to the viewer.
- The CRID value for each SI event or series of events is also associated with the viewer-facing EPG data delivered via DSMCC.
- The CRID forms the primary key used to associate DSMCC bound viewer-facing EPG data with SI bound accurate timing and schedule information.

An Application Programming Interface (API) is defined (section 12.6) to provide a communications link between the PVR Engine that manages the PVR core functionality and the Broadcast API Engine on which the EPG is executed. The EPG application uses this API to manage the booking of recording of programme content and to manage content from previous successful recordings stored on PVR local storage.

By separating the viewer-facing and system data and through implementation of an API between the engines that make use of these data, the SI and DSMCC streams may each be used to their best advantage as described:-

- ☐ All viewer-facing EPG data is compressible using standard ZLib compression available to DSMCC sections.

- ☐ A constant bitrate DSMCC stream has been set, which is independent of the size and shape of data carried within it. Where appropriate and available, opportunistic data may also be used in future to further improve efficiencies of the DSMCC stream.
- ☐ The EPG may be presented to the viewer using a standard Broadcast API rather than via an application native to the receiver. This enables a consistent look & feel and EPG behaviour to be maintained, even in a Freeview NZ horizontal market that includes multiple receiver manufacturers.

The EPG and EPG data delivered via DSMCC is formatted according to the requirements of the EPG application and to take best advantage of the method of delivery. This enables easy extension of EPG features as new requirements emerge.

The accurate recording of programme content is maintained using current receiver mechanisms through reference to SI tables. SI is used to deliver the minimum data required to uniquely identify Programmes, Series and Recommendations thus reducing EIT schedule bitrate requirements to a minimum.

This PVR functionality has been achieved with minimal changes to existing core PVR functionality base (based on the UK playback specification [25]).

7.1.1 Use of Service Information for PVR devices

The Service Information described in this section is based on the SI described in DBook [23] chapter 7 & 8 as used in other PVR implementations. SI is used as a primary control for starting and stopping the recording of events. There are however subtle differences between the way SI is used in this and existing PVR implementations as described:-

- The Programme CRID is mandatory for every event as described within in SI.
- The Programme CRID is used instead of the Event ID as the primary key for tracking individual programme content in the schedule.

7.1.2 Use of the Content Identifier Descriptor

The Content Reference Identifier (CRID) is a unique identifier that shall be used to identify individual Programmes, Series and Recommendations. CRIDs that identify programme content are referred to as Programme CRIDs and those that identify Series and Recommendations are called Group CRIDs.

The CRID is defined in the Content Identifier Descriptor (CID), which is carried in the Event Loop of Event Information Table Present/Following (EIT P/F) and Event Information Table Schedule (EIT Schedule). The CRID type is defined in the CID so that each CID may be used to describe one or more CRID on each type.

7.1.3 CRID Types

A content identifier descriptor can indicate the type of CRID that is carried therein. There are 2 types of CRID on the Freeview DVB-T Network:-

A Series CRID – to group together an arbitrary selection of content (e.g. a series)

A programme CRID – to identify a specific piece of content (e.g. programme)

In order to safeguard against potential legacy issues that may arise if a full TV-Anytime service is deployed on the Freeview NZ DVB-T Network the following *user private* CRID types (Which follow D Book [23] types) are to be used:

crid_type :-

0x31 DTG programme CRID (equivalent to type 0x01)

0x32 DTG series CRID (a restriction of type 0x02 to be used only for series)

A PVR should ignore all other CRID types.

7.1.4 Programme CRID

CRID Type 0x31

Programme CRIDs are used to identify two or more EIT events as being the same programme and may not be used to represent other content defined by the same Authority. This prevents duplicate programmes being recorded from within the same series and also allows alternative programme instances to be recorded (or offered for recording) if a booking clash occurs. An EIT event can only be associated with a single programme CRID.

7.1.5 Series CRID

CRID TYPE 0x32

Series CRIDs define groups of programmes linked by the series Concept. CID that describes a Series may contain multiple CRIDs; therefore a Programme may be part of more than one Series. Where an event is associated with more than one series, an invitation to record ‘programmes in the same series as this event’ would book to record all events in all series associated with the selected event. A PVR shall store and track series CRIDs for up to 13 weeks between occurrences in EIT schedule. To allow broadcasters to reuse a series CRID for a different editorial concept, receivers shall discard any series CRIDs not seen in EIT for 13 weeks.

7.1.6 Recommendations

Recommendations to other arbitrarily linked programmes which are defined by the broadcasters themselves are linked together within the MHEG EPG DSM-CC data.

For clarity the DTG Recommendation CRID, TYPE 0x33 is not signalled in the SI or MHEG data.

Recommendations if linked to a particular programme are carried in the MHEG EPG DSM-CC stream only. Recommendation CRIDs are **NOT** carried in the EIT tables.

A recommendation may point to a single event (programme CRID) or a series (series CRID). A CID that describes a Recommendation may contain multiple CRIDs; therefore a Programme may be part of more than one Recommendation group.

A single piece of programme content may be signalled to be part of multiple Series and multiple Recommendations.

If a recommended CRID does not appear in EIT within 13 weeks of the referencing event it shall be discarded.

If a programme also includes recommendations and the programme is booked for recording the programme CRID shall first be passed across the API and any conflict resolution is to be performed by the PVR engine. Each recommended programme or series CRID linked to the original programme shall then be sent across the API one at a time as separate booking transactions. Conflict resolution shall be performed on each CRID as it is booked. It is therefore possible to book a complete list of recommendations or a partial list only if some in the listed programmes conflict with previously made bookings. All recommendation CRIDs are therefore handled in the same way as individual programme or series CRID bookings.

A maximum of 5 recommendations per programme shall be defined.

If a recommended programme or series also contains recommendations these shall not be followed. The first level of recommendations for each programme shall be followed only.

7.1.7 Use of the Instance Metadata Identifier

A CRID in the CID shall be a programme CRID (crd type 0x31) with an IMI extension. Where two events have the same CRID and IMI value and the gap between each event is less than 3 hours (measured from the end of the preceding event to the start of the next event) then they shall be considered to be segments of a single item of content.

An item of content may be split across more than two events as long as the gap between each event remains less than 3 hours.

7.2 CID Carriage

Each Programme described within the EIT P/F and EIT Schedule shall carry in the Event Loop at least one CID that shall contain one CRID of type Programme. Additional CIDs may also be carried in the same Event Loop to describe Groups. A CID that describes a Series may contain multiple CRIDs; therefore a Programme may be part of more than one Series. A CID that

describes a Recommendation may contain multiple CRIDs; therefore a Programme may be part of more than one Recommendation group. A single piece of programme content may be signalled to be part of multiple Series and multiple Recommendations.

CIDs shall be carried within EIT Schedule to provide a schedule of unique identifiers that represent programme content. CIDs shall also be carried in EIT P/F to provide a means of accurately signalling the start and end of each event. Additionally Short Event Descriptors and other informative descriptors may be carried within EIT P/F to enable instant access to “Now/Next” information on service change.

The carriage of informative descriptors also enables basic programme title and synopsis information to be obtained by the PVR Engine if this data is not available in DSMCC at the time of recording.

7.3 CRID Encoding

A CRID contained within a Content Identifier Descriptor shall be encoded according to the following rules:-

The CRID must be a compliant URI as defined in ETSI TS 102 822-4 section 8.
The CRID is further restricted to only contain characters encoded over the range from ISO 6937 0x20 to 0x7F.

The length of the CRID plus IMI (if any) shall not exceed 64 characters. The maximum lengths of the separate parts of the CRID are as follows: -

authority	32 characters (excluding leading <code>_crid://</code>)
data	29 characters (including leading <code>_/'</code>)
instance metadata id	3 characters (including <code>_#'</code> separator)

The CRIDs are not intended to be human readable and shall not be displayed on-screen.

The CRID is split into a number of separate parts ;-

Given the CRID, **crid://tvnz.co.nz/0123ABF#A1**

Scheme:	crid://	The Scheme describes the format of the rest of the CRID and shall always be “crid://”.
Authority	tvnz.co.nz	The Authority is a registered domain used to represent the source of the content and may be taken from the producer of the content, the broadcaster or other body.
Content	/0123ABF	The Content Identifier uniquely identifies the content within the scope of the current Authority
Instance Identifier	#A1	The Instance Identifier is an optional part that shall be used when a single piece of content has been split into

more than one part.

The complete CRID including Scheme, Authority, Content Identifier and Instance Identifier shall be case-insensitive.

7.3.1 Default Authority Descriptor

To further reduce bandwidth usage within DVB SI a Default Authority Descriptor (DAD) is defined that describes the Scheme and Authority parts for any number of CRIDs that share the defined Authority. The single but not necessary unique DAD is located in the service loop of the SDT on each service referenced in the SDT. For services which may offer alternative instances of the same programme the DAD in each services SDT may be the same. For each CRID carried in a CID that shares the Authority defined by the DAD, the Unique Content Identifier and Instance Identifier parts need be defined only.

7.4 DSMCC CID Data

All data to be presented to the viewer by the EPG application shall be delivered via a DSMCC object carousel.

The CRID for each Programme, Series and Recommendation in the scope of the current schedule shall be carried within the DSMCC stream alongside any viewer-facing data that describes the content. The CRID shall be treated as the primary key that shall be used to make the connection between a description of an event in the EPG with the accurate timing information as described in EIT P/F. Further efficiencies are made within the DSMCC data by defining one or more Default Authorities for any CRIDs that share the same Authority.

7.5 The Booking Process

To book the recording of an event the viewer shall have the means to select from the EPG the content they wish to be booked for recording. This content may be an individual Programme, a Series or a Recommendation.

An API call shall be made to send from the Broadcast API Engine to the PVR Engine the CRID and CRID Type that represents the requested booking. Viewer facing data shall also be sent from the Broadcast API Engine to the PVR Engine at this time. This data may be used to aid management of recorded content by the viewer after a successful recording has been made.

A return code shall be returned to the Broadcast API Engine from the PVR Engine, the value of which indicates the success or failure of the booking request including details of the failure where appropriate. Refer to section 12 for a list of Broadcast API Engine calls implemented as MHEG Resident Program calls and return codes expected back from the PVR Engine.

When a booking is made using a Programme CRID a look-up within the CRIDs delivered via DVB SI shall be performed to query the existence of the selected Programme CRID. If a

successful booking request is made the Programme CRID and the viewer-facing data sent from the Broadcast API Engine to the PVR Engine shall be stored on the PVR local storage.

When a booking is made using a Series CRID this shall be resolved at the time of booking into a list of Programme CRIDs using a DVB SI look-up. The list of Programme CRIDs represents the actual Programmes to be recorded by the PVR Engine. For a booking request to be successful at least one Programme within the Group must exist within the scope of the current schedule. If a successful booking request is made the Series CRID and the viewer-facing data sent from the Broadcast API Engine to the PVR Engine shall be stored on the PVR local storage.

The Series CRID sent during the booking process from the Broadcast API Engine to the PVR Engine remains the primary key for the recording of any events within that Group. By this method it shall be possible to book for recording additional Programme events that are not yet in scope of the current EPG. By the method described it shall be possible to check at the time of booking, which individual Programmes within a Group should be booked for subsequent recording. The actual list of Programmes to record will be determined by Programme CRIDs carried in DVB SI and on the list of Programme CRIDs representing Programme content previously recorded and stored on the PVR.

7.6 The Recording Process

7.6.1 Programmes

The PVR Engine shall on a continuous basis check EIT P/F and EIT Schedule for the existence of the booked Programme CRID.

When the schedule is such that booked Programme CRID is described in the Event Loop of the EIT P/F as the Present event and has a Running Status of Running the PVR Engine shall start the recording process on the service indicated by the EIT P/F table. The PVR Engine shall take into account any resource management latencies and off-set buffer values (since broadcasters are currently not provisioning accurate start/stop triggers) in order to start the recording in a timely manner.

The recorded content shall be stored alongside the pre-stored Programme CRID and viewer-facing data in a format defined by the receiver manufacturer. The Programme CRID shall be obtained from the CID carried in DVB-SI. The viewer-facing data shall be obtained from data sent from the Broadcast API Engine to the PVR Engine at the time of booking.

The Event Loop of the active EIT P/F shall be monitored until the booked CRID is no longer the present event or is no longer signalled with a Running Status of Running after including the extra off-set time buffer (if set) at which point the recording shall be stopped. If the CRID does not include an Instance Identifier the recording shall be marked as complete and the Programme CRID shall be removed from the PVR list of CRIDs to monitor for recording.

7.7 Series and Recommendations

To record Programme content booked via a Group CRID the Group CRID must be continually resolved into a list of Programme CRIDs via DVB-SI look-ups. The Group CRID shall be used as the primary key when monitoring DVB-SI. However the Programme CRID shall be used for the actual recording. The recording shall be started at the time at which the Programme CRID enters the EIT P/F table as the Present event with a Running Status of Running including any pre-set buffer time. The recording shall be stopped when the Programme CRID is no longer described in the EIT P/F as the Present event or if the Running Status is no longer described as Running and the off-set buffer time (if set) has lapsed.

The programme shall be recorded only if the PVR logic states that this Programme in the Group shall be recorded. The actual list of Programmes to record shall be determined by Programme CRIDs carried in DVB SI and on the list of Programme CRIDs representing content previously stored on the PVR local storage.

Series CRIDs shall not include Instance Identifiers. However, at the point at which a Programme in a Group is recorded it shall be treated as a Programme since the recording is based on the now resolved Programme CRID. The Programme may therefore be described by a CRID that includes an Instance Identifier and may therefore be a single programme event broadcast in more than one part.

The recorded programme content shall be stored alongside the Programme and Group CRIDs that describe the content. If available, viewer-facing data describing the group shall also be stored at this time in a format defined by the receiver manufacturer. The Programme CRID shall be obtained from the CID carried in DVB-SI.

The viewer-facing data shall be obtained from data sent from the Broadcast API Engine to the PVR Engine at the time of booking.

Any viewer-facing data sent along with the request to book content is likely to be relevant to the Group rather than the Programme within the Group. It may therefore not always be possible to obtain data that describes individual Programmes within a Group when booked for recording via a Series CRID. Therefore viewer-facing data shall also be obtained from the Short Event Descriptor carried via EIT P/F at the time of recording.

Each Programme that is recorded as part of a Group shall be marked as complete according to the logic described in section 7.5. The Series CRID shall continue to be monitored for further events in the same Group. The Series CRID shall be removed from the PVR list of monitored CRIDs only if the CRID is not seen in the broadcast schedule for a defined period. This period is defined as 13 weeks by D-BOOK [23]

Recommendations to single events may be made to Programmes that are present in the current schedule only. If a Recommendation is made to a Programme that is also signalled as being part of a Series then at least one Programme in that Series shall be present in the current schedule.

If a Recommendation event also includes Recommendations these shall not be followed. Only the first level of Recommendations shall be scheduled for recording. If a Series event also

includes other Series only the first level of Series shall be scheduled for recording. If a Programme that is part of a Series and that also includes one or more Recommendations is booked it shall be possible to book the one or all of Programme, Series and Recommendation.

7.8 PVR Interface Illustration

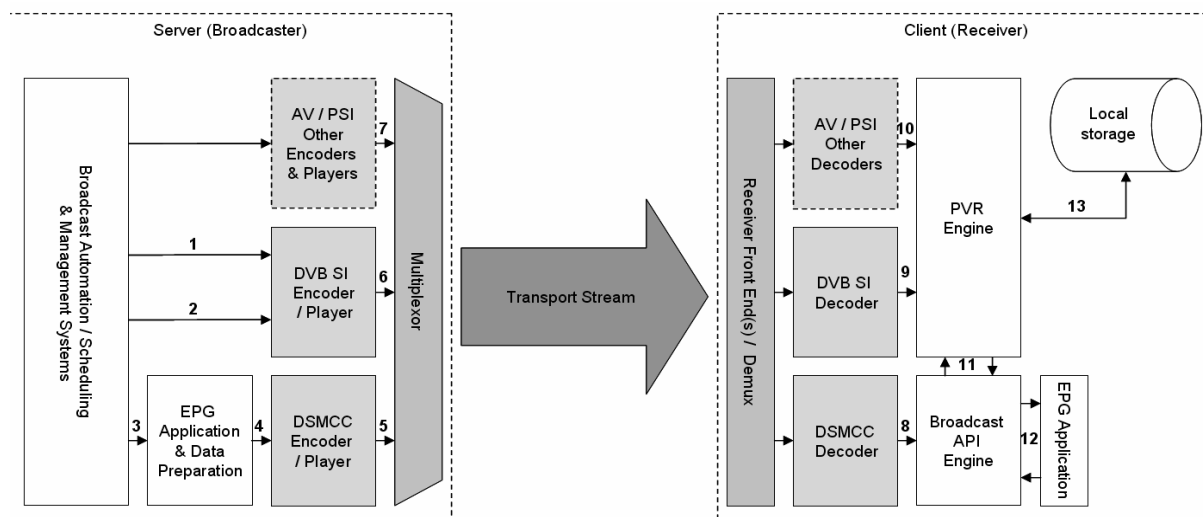


Diagram 7.8

7.9 Trailer Bookings

Promotional Linking offers a great enhancement to the PVR experience of viewers and listeners by making it easy acquire 'other' content in a manner that is synchronised to the to the content being watched. The most obvious use of promotional linking is 'Trailer Booking' where during a trailer for a programme the viewer can book the promoted programme to be recorded at the press of a button.

7.9.1 Operation

All trailer bookings signalled shall be carried within the MHEG DSM-CC carousel data stream and handled by a transient red-key MHEG application.

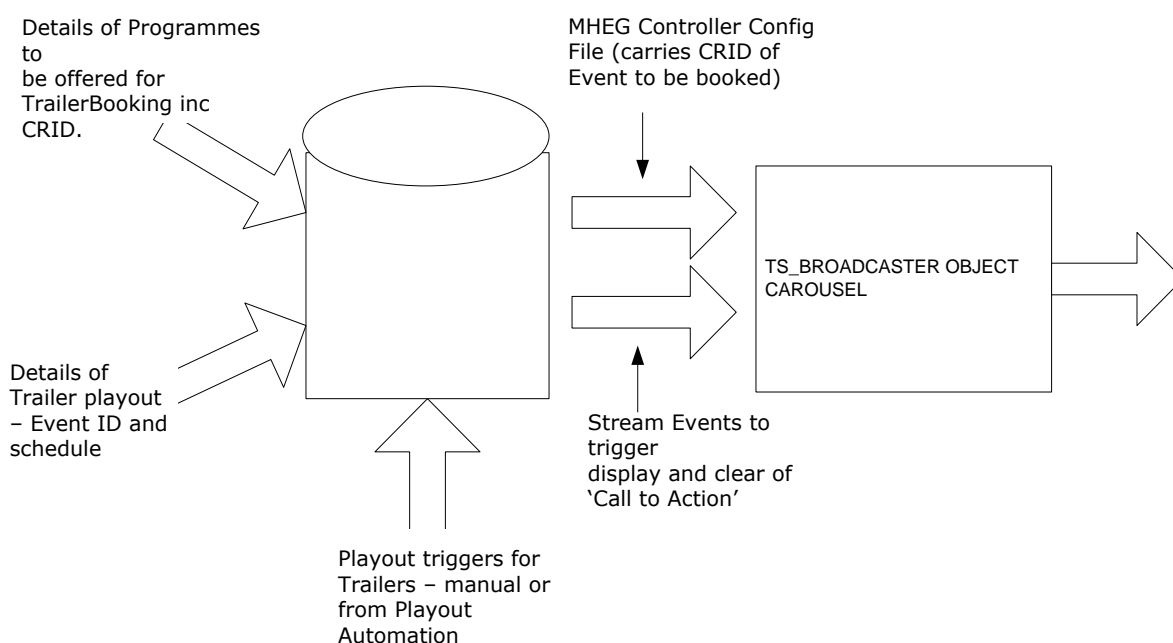
The details of programmes which shall be referenced to a trailer booking are exported from a broadcasters automation system. Each programme shall reference its event_id, start and stop time and the CRID of the promoted programme to be booked.

For each programme which is referenced to a trailer booking shall send a trigger for an MHEG StreamEvent to display and clear of "do-it-now" event. An MHEG Controller Config File shall carry the CRID of the programme to be booked.

If the Trailer booking is accepted by the user, the referenced CRID shall be passed via the PVR API and the record booking shall be handled as per section 7.6

A trailer booking may point to a single event (programme CRID) or a series (series CRID). Only one programme or series CRID can be referenced per steam event.

7.9.2 Trailer-booking Diagram



8 Operational Use of Receivers

The purpose of the following sections is to set guidelines on how the receivers should interpret and represent the SI and the basic functionality of the receiver in viewing mode and while zapping between digital TV services. This will reduce the risk of problems between the interoperability of the transmitted SI and the receiver response.

The functionality described lists the minimum requirements. The manufacture is free to provide additional features within their products which go beyond the scope of this specification.

8.1 Overview

As the network matures there will invariably be changes in the number of services in a multiplex, additional multiplexers brought online and additional transmitters to extend coverage. All these changes shall require no or minimal intervention by the user.

Receivers shall reprocess all the SI (NIT actual, SDT actual and EIT actual) when the user changes multiplexers. The PAT and PMT should be constantly reparsed. This shall be a transparent process.

The following sections deal with these and other issue in more detail.

8.2 Service Types

Freeview network intends to use the DVB service types in table 8.1 which shall be appropriately signalled by the service_descriptor in the SDT :-

Table 8.1 Service Types

Service Type	Description
0x02	Digital Radio Service
0x03	Teletext Service
0x0A	Advanced Codec digital radio service
0x0C	Data Broadcast Service
0x16	Advanced codec SD digital television service
0x19	Advanced codec HD digital television service
#1 0x01 – digital television service shall not be used as refers to MPEG2 SD material	

8.3 Stream Types

The PMT Signalling of Video and Audio type is described by the elementary stream loop `stream_type` field. The allowable values on the Freeview Network from ISO 13818-1 are listed in table 8.2.

Table 8.2 Video and Audio Stream Types

Value	Video Description
0x1b	H.264/AVC SD or HD video - ISO/IEC 14496-2: ITU-T Rec. H.222.0 ISO/IEC 13818-1 AVC video (amendment 3)
Value	Audio Description
0x03	MPEG 1, layer 2 typical audio ISO/IEC 11172 Audio
0x06	AC-3 / Enhanced AC-3– PES packets containing private data, additional
0x11	ISO/IEC 14496-3 AAC/ HE-AAC Audio

When the elementary stream contains AC-3 then the PMT shall include the AC-3_descriptor as defined by EN 300 468 [7] (Annex D)

When the elementary stream contains HE-AAC then the PMT shall include the ACC_descriptor as defined by EN 300 468 [7] (Annex H)

8.4 Initial Scan

The first time the receiver is installed the user shall be guided through the installation procedure by a clearly understandable set up menus.

The default values of the receiver are suggested in appendix B. These default settings shall be possible to change via the menu structure.

It shall be possible via the menu structure for the user to restore the receiver to its default status thereby deleting all old settings and service lists – “factory default” – this function is recommended to be password protected.

Once any preliminary settings are selected by the user i.e. TV type, Country of install, default auto-software upgrade, etc.. (all manufactures’ preference) the receiver should present to the user a message stating (or similar):-

The receiver will now scan for Freeview digital services. This may take a few minutes, please wait until this process is complete. Press OK to begin.

Once the user selects OK, the receiver may perform a NIT based scan based on the Terrestrial_delivery_descriptor and the frequency_list_descriptor or a full auto scan over the UHF bands IV and V and stated in the appendix C. It may also choose to use the cell_frequency_link_descriptor to perform an even faster scan based on the cells' TPS data.

The receiver shall inform the user about the progress of the scan in an appropriate manner.

The receiver is to tune in to the correct DVB framing structure, channel coding and modulation.

The receiver should build up the service list in the following way;-

It records the frequency and the cell-id (based on the TPS parameters) for the multiplex

It records the services which are not associated with a local cell (i.e. national) in the SDT.

It records the local services which are identified by the value of the cell_id field in the SDT which are equal to the TPS value of the received multiplex.

Due to the asymmetrical nature of the terrestrial network and that one unique service can be received from different transmitters (and frequencies) the following rules shall apply when performing a scan on the terrestrial network;-

A unique channel shall only be stored and displayed once. A unique channel is defined by its Original_network_id and Service_id only.

If the same unique channel is found several times, the one with the strongest RF level shall be stored and displayed.

If a channel is referenced in the SI but not found during scanning (due to insufficient RF levels) it shall not be displayed.

Every service on the Freeview network shall be allocated a LCN. Within the channel list of the receiver the service shall be listed in order of its LCN numerical value. The channel list can be activated from one key on the remote control or via the receiver's menu. The receiver may provide a separate key on the remote to change between video and radio services. It is not desirable for the user to change the ordering of these services or reallocate different channel number assignments but this is a manufacture preference.

8.5 Addition or removal of services from a Multiplex

The number of services active in any of the broadcaster's multiplexers will inevitably change especially in the first few years of the network.

It shall be deemed that a service has been added to a multiplex if there is an update in the SDT (actual) for that multiplex which references the new service.

The receiver shall consider a service to be removed from a multiplex if the service is not referenced in the SDT (actual) of that particular service.

A rescan of any or all the terrestrial multiplexers should not be required for the receiver to acknowledge the presence of a new service.

The receiver is to at least re-process the SDT (actual) and EITp/f (actual) when tuning to a different multiplex or every 2 secs as recommended by DVB TR 101 211 [8].

When a new service is added to a multiplex the receiver ~~shall~~ **may** inform the user that a new service has been added using an appropriate receiver specific method e.g. an informative on screen pop-up lasting 2-3 second.

The new service will be allocated a new and unique LCN by Freeview.

The new service should appear in the correct position of the channel list, EIT p/f and all other menus where the user has access to the channel.

The receiver is to respond to this event as defined in table 3 of ETSI TR 101 211 [8].

Service Present in				
PAT	PMT	SDT	SDT Running status	State of Service
YES	YES	YES	running	The service exists

When a new service has been removed from a multiplex the receiver **may** inform the user that a service has been deleted using an appropriate receiver specific method e.g. an informative on screen pop-up lasting 2-3 secs. The receiver may also require the user to accept the change.

The deleted service shall be removed from the channel list, EITp/f and all other menus where the user has access to the channel.

The receiver is to respond to this event as defined in table 3 of ETSI TR 101 211 [8].

Service Present in				
PAT	PMT	SDT	SDT Running status	State of Service
NO	NO	NO	not running	End state of service

8.6 Temporary removal of services from a multiplex

Temporary removal of a service from a multiplex occurs when the service moves to a non-running status (i.e. during over night closedown of that service).

A receiver should deem that a service is not running if an update is found in the SDTactual indicating the running_status for that service is 'not running'.

The receiver is to respond to this event as defined in table 3 of ETSI TR 101 211 [8].

Service Present in				
PAT	PMT	SDT	SDT Running status	State of Service
NO	NO	YES	Pausing, not running or undefined	The service still exists – it will be broadcast again

The service will still listed in the channel list but if selected the user will be informed that the “Channel is not broadcasting at this time”.

During periods when the service is not broadcast, generally it will be replaced by a static MHEG-5 placeholder application.

8.7 Addition or removal of Multiplexers from a Network

The initial launch of the terrestrial network will have three multiplexers however there is provision for at least an additional two.

The receiver shall automatically be able to detect the presence of a change to the Network makeup and offer new services to the user. With any change to the multiplexer line-up on the DTT network the network_change_notify_descriptor shall be signalled in the first loop of the NIT. The receiver may use the network_change_notify_descriptor to provide this functionality or alternatively use the method describe below.

When a multiplex is added to the network it will be referenced in the second loop of the NIT actual table. The NIT (actual) and SDT (actual and other) version_number shall be changed.

The receiver should recognise the change of version_number of the NIT table and that a new transport_stream_id is present in the NIT (actual). The receiver should inform the user that new services may be available and a rescan is to be performed. The rescan may be performed when the receiver is next switched to standby or with the user’s permission in the on-mode. The receiver should only search the frequencies which are present in the frequency_list_descriptor for the new multiplex but may perform a full UHF based scan to acquire the new services.

The SDT (actual) shall be updated and be carried on the transport streams in the region to reflect the services on the new multiplex.

When a multiplex is added to the network the receiver should indicate the presence of the new multiplex only if new services are available to the user from that multiplex.

When a multiplex is removed from the network all services which were referenced in that multiplex are to be deleted from the channel list.

Inability to acquire a particular multiplex after the initial scan is performed does not mean that the multiplex has been removed from the network only that the transmitter may be working on reduced power or is switched off for maintenance purposes.

8.8 Addition or removal of Transmitters from a Network

After the initial launch of DTT the situation may arise that new DTT transmitters are switched on to increase network coverage.

The receiver shall automatically be able to detect the presence of a change to the Network makeup and offer new serves to the user. With any change to the transmitter line-up on the DTT network the network_change_notify_descriptor shall be signalled in the first loop of the NIT. The receiver may use the network_change_notify_descriptor to provide this functionality or alternatively use the method describe below.

The signalling of the presence of new transmitters shall be done through the NIT and the addition or extension of the frequency_list_descriptor within it.

The receiver should recognise the change of version_number of the NIT table and a new extension of the frequency_list_descriptor. The receiver should inform the user that there has been changes to the network and that a rescan is required to be performed. The rescan may be performed when the receiver is next switched to standby or with the users' permission in the on-mode.

The receiver may parameterise its next frequency band scan based on the difference between the before and after frequency lists e.g. the receiver may try to acquire the same multiplex on a frequency which was not previously listed in the frequency_list_descriptor if that frequency provides a better signal quality. The receiver should not perform a full UHF based scan to acquire a new transmitter.

8.9 Retuning of Transmitters

The signalling of a change of frequency for an existing multiplex shall be done through the NIT by changing the frequency carried by the delivery system descriptor (in the case of the main transmitter) or appropriate entry in the frequency_list_descriptor.

Specifically, a receiver will need to interpret that there has been a change in multiplex frequency when;-

An update of the NIT discloses new possible frequencies for a particular network to the receiver.

9 System Software Upgrade Service

The updating of the receivers software via over-the-air processes is via the ETSI 102 006 DVB SSU process with the “Simple Profile” being the minimum level of functionality that is required. There are no immediate intentions to launch the UNT profile. The UNT profile will only be implemented if a particular manufacturer insists that this added dimension of data transfer integrity is necessary for one or more specific receivers in its range.

Whether or not the simple profile alone, or UNT profile additionally is used, Freeview will work with individual manufacturers to provide a solution that will work with their product(s).

The “Simple Profile” based software update services for this network utilise signalling in the NIT and PMT only.

In the DVB-T network the elementary stream that contains the upgrade broadcast data will always be carried within the TVNZ transport stream, transport_stream_ids’ 0x0019 – 0x00 1c.

The NIT table shall carry the linkage_descriptor 0x09 and **may** also carry the scan_linkage_descriptor 0x0A if a **manufacturer requests the use of this descriptor** during a system software upgrade for one or more receivers, or when such an upgrade is planned.

The PSI reference for a planned system software update will be included within the PMT of the data_broadcast_id_descriptor with the data broadcast value of 0x000A.

The DVB-SSU service that will be provided by Freeview for certified receiver products, will normally take place at times where there is minimum prospect of interfering with normal viewing.

For the simple profile mode of DVB-SSU Freeview will create relevant and unique NIT table signalling for each individual receiver model, and also broadcast the associated ASI data broadcast stream as a data carousel input to the multiplex. This data broadcast stream will be reflected in the PSI (PMT) as a standalone data broadcast service that will be independent of all other services.

Freeview will work with each individual manufacturer during the receiver conformance testing, and afterwards as necessary, to develop a robust and reliable DVB-SSU process.

The “Enhanced Profile” which may be a capability that is resident in some receivers, **may** additionally provide more sophisticated signalling via use of the “Update Notification Table”.

9.1 SSU Process

Manufacturers shall ensure that the receiver offered will only respond to a unique OUI code, (Organisation Unique Identifier). This means that the receiver will not react to any other OUI

from any other manufacturer nor react to any other OUI from the same manufacturer which relates to a different model.

When a new software upgrade is required for a particular receiver the manufacturer shall be required to deliver two compliant (188 packets) ASI transport streams containing relevant converted binary image files, together with all relevant NIT and PMT data necessary for their receiver to properly undergo a successful DVB-SSU operation. There shall be within the menu structure of the receiver the current software version number.

The receiver is to at least automatically check if new software is available when changing multiplexes by re-processing the NIT (actual) or every 10 seconds as recommended by DVB TR 101 211 [8].

It must NOT require a rescan of any or all the multiplexes to acknowledge the presence of a DVB-SSU service.

The receiver manufacturer has the option of implementing the download of new software to the receiver as a background activity that does not interfere with normal television viewing while the receiver is in the on-mode or one which may be controlled by waiting until the receiver is switched to a "Standby" mode.

Alternatively the receiver may require the user to actively accept a SSU upgrade. This should be performed (or a similar procedure) as detailed below;-

Once a relevant SSU is signalled in the NIT by means of the linkage descriptor – the receiver that has been directed at must prompt the user by means of a pop-up (or similar to);-

"A software upgrade is available. Please select YES to upgrade now – this will take X minutes – or leave in standby (off button on remote) when finished viewing to upgrade later. Thank You."

The message box shall have a YES or NO button. The YES button will be highlighted by default.

If YES is selected the OAD would proceed.

If NO, the OAD would wait until the user switches the receiver to standby when it would happen automatically and without further user intervention.

If there is no user intervention for a period of three minutes, then by default, the OAD should be performed automatically.

If the user unplugs the mains power during an OAD, the receiver should reboot using the pre-existing installed software version.

While the receiver is in the process of downloading the new software – it should display the message (or similar to);-

"Your receiver is currently downloading an essential software upgrade. This will only take a few minutes. Please DO NOT adjust your receiver or switch OFF during this

time. Thank You.”

10 AVC Video Transmission

This section references the work of Jon Green at Samsung UK.

Only H.264 AVC encoded video shall be transmitted on the DTT terrestrial network. There will be no MPEG-2 encoded services and receivers are not required to decode MPEG-2 encoded video.

~~At launch the majority of services will be AVC SD with possibly 1 or 2 HD AVC services.~~
There are currently 3 HD AVC services and a number of SD AVC services (see 16.1.5 for the current service list) As the network matures it is expected that a number of HD AVC services will increase.

Each multiplex on the network may consist of AVC SD services only, AVC HD services only or a mix of SD and HD services.

As only HD receivers will be certified for the DTT Freeview network there will be no need to simulcast (SD and HD) the same service.

The following considers the different scenarios for single or mixed format services.

10.1 AVC Single Format Service

Single format AVC through life of the service.

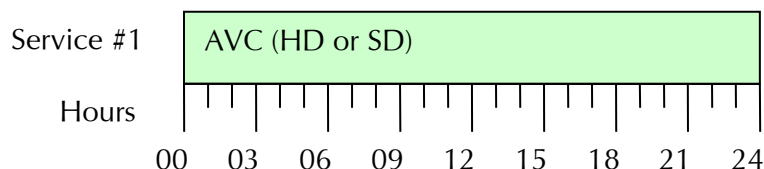


Figure 1 Single Format Service

10.1.1 Single Format SI Signalling

Table 10.1 Single AVC Format SI Signalling

Table Type	Description
PMT	May be static or dynamic. Elementary stream_type field signalled appropriate to AVC.
SDT	service_descriptor::service_type signalled as per En300468.
EIT	component_descriptor::stream_type/component_type signalled as per En300468.

Note : This will be the default scenario for most HD services. (For a HD channel all the broadcasters so far have decided to upconvert any SD material to HD).

10.2 AVC Multiple Format, Different Definition

A scenario whereby a service runs partially in HD and partially in SD.

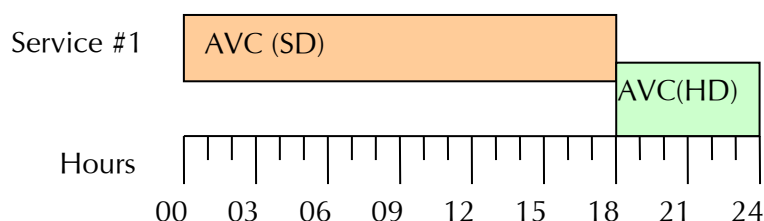


Figure 2 Multiple Format Service, Different Definition

10.2.1 Single Format SI Signalling

Table 10.2 HD/SD Single Format Signalling

Table Type	Description
PMT	Must be dynamic. Elementary stream_type field signalled appropriate to currently broadcast AVC.
SDT	service_descriptor::service_type signalled as per En300468 at the lowest elementary stream type.
EIT	component_descriptor:: stream_type/component_type signalled as per En300468.

Note : A reserved scenario for future services on the network.

10.3 AVC: Applicable standards

The video format shall be encoded and decoded as described in ISO/IEC 14496-10 [4] and EN 300 468 [7] constrained and interpreted as described in TR 101 211 [8] and TS 101 154 [14] and as clarified and extended below.

Only the 'H.264/AVC 25 Hz SDTV' and 'H.264/AVC 25Hz HDTV' bit streams and 25Hz H.264/AVC HDTV receiver described in the 'video' clause of TS 101 154 [14] are relevant to the NZ DTT receiver specification.

10.3.1 AVC: Required Format Information

The following elements must be included for all video services:

Random Access Point (RAP) in the video stream. The maximum time interval between RAPs shall be less than 2 secs.

The receiver shall be able to start decoding and displaying a H.264/AVC service at a RAP.

Since only HD enabled receivers will be conformant for the NZ DTT Network it shall be required to decode and display the “full screen” luminance pixel resolutions of: 720x576, 1280 x 720, 1920 x 1080, 1440 x 1080 or ‘less than full screen” resolutions as described in TS 101 154.

Cropping shall only be used to crop a 1920 x 1088 AVC coded signal to 1920 x 1080.

10.3.2 AVC: Optional to broadcast, required to decode

All conformant receivers are required to respond to the following optionally broadcast information:

Target background grid descriptor (ISO/IEC 13818-1 [1]) provided that the display grid is 720 x 576, 1280 x 720 or 1920 x 1080 as described in TS 101 154.

10.3.3 25Hz H.264/AVC SD Bit streams and HD Receiver

The minimum video format signalling required is the random access point.

The HD receiver shall be capable of decoding HD (High profile level 4) and SD (main profile level 3) video resolutions.

Table 10.3 represent the SD resolutions the HD receiver is required to decode and display.

The aspect ratio of SD services shall be either 4:3 or 16:9.

The table tabulates the horizontal scaling factors required to restore video to full screen resolution with the correct aspect ratio. These factors complement the scaling factors employed by the broadcaster when down sampling the video before encoding.

Table 10.3 SD/HD Coded Picture

Coded Picture					
Luminance Resolution (horizontal x vertical)	Interlaced Or Progressive	Source Aspect Ratio	aspect_ratio_idc	4:3 Monitors	16:9 Monitor up sampling
720 x 576	I	4:3	2	X1	x ¾(*1)
		16:9	4	X4/3(*2)	X1

Note 1: Up Sampling of 4:3 pictures for a 16:9 monitor is optional

Note 2: The up sampling with this value is applied to the pixels of the 16:9 picture to be displayed on a 4:3 monitor.

The receiver shall support decoding and displaying video with a frame rate of 25Hz interlaced.

10.3.4 H.264/AVC HD Bit streams and HD Receiver

The minimum video format signalling required is the random access point.

The HD receiver shall be capable of decoding HD (High profile level 4) video resolutions in the Table 10.4.

The aspect ratio of HD services shall be 16:9 only.

The table tabulates the horizontal scaling factors required to restore video to full screen resolution with the correct aspect ratio. These factors complement the scaling factors employed by the broadcaster when down sampling the video before encoding.

Table 10.4 HD Coded Picture

Coded Picture				
Luminance Resolution (horizontal x vertical)	Interlaced or Progressive	Source Aspect Ratio	aspect_ratio_idc	16:9 Monitor up sampling
1920 x 1080	I	16:9	1	x 1
1440 x 1080	I	16:9	11	x 4/3
1280 x 720	P	16:9	1	x 1

The receiver shall support decoding and displaying video with a frame rate of 25Hz interlaced or 50Hz progressive.

10.3.5 AVC: Format Switching

Format switching time shall be included within the definition of maximum channel change time to allow for channel change between formats.

10.3.6 HD to HD Format Switching

Receivers complying with this specification should be able to continue outputting decoded video pictures undisturbed by changes in the video format parameters provided that these changes are constrained as follows:

Changes are implemented at a random access point

The buffer models defined by AVC are met

The field parity of the first displayed field of the new sequence complements that of the last displayed field of the preceding sequence. Specifically, this allows the following parameters to be changed:

Coded picture width (horizontal_size)
 Coded picture height (vertical_size)
 Coded picture raster (interlaced or progressive)

NOTE: It is desirable that the HD image undergo the minimum number of format conversions.

Broadcasters will not change format dynamically. Format changes will only occur with a channel or programme change.

10.3.7 SD to HD and HD to SD Format Switching

SI / PSI shall be changed appropriately to indicate the change between SD and HD. See section 10.2.

10.3.8 AVC: SI / PSI signalling

The use of the signalling methods within the AVC video elementary stream is unchanged from that described previously i.e. Random Access Point parameters describe either a 16:9 or a 4:3 aspect ratio coded frame that is either one of the full screen formats or a cropped version of one of those. The EN 300 468 [7] component descriptor in the EITp/f shall be appropriate for the coded frame type of the video, i.e. 4:3 or 16:9.

10.3.9 Video format signalling extensions

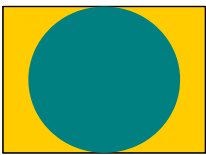
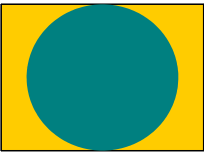
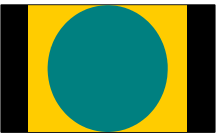
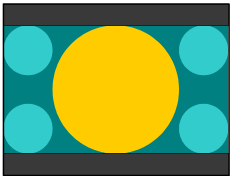
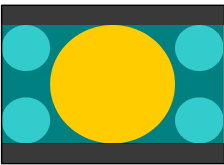
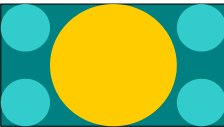
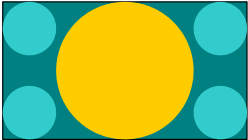
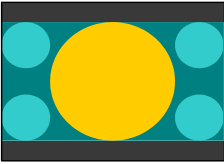
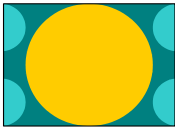
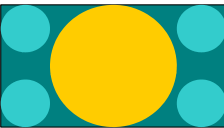
DVB requires receivers to support 16:9 and 4:3 coded video (support for 2.21:1 is optional).

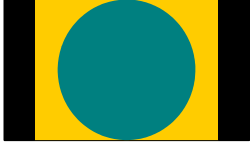
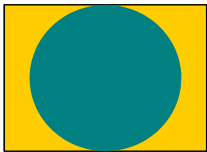
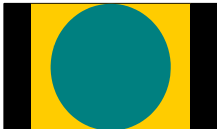
10.4 Active format description

The majority of services and all HD broadcasts on the DVB-T network are in a 16:9 aspect ratio. There is a concerted effort that all future services will also be in a 16:9 aspect ratio, however at present this cannot be guaranteed. Where some services are not in a 16:9 aspect ratio, AFD codes that **may be** carried in the MPEG4 video header, **may be** used by the receiver to determine the correct receiver display.

AVC AFDs are carried in the SEI (Supplemental Enhancement Information) messages. HD broadcasts shall always be in aspect ratio of 16:9. However, for receivers with a downconverted SD output it may be beneficial to optimise the SD output for a 4:3 display. AFDs may be used for this purpose in the same way as for 16:9 aspect ratio coded SD inputs. Active format descriptions (as defined in TS 101 154) **may be** broadcast by services to describe the portion of the 16:9 or 4:3 coded frame that is "of interest". The format descriptions are informative in nature and are provided to assist receivers to optimise their presentation of video. ~~The AFD shall be carried in the user data of the video elementary stream as defined in ISO/IEC 13818-2.~~ A subset of the active format descriptions is used in NZ broadcasts. These are tabulated with the recommended behaviour that all receivers should follow in the table below;-

Table 10.5 AFD Signalling

TEST STREAM / AFD VALUE	Display Aspect Ratio	Decoder Format Conversion	SCART PIN 8	RECEIVER DISPLAY
AFD 1000 	4:3	None	12V	
12F12 – 4:3 Ratio full height	16:9	None	12V	 12P16 – 4:3 Ratio picture in a 16:9 Ratio screen
AFD 1010 	4:3	None	12V	
16L12 – 16:9 Ratio picture letter boxed into a 4:3 Ratio screen	16:9	Scaling to 16:9 frame / None	6V	
AFD 1000 	4:3	Letter (scaling to 16:9 letterbox)	12	
16F16 – 16:9 Ratio full height	4:3	CC (centre cutout)	12	
	16:9	None	6	

TEST STREAM / AFD VALUE	Display Aspect Ratio	Decoder Format Conversion	SCART PIN 8	RECEIVER DISPLAY
AFD 1001  12P16 – 4:3 Ratio picture in a 16:9 Ratio screen	4:3	CC	12	
	16:9	None	6	 12P16 – 4:3 Ratio picture in a 16:9 Ratio screen

Receivers conformant with the full set defined in TS 101 154 [14] will work correctly with the NZ subset.

10.4.1 HD: Active Format Description

HD broadcasts shall always be in Aspect Ratio 16:9 and shall be configured for optimum viewing on a 16:9 display.

10.5 Wide Screen Signalling

Freeview will not transmit VBI line 23 WSS (wide-screen-signalling) and the receiver is not required to process the AFD codes into a WSS signal on any of the video output ports.

Notwithstanding this approach, Freeview will not alter the SCART pin 8 and/or HDMI Info-Frame signalling standard. In the New Zealand retail market-place the prevalence of SCART equipped display devices is quite low, but for those relatively few viewers who will have access both to SCART equipped receivers and to SCART equipped displays, automatic display format switching based upon AFD broadcast will be a viewing option.

10.6 AVC HD Receiver Processing

The reference model for the video format processing elements in the Set Top Box, TV and Integrated Digital TV are illustrated in Figures 10.1 and 10.2. The display format signalling between the Set Top Box and the display is by the HDMI INFO-FRAME signalling on the main HD output or SCART pin 8 on the secondary SD output. Within an Integrated Digital TV the signalling is logically equivalent to INFO-FRAME but could be conveyed by other means.

In the STB reference model the output of the AVC Video Decoder is logically 1920 x 1080, 1280 x 720 or 720 x 576. The Decoder Format Conversion shall ensure a compatible interface with the external display, based on the display's input format capability as described by its EDID. In many practical implementations the processes in the Decoder Format Conversion are an integral part of the AVC Video Decoder. This does not affect the logical reference model.

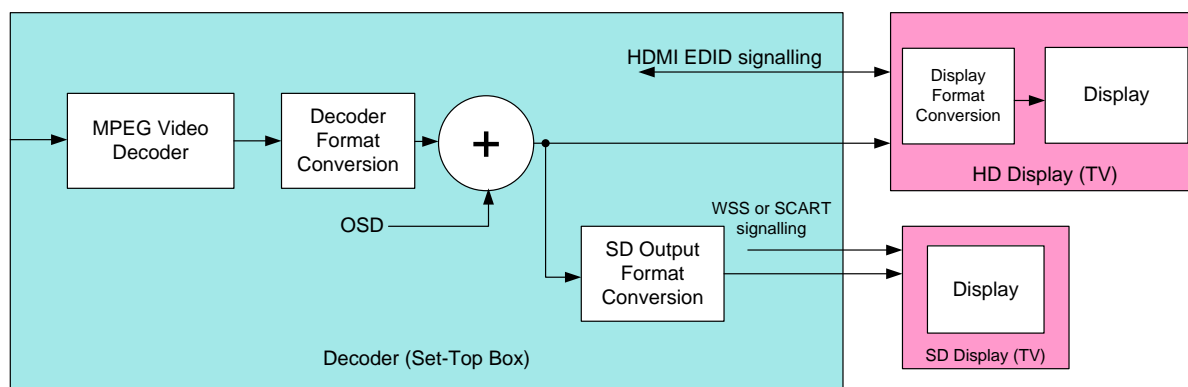
NOTE: It is desirable that the HD image undergo the minimum number of format conversions. To this end *EITHER*:

The Decoder Format Converter should output all video signals at the native format of the display *OR*

The Decoder Format Converter should limit its conversion to horizontal reconstitution of sub-sampled formats (e.g. 1440 x 1080 or 960 x 720) to 1920 x 1080, 1280 x 720 or 720 x 576, with no vertical format conversion. These three formats should be output to the display, where the display's format converter will convert them for compatibility with the display's native resolution.

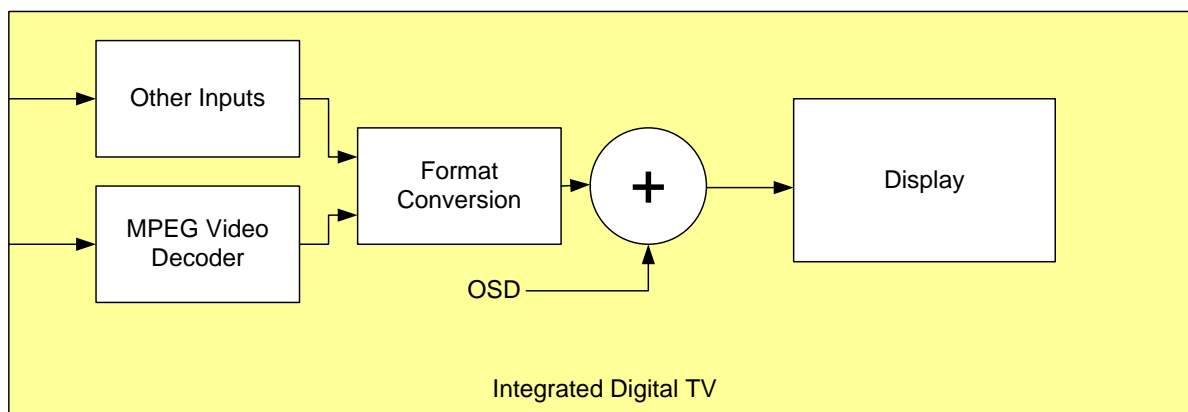
There should be a method for the end user to select Set Top Box PRIORITY or Display PRIORITY to choose between the above options.

If the STB has a secondary SD output, a separate SD Output Format Conversion is required to convert the HD format signal to an SD compatible format. The SD Output Format Conversion shall also provide selectable aspect ratio conversion from 16:9 to 4:3 for use with 4:3 aspect ratio SD TV sets. It may also use broadcast AFD codes to provide the full processing provided in 16:9 SD displays to accept 4:3 signals.



10.1 Separate STB and TV Set(s) Reference model - HD

Integrated Digital TV: In the Integrated Digital TV reference model the output of the AVC Video Decoder is logically 1920 x 1080 or 1280 x 720. The Format Conversion shall ensure a compatible interface with the internal display. In many practical implementations the processes in the Decoder Format Conversion are an integral part of the AVC Video Decoder. This does not affect the logical reference model.



10.2 Integrated Digital TV reference model – HD

10.7 HD Video with graphics

Figure 10.3 depicts the processing model for HD receivers;-

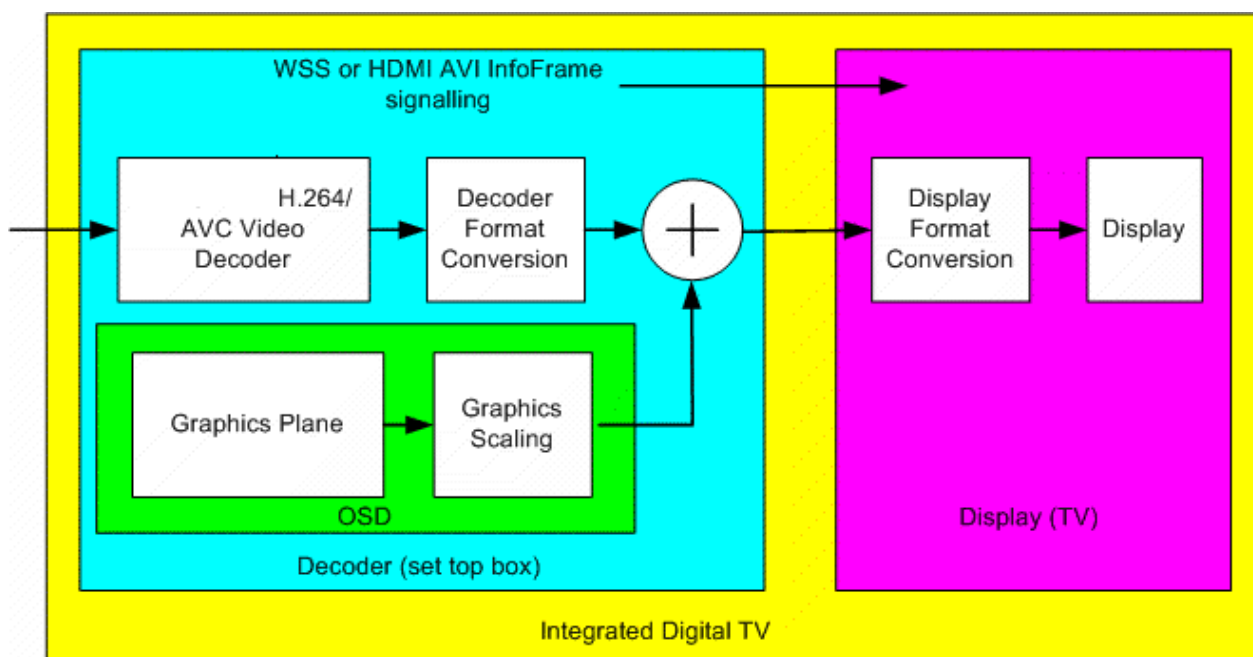


Figure 10.3 HD Receiver Reference Model

The On-Screen Display (OSD) comprises the Graphics Plane and Graphics Scaling. It is used for the presentation of MHEG graphics, EBU Teletext and Subtitles. The OSD should be implemented as multiple logical planes to improve the simultaneous presentation of subtitles, interactive applications and graphics. The Graphics Scaling resizes the logical graphics planes to exactly fill the Decoder output's active pixel area, regardless of the aspect ratio and format of the Decoder output. To allow interactive applications to navigate smoothly between video streams of different resolutions, the resolution of the MHEG plane used by applications shall be independent of the format of the decoded video stream. The minimum (and initial) resolution

of the MHEG plane shall be 720x576. For future 'HD' resolution MHEG applications it is expected that a resolution matching that of the Decoder's video output will be transmitted. The resolution of the Subtitle plane shall be equivalent to the **display_width** and **display_height** carried within the subtitle stream DDS.

The Decoder Format Converter (DecFC) shall be able up-convert and cross-convert signals between a minimum of all HD video formats (it is optional to up-convert SD input resolutions to HD), as well as perform aspect ratio conversion as required. The Decoder output may be 16:9 or 4:3 and shall be signalled to the Display. The Display Format Converter (DisFC) similarly converts the signals on the Display's input to a suitable format for driving the display itself. The DisFC should therefore also perform aspect ratio conversion; but contrary to CEA-861-D this feature is not always supported on the HDMI inputs of "HD Ready" displays, complicating the presentation of 4:3 video with graphics.

The output of the H.264/AVC video decoder is assumed to be scaled to 720x576 pixels for SD broadcasts and either 1920x1080 or 1280x720 pixels for HD broadcasts. When no MHEG applications are running, the output from the video decoder shall be further scaled to match the Decoder output format as follows:-

For 16:9 broadcasts, the DecFC shall scale the video decoder's output to exactly fill the Decoder output's active pixel area. The output from the Decoder shall be signalled as 16:9 to the Display.

For 4:3 broadcasts, two methods of achieving the correct presentation of video content and alignment with graphics are specified:

Decoder Aspect Ratio Conversion (set-top boxes only)

Since many "HD Ready" displays do not follow the aspect ratio signalling carried within the HDMI AVI InfoFrame, set-top box receivers shall also provide the option for the DecFC to convert 4:3 signals for presentation within a 16:9 Decoder output frame. The output from the Decoder shall be signalled as 16:9 to the Display. Note that this method may result in aspect ratio errors when video is mixed with MHEG content. Furthermore, it will also result in differences in the alignment of video and MHEG graphics dependent on the 4:3 presentation style that has been selected. For that reason, where supported by the display, Display Aspect Ratio conversion is preferred.

Display Aspect Ratio Conversion (set-top boxes and IDTVs)

To ensure the correct alignment and presentation of video and graphics on IDTVs and "HD Ready" displays, the DecFC shall additionally provide the option to "stretch" the 4:3 video signal to exactly fill the Decoder output's active pixel area. For Decoder output formats that are usually considered to be 16:9, the "stretch" process will result in an anamorphic 4:3 frame. The output from the Decoder shall be signalled as 4:3 to the display. Should the Display not respond to the aspect ratio signalling, correct alignment of video and graphics is still maintained, but the aspect ratio of both video and MHEG content may be incorrect.

10.8 Audio Transmission

The receiver will provide at least audio decoding and pass through of MPEG 1 Layer II (Musicam), MPEG 4 HE AAC and Dolby Digital (AC-3) audio elementary streams.

10.8.1 Musicam Decoding

If a MPEG 1 Layer II audio stream is present this shall be signalled by the audio_stream_descriptor (tag 0x03) in the services PMT.

It shall be encoded according to ISO/IEC 13818-3 constrained according to TS 101 154.

The level for reference tones for transmission shall be -18 dB FS, in accordance with EBU Recommendation R.68 "Alignment level in digital audio production equipment and in digital audio recorders" as recommended by TS 101 154 [14]

The receiver shall decode the following MPEG 1 Layer II audio modes;-

Modes:-

Single Channel : ISO/IEC 11172-3

Joint Stereo : ISO/IEC 11172-3

Stereo : ISO/IEC 11172-3

Sampling Frequency ;-

32 KHz

44.1 KHz

48 KHz

Bit Rates;-

64 kbit/s

96 kbit/s

128kbit/s

192kbit/s

256kbit/s

384kbit/s

10.8.2 Dolby Digital (AC-3)

If AC-3 multi-channel audio elementary stream is broadcast, it shall be encoded according to TS 102 366 and constrained according to TS 101 154 [14], Annex C (Guidelines for the Implementation of AC-3 Audio in DVB Compliant Transport Streams).

The broadcaster shall ensure that the correct signalling is used to enable receivers to output the audio encoded as AC-3 at a similar level to that of an MPEG1L2 and HE-AAC audio component (even when this component is not broadcast).

It is required that all receivers shall conform to Dolby Technical Bulletin 11 for the default use of RF Mode on AC-3 decoding to boost audio levels by 11dB to match with HE-AAC and MPEG-1 L2 levels.

It is required for the receiver to pass through the AC-3 multi-channel stream via a dedicated digital output (optical or coaxial).

The receiver shall be capable of outputting:

Musicam, or
MPEG 4 HE AAC audio, or
Pass through AC-3 stream

If both a stereo audio component and a AC-3 audio component are simultaneously transmitted then the digital audio output is to provide pass through of the AC-3 stream only.

It is ~~optional~~ required for receivers to provide a stereo down-mix of an AC-3 stream to analogue and digital audio outputs (including HDMI).

The DVB specified AC_3_descriptor shall be included in the PMT for this elementary stream and the reserved AC-3 component descriptor in the EITp/f.

10.8.3 MPEG 4 HE AAC AUDIO

The stereo audio components associated with most (if not all) video services and dedicated radio services shall be MPEG 4 HE AAC encoded.

The MPEG-4 HE AAC shall be encoded as described in ISO/IEC 14496-10 [4] and constrained according to TS 101 154 [14]

The broadcaster shall ensure that the correct signalling is used to enable receivers to output the audio encoded as MPEG4 HE-AAC at a similar level to that of an MPEG1L2 audio component (even when this component is not broadcast).

The DVB specified AAC_descriptor shall be included in the PMT for this elementary stream and the HE-AAC stream content (0x06) and component type (0x03) shall be signalled (assuming a HE-AAC stereo pair) in the component descriptor of the EITp/f (see table 5.6)

The receiver is only required to support a MPEG-4 HE AAC mono and stereo level 2 bitstreams. It is optional for the receiver to decode multi-channel level 4 bitstreams.

11 MHEG-5 Transmission

11.1 MHEG-5 EPG Application

Every service on the Freeview DVB-T network shall reference a MHEG-5 EPG application. The EPG application provides a comprehensive 8-day schedule listings data for every service on the network. It is expected that as the network matures there will be a future Digitext application which will replace the existing DVB Teletext service and numerous red-key applications linked to particular programmes.

The EPG, Text and colour keys are not hard-wired to any particular application. A small "Launcher" application, is broadcast as the auto-booting application on all services which will take control of these keys and manage the launching of other applications also being broadcast in the object carousel. These additional applications might include an EPG, an Info Service (DigiText) plus transient Enhanced TV applications that would be launchable from any of the colour keys. The receiver software should simply pass key events to the MHEG application in the same way as the UK, with the addition of the EPG key. It is not required to distinguish between these applications.

11.2 HD MHEG-5 Engine

~~No change is required to the MHEG-5 profile version 1.06 for SD AVC/H.264 services. For HD services the MHEG-5 engine will eventually require an update to display HD graphics on HD displays.~~

~~Work to define the required changes to the MHEG-5 UK profile version 1.06 is currently underway in the UK by the DTG. It is unlikely that the standard will be complete and implemented in MHEG-5 engines in time for the launch of the Freeview DTT network.~~

It is a requirement that all receivers implement the HD MHEG-5 1.06 UK profile as specified in D-Book [23] 6.2.1 section 14.11 and related sections with the NZ variations as per section 12 of this specification are resident in the manufacturers receivers

Receivers with a Network Interface ~~For all iDTVs with a screen size ≥ 30 " diagonal and PVR devices~~ shall support the MHEG 5 Interaction channel Extensions and the ICStreamingExtensions as defined in the D-Book 6.2.1 [23] sections 17.7 and related sections. See Table 11.1 for MHEG 5 DTT receiver support

Table 11.1 DTT MHEG-5 Engine Requirements

	DTT Receiver Type	Basic STB	IDTV<30" diagonal diameter	IDTV30"≥ diagonal diameter	PVR
MHEG-5 Engine Extension					
UK MHEG v1.06 profile + NZ variations. Table 12-10		Mandatory	Mandatory	Mandatory	Mandatory
MHEG PVR Extension – NZ Transmission Rules section 12 Support for MHEG-5 PVR Receivers		Optional	Optional	Optional	Mandatory
HD_GraphicsPlane_Extension DBook 14.11.1 Extends the MHEG-5 engine to allow support for HD graphics plane		Optional	Optional*	Mandatory	Mandatory
HDVideoExtension DBook 14.11 Extends support for HD video presentation		Optional	Optional*	Mandatory	Mandatory
InteractionChannelExtension Allows support for static content retrieval on an IP connection		Optional	Optional*	Mandatory	Mandatory
ICStreamingExtension Extends support for static and streaming content on an IP connection		Optional	Optional*	Mandatory	Mandatory
ICEncryptedStreamExtension Extends support for decoding and presenting streaming content that has been encrypted before delivery by IP to the receiver		Optional	Optional*	Mandatory	Mandatory
LifecycleExtension D-Book 16.2.9 Allows MHEG-5 applications to continue running across service tunes		Optional	Optional*	Mandatory	Mandatory
NativeApplicationExtension D-Book 8.5.11 Allows the co-existence of MHEG-5 applications and broadcast triggered native applications		Optional	Optional	Optional	Optional
DownloadableFontExtension		Optional	Optional	Mandatory	Mandatory

Allows support for a range of typefaces, styles and sizes for text presentation				
MHEG InputMaskExtension DTG MHEG Spec group white Paper Provides a bitmask mechanism to define which keys are available to a running MHEG application	Optional	Optional	Optional	Optional

* Receivers with a Network Interface shall support the functions listed as 'Optional*' in Table 11.1

Freeview will launch the DVB-T platform continue to broadcast the MHEG-5 EPG application in SD format on both SD and HD video services. Future MHEG-5 applications particularly those associated with the MHEG interaction channel may be formatted to the MHEG HD profile

For legacy receivers since the MHEG-5 HD profile is now complete and tested manufacturers can provide an OAD SSU to Freeview to implement the new MHEG-5 engine into their legacy receivers.

MHEG-5 applications that may be procured or developed by Freeview or any of the broadcasters will be streamed from an MHEG-5 object carousel. Any MHEG-5 applications that are broadcast shall conform to the MHEG-5 Version 1.06, HD or interaction profile as specified in D-Book [23] (U.K profile) plus the NZ extensions as described in section 12.

12 NZ MHEG-5 extensions to MHEG-5 UK Profile v1.06

12.1 Purpose

This section provides the detailed specification of the MHEG-5 engine required in compliant Freeview NZ approved DTT receivers.

This specification defines “application domain” in the terms set out in Annex D of ISO/IEC 13522-5.

This document defines the following “application domain”:

- “NZProfile1”

12.1.1 Scope

As far as is practical this document does not intend to create new specifications. Where possible existing public standards/specifications are referenced and if required profiled.

12.2 Specifications

Unless stated otherwise specifications follow those in [MHEG]. For the avoidance of doubt these specifically include:-

- Content data encoding
- Application defaults

Note: No features specified in [MHEG] are removed or modified so as to fail conformance tests defined for [MHEG]. This section specifies additions to [MHEG]. Some features (e.g. additional characters) require invocation by the MHEG application before they become active. For example, additional characters require attributes to be set in the application. Without such activation the receiver shall conform to [MHEG] and shall pass the conformance tests specified for [MHEG].

12.2.1 Miscellaneous

This clause provides specifications that may be used in one or more of the extensions packages.

12.3 Platform identification

12.3.1 UniversalEngineProfile GetEngineSupport feature string

The UniversalEngineProfile (UEP()) GetEngineSupport feature string is defined in [MHEG]. It allows version information about the platform to be interrogated. This clause extends this behaviour allowing the “international profile string” (see Table 12.9 “List of international profiles,”) for each of the international profiles that the receiver supports to be interrogated in addition to those defined by [MHEG].

12.3.2 WhoAml resident program

The WhoAml (WAI()) resident program is defined in [MHEG]. It returns a string that contains a space separated set of sub-strings. This clause extends this resident program so that the string returned contains additional space separated sub-strings. The additional sub-strings are the “international profile string” (see Table 12.9, “List of international profiles,”) for each of the international profiles that the receiver supports.

12.4 Character set extensions

The text in this section has been generalised with the goal of allowing the specification to address multiple markets and allowing receivers to be developed to address multiple markets. The base set of characters that all receivers shall support is defined in [MHEG]. [MHEG] also specifies how text is encoded, stored, processed and presented. This clause provides additional specifications that enable packages of characters to provide support for additional regions/languages/peoples.

Unless stated otherwise all aspects of text storage and presentation follow the specifications in [MHEG]. For the avoidance of doubt these specifically include:-

- Character encoding
- CharacterSet attribute
- Required sizes and styles
- Control of text flow
- Text rendering
- Text mark-up
- EntryFields
- HyperText
- Character repertoire

12.4.1 Maori character extensions

This package provides macronised vowels to support characters in the Maori alphabet.

Font

Receivers shall implement this package of characters using one of the following fonts:
Tiresias V7.51 (NZ) from Bitstream Inc (www.bitstream.com).

Character encoding

Text shall be encoded as in [MHEG] (UTF-8).

Invocation

This package of additional characters shall become available to MHEG applications in text objects that have attributes set as specified Table 12.1, "Invocation of Maori character set package".

Attribute name	Value	Comment
Font	"rec://font/nz1"	
ContentHook	As [MHEG]	UTF-8 encoding is used as specified in [MHEG]
CharacterSet	11	The character repertoire is a specific superset of that defined in [MHEG]

TABLE 12-1: Invocation of Maori character set package 8

Note: These attributes can be set in a variety of ways. For example, the attributes can be set globally on the application object or locally on a text object. Suitable setting of attributes enables all of the following scenarios:

All text objects conform to [MHEG]

All text objects can use the extensions defined in this package

Some text objects conform to [MHEG] and others can use the extensions defined in this package

Rendering rules

When rendering this package of additional characters receivers shall use the layout and rendering rules defined in [MHEG].

Receivers shall support all of the font sizes specified in [MHEG].

Character repertoire

This package of additional characters requires that receivers shall implement the set of characters listed in Table 12-2, "Character additions for Maori" in addition to those defined in [MHEG].

UCS2	UTF8	Glyph	Unicode Name For Character
------	------	-------	----------------------------

UCS2	UTF8	Glyph	Unicode Name For Character
0100	C480	Ā	Latin Capital Letter A With Macron
0101	C481	ā	Latin Small Letter A With Macron
0112	C492	Ē	Latin Capital Letter E With Macron
0113	C493	ē	Latin Small Letter E With Macron
012A	C4AA	Ī	Latin Capital Letter I With Macron
012B	C4AB	ī	Latin Small Letter I With Macron
014C	C58C	Ō	Latin Capital Letter O With Macron
014D	C58D	ō	Latin Small Letter O With Macron
016A	C5AA	Ū	Latin Capital Letter U With Macron
016B	C5AB	ū	Latin Small Letter U With Macron

TABLE 12-2: Character additions for Maori 9

12.5 User input extensions

The base set of user input keys that all receivers shall support is defined in [MHEG]. This clause specifies additional packages of UserInputEventData values, User Input registers and EngineEvents.

12.5.1 EPG key

UserInputEventData value

The EPG key shall generate UserInputEventData value 300.

UserInput registers

In addition to the input registers defined in [MHEG], receivers shall support the following input registers: All three input registers (13, 14 and 15) must be supported.

UserInput EventData value	Function Name	Register Number			
		13	14	15	16 ^{#1}
1	Up		√	√	√
2	Down		√	√	√
3	Left		√	√	√
4	Right		√	√	√
5-14	0,1,2,3,4,5,6,7,8,9 respectively		√		
15	Select		√	√	√
16	Cancel / Exit	√	√	√	√
100	Red	√	√	√	√
101	Green	√	√	√	√
102	Yellow	√	√	√	√
103	Blue	√	√	√	√
104	Text	√	√	√	√
300	EPG	√	√	√	√
120	Stop				√
121	Play				√
122	Pause				√
123	Skip Forward				√
124	Skip Backward				√
125	Fast Forward				√
126	Rewind				√

TABLE 12-3: Input registers EPG key

#Note 1 : Register 16: Receivers that support ICStreamingExtension shall support this register group. However, only those keys that exist on the receiver's remote control shall actually generate events. If no keys for IC Streaming are present, this input register is equivalent to register 14

EngineEvents

EventData		Notes
Name	Value	
EPGKeyFunction	300	<p>Generated when the user activates the EPG key and there is an active scene object. This event is raised independently of the InputEvent register selected at the current moment or whether any interactable has the InteractionStatus of True.</p> <p>If a key press causes both the EngineEvent and the UserInput event then the EngineEvent shall be raised first.</p>

TABLE 12-4: EngineEvents

12.6 PVR extensions

This clause specifies a package of extensions that are used for controlling Personal Video Recorders (PVR), this is identified as the *PVRExtension*.

12.6.1 Implementation

Receivers implementing the PVRExtension package shall follow the requirements for D-Book [23] and for [DTG DTR], but note that referencing programme events by EIT event_id (as described in D-Book [23] clause 8.12.1.1) is not supported by this package. Instead all events in EIT shall include a Content Identifier Descriptor that, in conjunction with a Default Authority Descriptor, provides a CRID for the event.

12.6.2 GetEngineSupport feature string

Receivers implementing this package shall return "TRUE" to the Engine Support String "PVR(n)", where n = 0.

12.6.3 EngineEvents

EventData		notes
Name	Value	
PVRChangedEvent	20	Generated when the list of events to be recorded by the PVR changes. Possible reasons for changes include but are not limited to: event recorded, event cancelled due to conflict, event added or removed through the PMB or PCB ResidentPrograms

TABLE 12-5: EngineEvents

12.6.4 Resident programs

Receivers implementing this package shall support the following Resident Programs.

CRID format

CRIDs carried in SI may be defined in such a way that the Scheme and Authority parts are carried once only if they are common to a group of CRIDs. However the format for CRIDs passed across the MHEG PVR API in any of the following Resident Program calls shall include the Scheme and Authority parts in all cases.

A CRID that does not include an instance identifier shall be in the format:
Scheme + Authority + Unique Identifier

A CRID that includes an Instance Identifier shall be in the format:
Scheme + Authority + Unique Identifier + # + Instance Identifier

Examples of CRIDs with and without Instance Identifiers follow:
crid://company.tv/123df5
crid://broadcaster.com/hef5w#e1

As specified by section 7.3 CRIDs carried in SI are case insensitive. However, MHEG-5 operations on strings are case sensitive. So:

- the following Resident Programs shall be case preserving
- operations relative to broadcast SI shall be case insensitive

PVR_MakeBooking

Adds an event to the PVR schedule.

Synopsis PMB(crid, cridType, name, description, result)

in/out/ in-out	type	name	comment
in	GenericOctetString	crid	
in	GenericInteger	cridType	The type of CRID being referenced, where: 49 (0x31) is a programme event 50 (0x32) is a series event
in	GenericOctetString	name	A descriptive name for the event
in	GenericOctetString	description	A brief description of the event
out	GenericInteger (shall provide an indirect reference to an IntegerVariable)	result	The result of the operation: 0 = booking successful 1 = alternate instance booking successful -1 = conflict with a previous booking -2 = CRID not found -3 = CRID already booked for recording -4 = booking cancelled by user -5 = booking failed for other reason -6 = booking failed due to insufficient space -7 = booking failed due to too many bookings

TABLE 12-6: Arguments

Description

The Resident Program adds an event to the PVR's list of scheduled events to record. The type of CRID can be any of a single programme or series – the type is defined in cridType to aid the PVR in finding the required CID. Where the CRID is a series CRID the booking relates to all programme events that are part of the series.

The PVR is required to validate the CRID and check that resources are available for the booking. This may involve searching for multiple instances of an event until one is found that does not clash with a previous booking. Where no such instance is found the PVR may choose to indicate the conflict to the viewer, giving them the option to cancel one or more of the bookings.

Where the instance chosen to record (either automatically or by user intervention) is not the (temporally) first instance found the call shall return with a result value of 1.

The name and description can be used by the PVR to describe the event when it is placed in the booking list.

PVR_CancelBooking

Removes an event from the PVR schedule.

Synopsis PCB(crid, cridType, result)

in/out/ in-out	type	name	comment
in	GenericOctetString	crid	
in	GenericInteger	cridType	The type of CRID being referenced, where: 49 (0x31) is a programme event 50 (0x32) is a series event
out	GenericInteger (shall provide an indirect reference to an IntegerVariable)	result	The result of the operation: 0 = booking removed -1 = the event is being recorded -2 = CRID not found -3 = the event has already been recorded

TABLE 12-7: Arguments

Description

This resident program removes the requested event from the list of events currently booked for recording. The event is referenced by its CRID, along with the CRID type.

Canceling a series CRID will cause all future events in the series to be ignored, in addition to ones currently visible in the schedule.

PVR_ListBookings

Returns a list of CRIDs and CRID types currently being monitored.

Synopsis PLB(crids_and_crid_types)

in/out/ in-out	type	name	comment
-------------------	------	------	---------

in/out/ in-out	type	name	comment
out	GenericOctetString (shall provide an indirect reference to an OctetStringVariable)	crids	A space separated list of full CRIDs currently being monitored.

TABLE 12-8: Arguments

Description

The Resident Program returns an OctetString carrying a list of the currently valid bookings. The format for each booking shall be a CRID followed by CRID type. A single space (0x32) character separates each CRID and CRID type. A single space (0x32) character separates each booking.

The list shall contain all currently valid bookings previously added using the PMB Resident Program. There shall be no duplicate bookings in the list. In each booking the CRID and CRID type shall be in the format that was used when the booking was created using the PMB Resident Program. The order of bookings in the list is not defined. Bookings that are no longer valid because they have lapsed or have been successfully recorded or have been removed by other means shall not be present in the list.

An example of the OctetString returned from the PVR_ListBookings call describing one programme CRID and one Series CRID is as follows:

```
"crid://service1.tv/4df6a2 49 crid://service1.tv/news 50"
```

12.7 Regionalised broadcasts

12.7.1 Signalling of local services (informative)

The Freeview DVB-T network utilised the Service_Availability_Descriptor in conjunction with the cell ID (carried in the TPS – see section 5.8.1) to determine if some services are available or not in a particular cell.

By default services are “available” if they are technically receivable and their Running Status is either “running” or “undefined”. The Service Availability Descriptor in the SDT adds an additional factor before a service is considered “available”. The descriptor lists the IDs of cells where the service should, or should not, be available.

The receiver decodes the cell ID from the transmission. If the Service_Availability_Descriptor is present for a service, and signals that the service shall not be available in that cell, then the receiver shall not make it available to the viewer.

The following clause addresses how this signalling of service ability modifies the behaviour of the MHEG-5 engine.

12.7.2 Service Availability Signalling and SI_GetServiceIndex

Calls to the SI_GetServiceIndex Resident Program shall return a non-negative integer if the following condition is true:-

If the Running Status of the referenced service, defined in the Service Description Table, is either "running" or "undefined" and either a Service Availability Descriptor exists in the SDT service descriptor loop of the referenced service indicating that the service is available in the current cell or no Service Availability Descriptors exist in the SDT service descriptor loop of the referenced service indicating the service is available in all cells.

If the above requirement is not met then the Resident Program shall return a SI_GetServiceIndex value of -1.

12.8 Profiles

This clause identifies the features specified in section 12.2, "Specifications" that a receiver must implement (in addition to the requirements specified in [MHEG]) to implement a particular profile. Note that OPT defines a normative option.

Table 12-9 List of International Profiles

Profile Ref Number	Profile Name	Version	International Profile String #1
1	UK MHEG		
2	New Zealand Freeview 1	001.000.000	INT002001000000

#1Note:-

Receivers that support a profile shall return the feature string as part of the value returned by the WhoAml resident program and shall return 'true' when the feature string is tested using the UniversalEngineProfile resident program.

12.8.1 Requirements of Profile

This clause tabulates the requirements for each profile.

Table 12-10 Profile requirements for New Zealand Freeview 1

Specification Clause	Requirement
12.3 "Platform Identification"	Mandatory
12.4 "Maori Character Extensions"	Mandatory
12.5 "EPG Key"	Mandatory
12.7 "Regionalised Broadcasts"	Mandatory

13 Teletext and Subtitling Transmission

13.1 EBU Teletext

For selected services there will be an accompanying Teletext service. The Teletext system used is defined in ITU-R System B Teletext in DVB Bitstreams, and Enhanced Teletext. Teletext is also generically known as “EBU Teletext”. Closed captions shall not be provided on line 21 of the VBI for any selected programmes within associated services on the Freeview DVB-T network

13.1.1 STB and PVR use of the Text Key

The minimum requirement for this service for STBs' and PVRs shall deliver the Teletext and line 21 subtitling information via the VBI to the Teletext decoder of an equipped Television. A teletext decoder supporting at least teletext level 1.5 as an OSD image in the receiver is optional (as defined in ETS 300 706 [15]– this will require a remote control button other than the 'TEXT' button which will be assigned to MHEG-5.

Alternatively if the remote control has only one suitable key to launch either EBU Teletext or an MHEG Digitext application may support either dual Use of the TEXT key to launch either a Digitext MHEG application or a EBU Teletext service based on the user cases in Table 12.1

OR

The MHEG InputMaskExtension DTG MHEG Spec group white Paper (attached here for convenience), which utilises a bitmask mechanism to determine which arbitrary set of keys is available to a running MHEG-5 application.

13.1.2 iDTV use of the Text Key

iDTVs shall include a teletext decoder supporting at least teletext level 1.5 (as defined in ETS 300 706 [15] iDTVs which only support one suitable 'TEXT' type key on the remote shall support

either the dual Use of the TEXT key to launch either a Digitext MHEG application or an EBU Teletext service based on the user cases in Table 13.1

OR

The MHEG InputMaskExtension DTG MHEG Spec group white Paper (attached here for convenience), which utilises a bitmask mechanism to determine which arbitrary set of keys is available to a running MHEG-5 application.

Table 13.1 'Dual Use of the TEXT' KEY USER cases

MHEG 'DigitText' Application	DVB TELETEXT	Action by TEXT KEY on RCU	Notes
Not Present	Not Present	No Response	The TEXT key can be moved up the key stack so it takes priority over MHEG. While EBU-teletext is on the service it will grab the 'TEXT' key before MHEG sees it. When teletext stops being signalled in the PMT, the 'TEXT' key will drop down to MHEG and be processed normally.
MHEG APP	Not Present	Pass Key to MHEG APP	
Not Present	Present	TV grab TEXT key and launch Teletext screen	
MHEG APP	Present	Undefined	(This is a user case that shall not be present on the live network)

The receiver is to check a services' PMT for the presence of a Teletext component and the associated descriptor. For those services with a Teletext component in the PMT the receiver is to pass the TEXT Key further up the stack so it takes priority over MHEG.

#Note—There is currently within the DTG MHEG group a proposal to extend the MHEG Input Register groups by means of a possible bitmask register. It is expected this would provide an alternative solution to the dual use of the 'TEXT' key issue. The agreed specification is targeted to be complete by the end of November and published as a DTG white paper. This specification will reference this white paper. Manufactures shall then be open to choose between the 'EBU Teletext not present in a services PMT' as detailed in table 12.1 or the upcoming Input Register group extension white paper to determine if the 'TEXT' is to be passed to the MHEG layer.

13.2 DVB Subtitles

The receiver shall support the requirements of EN 300 743 [16]– Digital Video Broadcast (DVB); Subtitling Systems.

EN 300 743 [16] – Digital Video Broadcast (DVB); Subtitling Systems supports both HD and SD bitmaps, the receiver shall down convert HD bitmaps to SD bitmaps on all SD outputs.

Subtitling streams are signalled in the ISO/IEC 13818-1 [1] – Programme Map Table (PMT) using stream type 0x06 indicating PES packet private data and with a subtitling_descriptor associated with the subtitle stream component.

The subtitling descriptor defined in section 6 of the DVB SI specification EN 300 468 [7] enables different subtitling streams to be distinguished by their ISO-639_language_code, subtitling_type, composition_page_id and ancillary_page_id.

Subtitling streams with a DDS and associated with an HD service should have a value for subtitling_type of 0x14 - denoting “DVB subtitles (normal) for display on a high definition monitor” - or of 0x24 - denoting “DVB subtitles (for the hard of hearing) for display on a high definition monitor”.

14 Digital Copy Right Protection

It is a mandatory requirement that the receiver provides High-Definition Digital Content Protection (HDCP) via the HDMI output.

All functioning analogue output ports (Y Pb Pr, RGB, CVBS) shall provide SD video resolution (max 720 x576p) output only.

~~The DVB is in the process of specifying the carriage of DVB-CPCM USI. Receivers which are DVB-CPCM compliant shall obey the USI.~~

~~DVB-CPCM USI is scheduled for completion in Q4 2007. The Freeview DTT network intends to conform to DVB-CPCM USI at some point in the future.~~

See section 6.2 for the Content Management Requirements

15 Conditional Access

The Freeview service does not ~~utilise~~ currently use the conditional access system.

The CAT shall be broadcast if CA is applied to any service on the network.

16 APPENDIX A

16.1 *DVB Specific Identifiers*

The Receiver shall identify a service uniquely through the combination of;

Original_network_id, and
Service_id

16.1.1 Original_Network_id

The Freeview Original_network_id is 0x222A TR 101 162 [11] and shall be common across all multiplexes

16.1.2 Network_id

The Freeview network_id is from 0x3401 to 0x3500 TR 101 162 [11]. The Freeview network consists of a number of transport streams as described in this document and is considered as one network, hence shall only use the network_id 0x3401. This does not preclude the use of other networks on the DVB-T platform in the future.

16.1.3 Private Data Specifier

The Freeview allocated Private_data_specifier = 0x0000 0037 TR 101 162 [11]. It shall be inserted within the private_data_descriptor. At present the use of private_data_descriptor is limited to the insertion of the logical_channel_descriptor..

16.1.4 Transport_stream_id

The transport_stream_id shall uniquely define a transport stream within the network comprising of a specific combination of services and components. Each multiplex operator allocates transport_stream_ids on an individual basis however it is agreed between the Freeview and the multiplex holders that all transport streams within the network will carry a unique transport_stream_id.

Each multiplex is allocated a transport_stream_id representing a region.

Table 16.1 Transport_stream_ids allocation

Multiplexer Operator	Region	Transport_stream_ID
TVNZ	Auckland	0x0019
	Central	0x001A
	Wellington	0x001B
	South Island	0x001C
TVWorks	National Multiplex	0x001D
	Reserved 1	0x001E
	Reserved 2	0x001F
	Reserved 3	0x0020
Kordia (National Multiplex with injection of local services)	National Multiplex	0x0021
	Reserved 1	0x0022
	Reserved 2	0x0023
	Reserved 3	0x0024
Reserved 1 Future Multiplex	Reserved 1	0x0025
	Reserved 2	0x0026
	Reserved 3	0x0027
	Reserved 4	0x0028

16.1.5 Service_id

Each service shall be associated with a 16-bit integer service_id. All service IDs on the DTT Freeview network shall be unique. A service is considered unique if its service name, scheduled events and service components are different to any other service on the network. The service_id is equivalent to the program_number used in PAT and PMT.

Table 16.2 Allocation of LCNs

Multiplexer Operator	Channel	Service_ID	LCN
TVNZ (The same service_IDs shall be allocated for each Transport_stream_ID)	TV One	0x04b0	1
	TV2	0x04b1	2
	TVNZ6	0x04b2	6
	TVNZ7	0x04b3	7
	TVNZ Sport Extra	0x04b4	20
	TVNZ reserved1	0x04b5	
	TVNZ reserved2	0x04b6	
	TVNZ reserved3	0x04b7	
	TVNZ reserved4	0x04b8	
	TVNZ reserved5	0x04b9	
TVWorks	TV3	0x0514	3
	C4	0x0515	4
	TV3+1	0x0516	8

Multiplexer Operator	Channel	Service_ID	LCN
	C42	0x0517	9
	TVWorks_reserved3	0x0518	
	TVWorks_reserved4	0x0519	
	TVWorks_reserved5	0x051a	
	TVWorks_reserved6	0x051b	
	TVWorks_reserved7	0x051c	
	TVWorks_reserved8	0x051d	
Kordia	Maori Television	0x0578	5
	Parliament TV	0x0579	22
	Kordia_reserved2	0x057a	
	Chinese TV8	0x057b	28
	PRIME	0x057c	10
	TV33	0x057d	33
	Kordia_reserved6	0x057e	
	Kordia_reserved7	0x057f	
	TVCentral	0x0580	30
	Kordia_reserved9	0x0581	
	RNZ National	0x07d0	50
	RNZ Concert	0x07d1	51
	Base-FM	0x07d2	71
	Radio Reserved 2	0x07d3	
Reserved Multiplex 1	Reserved Channels	0x05dc - 0x05e3	

16.1.6 Event_id

The event_id is a 16-bit field which contains the identification number of the described events that are listed in the event_information_tables. The event_id shall be included in the following EIT tables;

EIT_actual_p/f
 EIT_other_p/f
 EIT_actual_schedule
 EIT_other_schedule

16.1.7 Cell_id

As all transmitters for all multiplexes are co-located a cell in the Freeview DTT network represents a geographical area that is covered by all Freeview multiplexes. Each multiplex in a particular region shall be allocated a unique cell_id in the TPS parameters.

Table 16.3 DTT Transmitter Address and Cell ID Numbering Plan

	Transmitter Address			Cell ID		
	TVNZ	TVWorks	Kordia	TVNZ	TVWorks	Kordia
Auckland (01)						
Waiaatarua	10100	20100	30100	10100	20100	30100
Pine hill	10101	20101	30101	10101	20101	30101
Remuera	10102	20102	30102	10101	20101	30101
SkyTower	10103	20103	30103	10101	20101	30101
Waiheke	10104	20104	30104	10101	20101	30101
Waikato - Bay of Plenty (02)						
Te Aroha	10200	20200	30200	10200	20200	30200
Kopukairua	10201	20201	30201	10201	20201	30201
Hamilton Tower	10202	20202	30202	10202	20202	30202
Hawke Bay (03)						
Mt Erin	10300	20300	30300	10300	20300	30300
Napier Airport	10301	20301	30301	10301	20301	30301
Manawatu (04)						
Wharite	10400	20400	30400	10400	20400	30400
Wellington (05)						
Kaukau	10500	20500	30500	10500	20500	30500
Fitzherbert	10501	20501	30501	10501	20501	30501
Baxters Knob	10502	20502	30502	10502	20502	30502
Ngarara	10503	20503	30503	10503	20503	30503
Haywards	10504	20504	30504	10501	20501	30501
Christchurch (06)						
Sugarloaf	10600	20600	30600	10600	20600	30600
Dunedin (07)						
Mt Cargill	10700	20700	30700	10700	20700	30700

Format	Mux	Region	Sites
	1 - 6	1 - 99	0 - 99

SFN Sites	Sites in an SFN Must have the same Cell ID, hence retain same ID
-----------	--

16.2 Modulation Parameters

All modulators on the network will all be set to the same transmission parameters.

The settings which are ;-

Allocated Bandwidth (per Transport Stream) : 8Mhz

Transmission Mode : 8K

Modulation : 64 QAM

Code Rate : $\frac{3}{4}$

Guard Interval : 1/16

Transport Stream Data Rate : 26.346 Mbit/s

17 APPENDIX B

17.1 **Default Settings**

It is highly desirable but not mandatory (left to manufactures preference) if the receiver has the following default settings;-

Default Language of Menu : English

Default Audio Language : English

Secondary Audio Language : Maori

Default Subtitle Language : English

Secondary Subtitle Language : Maori

The Background colour of all menus set to RED

Now / Next Banner to occupy bottom third as OSD

Timeout of Now / Next Banner : 3 sec

If Receiver has Scart(s) : Default output to be CVBS

Brightness and Contrast settings set to 50%

Hearing/Visual impaired default set to off.

Default Volume Setting : -10dB relative volume

18 APPENDIX C

18.1 UHF Channel Allocation

BANDS IV/V

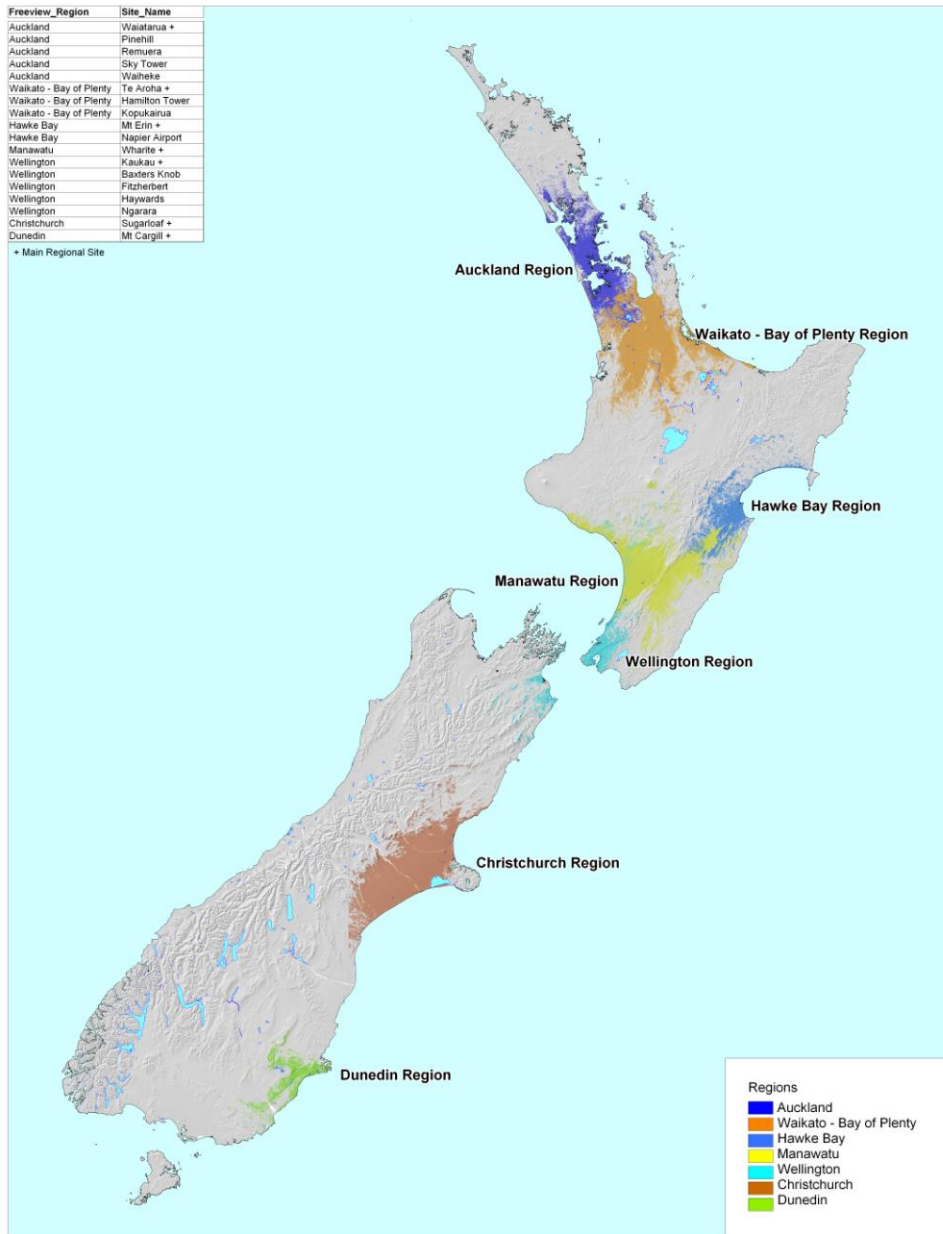
In New Zealand the usage of bands IV / V for broadcasting purposes is constrained to 502 – 806MHz.

Channel	Channel Limits (MHz)	DTT Centre Frequency (MHz)
21	470 - 478	474
22	478 - 486	482
23	486 - 494	490
24	494 - 502	498
25	502 - 510	506
26	510 - 518	514
27	518 - 526	522
28	526 - 534	530
29	534 - 542	538
30	542 - 550	546
31	550 - 558	554
32	558 - 566	562
33	566 - 574	570
34	574 - 582	578
35	582 - 590	586
36	590 - 598	594
37	598 - 606	602
38	606 - 614	610
39	614 - 622	618
40	622 - 630	626
41	630 - 638	634
42	638 - 646	642
43	646 - 654	650
44	654 - 662	658
45	662 - 670	666
46	670 - 678	674
47	678 - 686	682
48	686 - 694	690
49	694 - 702	698
50	702 - 710	706

Channel	Channel Limits (MHz)	DTT Centre Frequency (MHz)
51	710 - 718	714
52	718 - 726	722
53	726 - 734	730
54	734 - 742	738
55	742 - 750	746
56	750 - 758	754
57	758 - 766	762
58	766 - 774	770
59	774 - 782	778
60	782 - 790	786
61	790 - 798	794
62	798 - 806	802
63	806 - 814	810
64	814 - 822	818
65	822 - 830	826
66	830 - 838	834
67	838 - 846	842
68	846 - 854	850
69	854 - 862	858

19 APPENDIX D

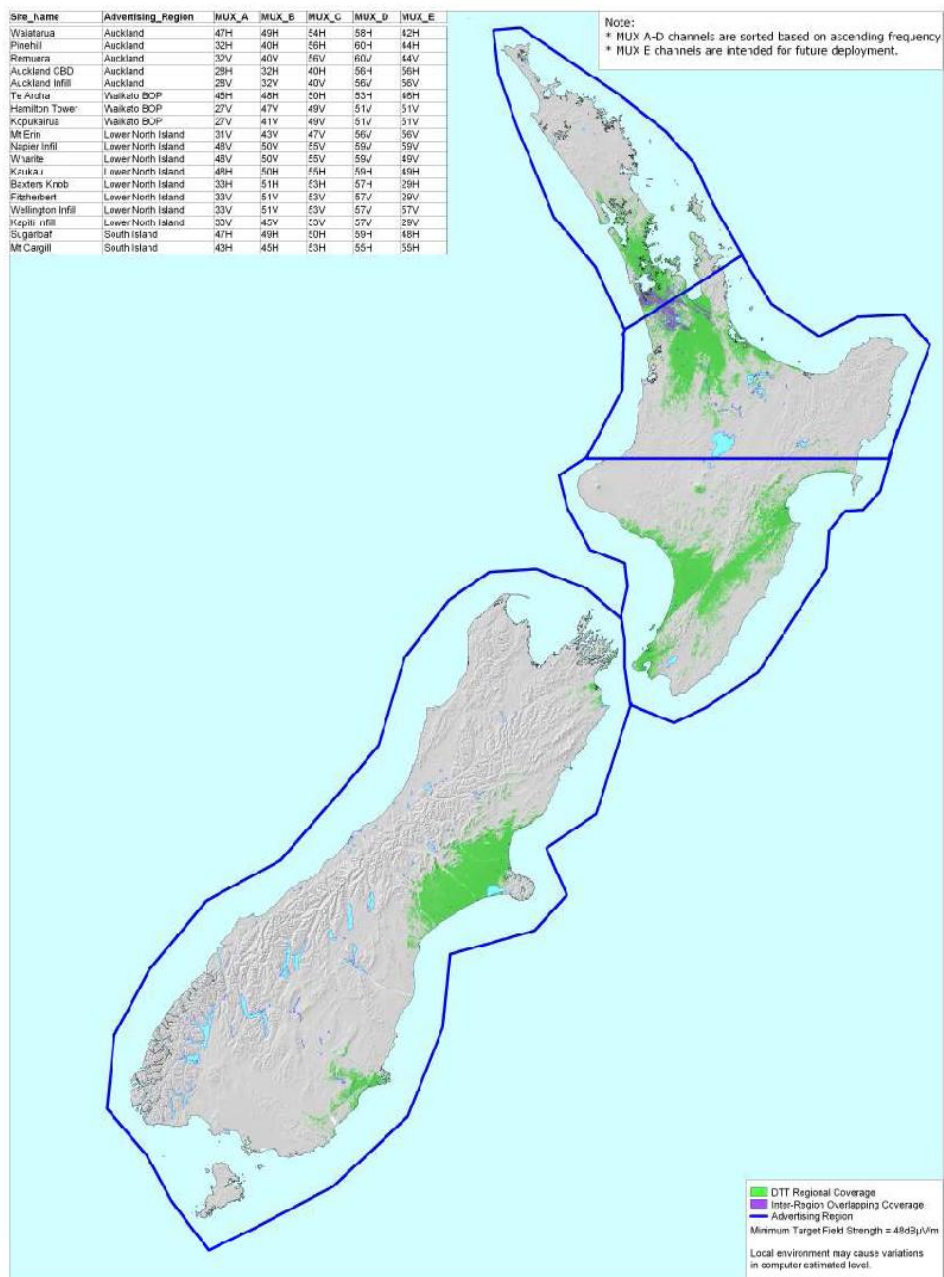
19.1 COVERAGE MAPS



NZ Freeview Regions

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TVNZ Regions



NZ DTT Coverage Map (Inter-Region Overlap)

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[END]