Free to Air Digital Terrestrial PVR (Personnel Video Recorder) Requirements Profile

For New Zealand Free to Air Digital Broadcasting

Date: 22 September 2014

Table of Contents

1 Introduction

1.1 Document History

Version	Date	Author	Details
0.9	23/5/08	S.McBride	Pre-release
0.95	03/06/08	S.McBride	First release with internal and S&T updates
0.96	02/07/08	S.McBride / S.Browning	Second release for internal updates
1.0	11/07/08	S.McBride / S.Browning	First release for manufacturers
1.1	19/11/09	S.McBride	Updated Specifications encompassing HD MHEG and MHEG Interaction channel. All changes from ver 1.3 have been highlighted.
2.0	1/7/10	S.McBride	Official Release to Manufactures References the new D-Book 6.2.1 MHEG ICEncryptedstreamExtension and LifecycleExtension
2.2	15/7/2014	G. Newman	General updates and the inclusion of the HbbTV middleware. All changes from version 2.1 have been highlighted in blue.
2.3	25/7/2014	G. Newman	Updates to the PVR Functional Requirements following the inclusion of HbbTV middleware.
3.0	16/9/2014	G. Newman	Updates relating to the EIT schedule population within the FreeviewNZ DVB-SI. All changes from version 2.3 have been highlighted in pink.

1.2 Proposition

This baseline profile, which is based upon open standards, is for a high definition (HD) Digital Terrestrial Personal Video Recorder. The Freeview DVB-T platform will not certify H.264 AVC SD PVRs.

Items in this specification are divided into 'Required' and 'Optional' categories. Where a feature is stated as 'Required', its inclusion is necessary for the achievement of a minimum compliance with Freeview transmission requirements. Additional Optional functions may be added by the vendor to enhance the consumer proposition and these will be welcomed by Freeview. In order to be compliant, where a feature is 'Optional' and is included in an offered receiver design, the optional feature must be implemented in accordance with the associated referenced standards.

This specification is not a comprehensive list of all relevant standards relating to consumer equipment that can provide digital terrestrial reception but rather a list of those standards considered relevant to Freeview requirements.

The profile is based upon open standards predominantly Digital Video Broadcasting (DVB) standards and the UK DTG D-Book or includes open implementations which are in use on the UK DTT platform. Changes and

additions have been made in this document to suit the required digital terrestrial platform in New Zealand. This most notably, includes requirements for H.264 AVC decoding (not MPEG-2) and high definition video resolution output as well as HbbTV v1.5 (ETSI TS 102 796 v1.2.1).

1.3   New Specification Requirements Introduction

Freeview NZ have implemented the ETSI TS 102 796 v1.2.1 specification for HbbTV to be the new middleware for PVRs.

HbbTV provides mechanisms for the viewer to access applications delivered via both broadcast carousels as well as bi-directional IP communications over the broadband delivery network. The application, most often initiated from the broadcast service, allows the viewer to navigate between both broadcast and broadband platforms to receive enhanced A/V content and other services. The system architecture is described in ETSI TS 102 796 v1.2.1 and the broadcast signalling is described in ETSI TS 102 809 v1.2.1. It is Freeview NZ's intention is to mimic the Freeview Australia adoption of the HbbTV v1.5 specification as laid out in Free TV Australia's OP-61 document. This will ensure that New Zealand requires minimal customisation and can take advantage of the manufacturer receivers that are destined for that and other international markets. There is currently no intention to deviate from the Free TV OP-61, ETSI TS 102 796 v1.2.1 and ETSI TS 102 809 v1.2.1 specification.

It is a requirement that all MyFreeview Personal Video Recorders (PVRs) implement the HbbTV v1.5 specification as laid out in the ETSI TS 102 796 v1.2.1.

FreeviewNZ are now fully populating the DVB SI EIT schedule with 8 days worth of data. The EIT schedule information should be made available via the "EPG" or "Guide" button on the Freeview remote control.

FreeviewNZ have implemented the ability for Huffman compression to be applied to the broadcast DVB SI strings in order to reduce bitrate usage. FreeviewNZ will initially be only applying Huffman compression to the EIT schedule short_event_descriptor. The receiver will be required to store 2 Huffman compression lookup tables as they will not be broadcast. Refer to the FreeviewNZ Transmission Rules v2.5 for more details.

All Freeview NZ receivers must adhere to the standards referenced in this document as well as the FreeviewNZ DTT Transmission Rules v2.5.

1.4   Purpose

The purpose of this document is to describe the requirements for a Freeview certified Free to Air Terrestrial receiver for New Zealand and to refer to detailed specifications that are required for conformant implementation. The profile is in the form of a hardware specification outline, together with an overview of software requirements.   The software is to be routinely capable of being upgraded via 'through-the-air-download'.

A 'Response' column is included in section 3 to enable detailed feedback on each requirement in the specification if the manufacturer wishes to advise Freeview of its products conformance or any variation from the stated function.

1.5 Scope

The document sets out to identify the baseline functional specification of a H.264 AVC HD Freeview digital terrestrial PVR only. It does not specify the requirements of a SD capable only PVR, which will not be certified for use on the Freeview DVB-T network. Terrestrial Receivers and Integrated Digital Televisions (iDTV) have separate specifications and are therefore outside the scope of this document.

It is intended that a terrestrial PVR conforming to this profile should comprise part of a domestic installation, in conjunction with an external, fixed wideband terrestrial UHF antenna input. The receiver output(s) will connect to the television display (and possibly other domestic equipment).

It is the aim of the specification to ensure that the Freeview approved receiver in New Zealand satisfies the minimum requirements of each broadcaster. The receiver will operate as defined in the "Freeview Transmission Rules for Freeview DTT Network (New Zealand)" document.

PVRs' which are capable of recording onto 'removable media' (e.g. Blu-ray disc) or distributing content over a network are subject to the Content Management restrictions as stated in section 6.2 of the NZ Freeview Transmission Rules ver. 2.5 Document.

At present there are 3 FTA DTT multiplexes in New Zealand with a future provision for a further 2 covering Bands IV and V of the UHF Frequency range. The receiver is to search and decode all multiplexes in these bands.

1.6 Glossary

AFD	Active Format Descriptor
AIT	Application Information Table
AC-3	Dolby Digital (5.1 Channel)
Alphabetic	Characters that typically represent a component of a spoken word. For example he Latin derived characters used to represent English or the Cyrillic characters ued to represent Russian.
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.

ContentHook	MHEG term defined as: Determine the encoding format of the data included or Referenced by the Content attribute.
CENC	Common Encryption
DASH	Dynamic Adaptive Streaming over HTTP
DRM	Digital Rights Management
BER	Bit Error Rate
CA	Conditional Access
C/N	Carrier to Noise Ration
CRID	Content Reference Identifier
CID	Content Identifier Descriptor
CVBS	Composite Video Baseband Signal
CVBS	Composite Video Blanking and Synchronization
DD	Dolby Digital
D-Book	See technical standards listed elsewhere in this document
DTT	Digital Terrestrial Television
DVB	Digital Video Broadcast organisation
DVB-T	DVB-Terrestrial
DTG	Digital Television Group – a UK digital television industry organisation
EBU	European Broadcasting Union
EPG	Electronic Programme Guide
EIT	Event Information Table
EPG	Electronic Programme Guide
ETSI	European Telecommunication Standards Institute

FEC	Forward Error Correction
FTA	Free to Air
Freeview	Consumer Brand and company name of the Digital Platform service provider in NZ
HbbTV	Hybrid Broadcast Broadband Television
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
May	Indicates an event or provision which is permitted, but not mandatory
MHEG-5	A standard devised for the middleware for interactive services. MHEG stands for "Multimedia and Hypermedia information coding Expert Group"
MPEG	Moving Pictures Expert Group
MP@HL	Main Profile at High Level
MP@ML	Main Profile at Main Level
Must	Indicates that a third party must comply to ensure correct operation
NIT	Network Information Table
OSD	Onscreen Display
PAL	Phase Alternating Line
PVR	Personnel Video Recorder
QAM	Quadrature Amplitude Modulation

QPSK	Quadrature Phase Shift Keying
OSD	Onscreen Display
RF	Radio Frequency
RS	Reed-Solomon
SD	Standard Definition
SDTV	Standard Definition Television
SFN	Single Frequency Network
SI	Service Information
S/PDIF	Sony/Philips Digital Interface
STB	Set-Top-Box, which is equivalent to a digital Terrestrial receiver
Shall	Indicates a mandatory provision
Should	Indicates a desirable, but not mandatory, provision
(TS)	Transport Stream: A data structure defined in ISO/IEC 13818-1
UHF	Ultra-High Frequency
UTF	Unicode Transformation Format
Y/C	S-Video Signal
YPbPr	Wideband Component Video Signal
Will	Indicates an assumption about existing states or future events

1.7   References

[D-BOOK]	"Digital Television Group: Digital Terrestrial Television, Requirements for Interoperability, Issue 6.2.1"
HDMI	"High-Definition Multimedia Interface; specification Version 1.3a"

HDCP	"High-Definition Digital Content Protection System Revision 1.1"
EN 300 468 V1.11.1	Digital Video Broadcasting (DVB) Digital Broadcasting Systems for Television, Sound, and Data Services. Specification for service information (SI) in Digital Video Broadcasting (DVB) European Telecommunication Standards Institute ETSI
TR 101 211 V1.11.1	Digital Video Broadcasting (DVB); guidelines on implementation and usage of Service information(SI)
EN 300 472 v1.3.1	Digital Video Broadcasting (DVB) Digital Broadcasting Systems for Television, Sound, and Data Services. Specification for conveying ITU-R system B Teletext in Digital Video Broadcasting (DVB) Bitstreams. European Telecommunication Standards Institute ETSI.
EN 300 744 v.1.6.1	Digital Video Broadcasting (DVB); DVB Framing structure, Channel coding and modulation for digital terrestrial television. European Telecommunications Standards Institute. ETSI.
TR 101 190 v.1.2.1	Digital Video Broadcasting (DVB); Implementation guidelines for DVB terrestrial Transmission aspects.
ETR 101 154 v1.7.1	Digital Video Broadcasting (DVB); Implementation Guidelines for the use of video and audio coding in Broadcasting Applications based on the MPEG-2 transport stream
ETSI 162	Digital Broadcasting Systems for Television, sound and data services, allocation of service information (SI) codes for digital Video Broadcasting (DVB) systems. European Telecommunication Standards Institute. ETSI.
ETSI 300 743	Digital Video Broadcasting (DVB); DVB Subtitling Systems. European Telecommunication Standards Institute. ETSI.
EN50221	Digital Video Broadcasting (DVB) Common Interface Specification for Conditional Access and other Digital Video Broadcasting Decoder Applications
ETR 289	Digital Video Broadcasting (DVB) - Support for Use of Scrambling and Conditional Access (CA) within digital broadcasting systems
ISO/IEC 14496-10 2005	Information Technology – Coding of audio visual objects – part 10 – Advanced Coding
[ETSI-MHEG]	MHEG Broadcast Profile ETSI ES 202 184 v1.1.1"

Logical Channel Numbering	The logical channel numbering specification used is the Australian variation to the UK specification. It is titled "Free TV Australia Operational Practice OP-41" and can be viewed at http://www.freetvaust.com.au/SiteMedia/w3svc087/Uploads/Documents/18efb4b4-cd30-4da4-a3ae-5fb4f4b64884.pdf
NorDig Unified ver 1.0.2	NorDig Unified Requirements for Integrated Receiver Decoders for use in cable, satellite, terrestrial and IP-based networks.
Digital TV Group	DTG Functional Specification for Digital TV Recorders. Version 1.1
Freeview NZ	TRANSMISSION RULES FOR FREEVIEW DVB-T NETWORK (New Zealand) ver. 2.5.
ETSI 102 796 v1.2.1	Hybrid Broadcast Broadband Television
ETSI 102 809 v1.2.1	Digital Video Broadcasting (DVB); Signalling and carriage of interactive applications and services in Hybrid broadcast/broadband environments
Free TV OP-61	Free TV Operational Practice OP-61 – Implementation of Hybrid Broadcast Broadband TV by Australian Free-to-air Television Broadcasters

2 Overview

This specification uses the UK DTG D-BOOK (V6.2.1) as its primary reference, in particular Chapter 22, section 8.7 of Chapter 8 UK DTT SI rules of Operation Receiver Requirements, Chapters 23-27 relating to receiver behaviour and diagnostics and the DTG Functional Specification for Digital TV Recorders Ver. 1.1 with changes/modifications to suit Digital Terrestrial Broadcasting in New Zealand. ~~It also references the work currently undertaken by the UK DTG groups on the next revision to the D-Book.~~

3   PVR Receiver Profile

The 'Manufacturers Response' column in the following table is included to enable a detailed response to each specification item.

Item No.	Resources	Reference/Detail	Notes	Manufacturers Response
1		The processing power and memory configuration of the receiver must be suitable for the routine operation of FTA HD digital Terrestrial reception (DVB-T), together with the embedded operation of HbbTV v1.5 (according to ETSI TS 102 796 v1.2.1 and FreeTV OP-61) or MHEG-5 Version 1.06. It must also be suitable for the recording of HD MPEG-4 encoded material with Dolby Digtital surround sound and the provision of the routine replacement of all software via 'through-the-air-download". If the receiver is an IP connected device with a network interface, then it should be suitable for receiving HD multimedia streams via the network interface and applying the necessary DRM to the stream in order to decrypt it; it must also be suitable for the routine replacement of all software via the IP network interface. The performance of the receiver must be such that a user does not feel that the receiver is "sluggish" whilst loading applications.		
~~1.1~~	~~DDRAM~~	~~128 MBytes~~	~~Minimum baseline functionality~~	
~~1.2~~	~~Flash~~	~~8 Mbytes~~	~~Minimum baseline functionality~~	
~~1.3~~	~~CPU Processor Speed~~	~~200MHz~~	~~Minimum baseline functionality~~	
~~1.4~~	~~HDD~~	~~250GB SATA~~	~~Minimum acceptable baseline~~	
1.5	Common Interface	CI PLUS Specification. Ver 1,2. Content Security Extensions to the Common Interface	OPT Although there are no encrypted services at present on the NZ DVB-T network. It is expected that in the future that the network will comprise of FTA and pay services. It is therefore highly recommended that all PVRs' support a CI Plus interface. This interface shall work with the MHEG-5 Profile and the HbbTV Profile (ETSI TS 102 796 v1.2.1)	

Item No.	Resources	Reference/Detail		Notes	Manufacturers Response
2	Services Summary	The PVR must give access to all NZ free-to-view broadcast digital Terrestrial television, radio and enhanced/interactive television services. This must include the capability to efficiently present radio channels, DVB subtitles, Digital Text and Enhanced Broadcast elements of all services. It must present DVB subtitles when broadcast and if requested by the viewer; manage the output video in both widescreen 16:9 and 4:3 picture formats to suit the connected display. Where possible PVRs should be able to present both subtitles and interactive graphics simultaneously. However, not all PVRs may be able to do this, the result being that interactive content will not always be available to viewers that wish subtitles to be presented.			
2.1	Time-exclusive services	Some services called time exclusive services are only broadcast for part of the day and share their multiplex capacity with other services. During periods when the service is not broadcast, generally it will be replaced by a static MHEG-5 placeholder application. The PVR shall handle the transition between the active and inactive states of a time exclusive service in an orderly fashion, presenting clean transitions into and out of video, audio and inter-active content streams without presentation of any content or application not intended for the selected service.			
3.0	Functions				
3.1	MPEG4 video	H.264 AVC Encoding	Req	ISO/IEC 14496-10 2005 (Information Technology – Coding of audio visual objects – part 10 – Advanced Coding)	
3.2	MPEG2 Video	MPEG 2 MP@ML, video resolution, 720x576 (PAL)	Opt	ISO/IEC 13818	
3.3	HDTV Formats	Resolution / Frame Rate/ Scanning / Aspect Ratio			
	1080p50	1920x1080 / 50 / Progressive / 16:9	Opt		
	1080p25	1920x1080 / 25 / Progressive / 16:9	Opt		
	1080i25	1920x1080 / 25 / Interlaced / 16:9	Req		
	720p50	1280 x720 / 50 / Progressive / 16:9	Req		
3.4	SDTV Formats	Resolution / Frame Rate / Scanning / Aspect Ratio			
	576p25	720x576 / 25 / Progressive / 16:9 and 4:3	Opt		

Item No.	Resources	Reference/Detail		Notes	Manufacturers Response
	576i25	720x576 / 25 / Interlaced / 16:9 and 4:3	Req		
		Within the Menu System and/or Remote control of the PVR an option is provided to change the output video format as required by the user. The PVR is not to output a HD format on any analogue video output ports. The PVR is to perform a downconversion or upconversion from any valid HD input resolution to a user selected video resolution output. It is optional for the PVR to upconvert a SD input resolution to any valid HD resolution on the HDMI output.			
3.4	Audio Decoding	MPEG1 Layer II /Musicam, audio mode stereo. Sampling Rate 32, 44.1 & 48KHz	Req	ISO/IEC 11172-3	
3.5		Dolby Digital (AC-3) 32, 44.1 & 48KHz – Pass Through on SPIDF.	Req	ISO/IEC 14496-3 and signalled by TS 101 154, Annex C. Only Pass through of DD audio to the Digital Audio Connector is required	
3.6		Dolby Digital (AC-3) 32, 44.1 & 48KHz – Downmix to stereo Pair	Req	ISO/IEC 14496-3 and signalled by TS 101 154, Annex C. 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 levels.	
3.7		MPEG-4 HE AAC (up to mono and stereo level 2 bitstreams only)	Req	ISO/IEC 14496-3. HE AAC audio for services will be encoded for the stereo pair. It is optional for the PVR to decode multi-channel level 4 bitstreams	

Item No.	Resources	Reference/Detail		Notes	Manufacturers Response
3.8	Subtitles	DVB Subtitles. All receivers shall be capable of decoding and presenting HD DVB subtitles in accordance to EN 300 743	Req	ETSI EN 300 743 V1.3.1 (rev 7 HD ammendent) DVB subtitles shall be invoked from a suitable labelled remote control key which is always under the control of the PVR. i.e. not under control of PVR group 3 of MHEG	
3.9	Display of subtitles during enhanced programming	Where both are components of a service, ability to simultaneously present both Subtitles and interactive application graphics if required by viewer preferences. (D-Book sections 17.4 and 15.2 Note: If simultaneous presentation is not possible either an automated transition is required or as a minimum an onscreen message to warn the user that they cannot launch the interactive application until subtitles is disabled.	Opt Req	PVRs that are capable of simultaneously presenting both subtitles and interactive application graphics must observe the rules enabling applications to suspend presentation of Subtitles where editorially required. The exception to this is the EPG application which should be invoked by the EPG and have priority even if subtitles have been invoked.	

Item No.	Resources	Reference/Detail		Notes	Manufacturers Response
3.10	Teletext	A PVR shall either: a/ have the facility to acquire teletext as defined in EN 300 472 (DVB: Specification conveying ITU-R System B Teletext in DVB Bitstreams) and reinsert it in the vertical blanking interval (VBI) of the composite video output according to specification ITU-R BT.653-2, Teletext Systems and / or b/ include a Teletext decoder as defined by ETSI standard 300 706 Enhanced Teletext Specification including up to Teletext V1.5 and display Teletext pages on the attached TV or video monitor via an on-screen-display (OSD) that can be viewed via all available video output interface signals. A suitable remote control button other than the 'TEXT' button must be provided to launch the Teletext OSD display	Req	PVRs must support Teletext either via OSD or VBI pass-through mechanisms. Providing both mechanisms is optional. The 'TEXT' RCU button is under MHEG control – see 3.11.	
3.11	Digitext	A Digitext service may be provided via an MHEG-5 Application. This will be accessed by the "TEXT" Button on the RCU.	Req	Via an MHEG-5 Application If the PVR has only one suitable labelled 'TEXT' key on the remote control then it shall follow the user cases in section 12.1 of the Freeview Transmission Rules Document	
3.12	HbbTV EPG	An EPG service will be provided via an HbbTV application carried on a bidirection IP connection. This shall be accessed via a configurable RCU button via the application.	Req	Mandatory for PVRs via an HbbTV Application	
3.13	Audio Description	D-Book Section 4 PVRs that are capable of presenting audio description shall provide at least the minimum user controls. (D-Book 4.0 section 4.5)	Opt	Design of controls should take into account that many users of audio description are visually impaired.	

Item No.	Resources	Reference/Detail		Notes	Manufacturers Response
3.14	Multi-Language Support	The PVR is to at least support a primary and secondary audio language based on the ISO 639 language descriptors associated with the audio-streams in the ISO/IEC 13818 MPEG2 transport stream.	Req	If the secondary audio language is not present then the PVR shall automatically choose the primary audio language	
3.15	Widescreen	For SD video resolution output format D-Book V4 Section 3.4 and Section 24.2	Req		
3.16	Active Format Descriptors	Ability to handle 16:9 widescreen and 4:3 picture format changes as detailed in the 'transmission rules' including support for correct aspect ratio and Active Format Descriptors	Opt	PVR may support WSS insertion on any analogue outputs	
3.16	14x9 processing	PVR may offer the option of a 14:9 (letter box) format when working with SD outputs on 4:3 displays (D-Book section 24.)	Opt		

Item No.	Resources	Reference/Detail		Notes	Manufacturers Response
3.17	OSD	Minimally Support for a 2 graphics layer model:-	Req	Video/Still Image layer. There is no requirement to display both still image and motion video at the same time, they are mutually exclusive.	
		• Image Layer (a full colour layer to display I-Frame stills captured from the video decoder)			
		Layer to support: Y=8 bit, Cb=8 bit, Cr=8 bit			
		Chroma to be sub-sampled to either 4:2:0 or 4:2:2			
		Alpha blending need not be supported, but the layer may be shown or hidden.			
		• Video Layer (a full colour layer displaying the output of the MPEG video decoder)			
		Layer to support: Y=8 bit, Cb=8 bit, Cr=8 bit			
		Chroma to be sub-sampled to either 4:2:0 or 4:2:2			
		Alpha blending need not be supported, but the layer may be shown or hidden.			
		• OSD/Graphics Layer (an 8-bit palletised layer which can display region-based graphics)		A palletised layer is the minimum requirement. Alternatively True Colour can be utilized	
		Each CLUT palette entry to support: Y=8 bit, Cb=8 bit, Cr=8 bit			
		Chroma to be sub-sampled to either 4:2:0 or 4:2:2			
		Alpha blending to be either 6 bit across the entire layer, or 2 bit per pixel			
		• Graphics Layer			
		HD Graphics layer shall comply with the HD graphics layer as specified in D-Book 6.1 section 14.11.1.1		HD MHEG extensions	

Item No.	Resources	Reference/Detail		Notes	Manufacturers Response
3.18	PVR Character Set	The Character set of the PVR shall be the Character code table 00 – Latin Alphabet as specified in IS0 6937.		Req	EN 300 468 Annex A	
3.19	Parental rating	DVB Rating: - 0 x 00 - 0 x 06 - 0 x 08 - 0 x 0C	NZ Translation: - undefined - G (to 9 years) - PGR (to 11 years) - AO (to 15 years)	Req	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 . See PVR functions section in the PVR functionality section for use of parental ratings to control viewing of recorded programmes.	
4.0	**Tuner / Decoder**	In accordance to EN300 744 Rev R1.4.1		Req		
4.1	No. Of Tuners	2		Req	Minimum	
4.2	RF input connector	IEC 60169-2		Req		
4.3	RF loop-through connector	IEC 60169-2		Req		
4.4	Loop-Through Gain	0 dB typical		Req		
4.5	Input impedance	75 ohm nominal		Req		
4.6	Modulation	COFDM		Req		
4.7	UHF Frequency Range	514 MHz to 682MHz		Req	Minimum requirement. 474MHz to 858MHz is acceptable	

Item No.	Resources	Reference/Detail				Notes		Manufacturers Response
4.8	Channel Bandwidth	8Mhz (Signal Bandwidth 7.61MHz) The PVR shall be able to receive carriers within an offset of up to 50KHz from the nominal centre frequency			Req			
4.9	Input Signal Level / Receiver Sensitivity	Required signal power (dBµV) for 2x10-4 post Viterbi			Req	Guassian transmission channel assumed		
		Modulation	Code Rate	Guassian dBµV				
		QPSK	½	15.2				
			2/3	17.0				
			¾	18.0				
			5/6	19.0				
			7/8	19.8				
		16-QAM	1/2	20.9				
			2/3	23.3				
			¾	24.7				
			5/6	25.7				
			7/8	26.1				
		64-QAM	1/2	26.6				
			2/3	28.8				
			¾	30.4				
			5/6	31.9				
			7/8	32.8				
4.10	PVR Noise Performance	Better than 7dB noise figure in the UHF Band IV and V			Req			

Item No.	Resources	Reference/Detail		Notes	Manufacturers Response
4.11	PVR implementation Margin	Better than 1.5dB	Req	With reference to C/N values given in the D-Book, section 9.12, for all modulation and code rates listed.	
4.12	Interference Immunity	Values as stated in Tables 14, 15, 16, 17, 18, 19, 22 and 23 ITU-R BT. 1368-6 document	Req		
4.13	FFT Size	PVR shall be capable of detecting and presenting services transmitted using 2K and 8K carriers.	Req		
4.14	Demodulation	QPSK, 16 QAM and 64 QAM	Req	As specified by EN 300 744.	
4.15	Forward Error Correction Codes	½, 2/3, ¾, 5/6 7/8, Auto	Req		
4.16	Guard Interval	Tu/4, Tu/8, Tu/16, Tu/32	Req		
4.17	SFN Operation	There shall be regions mainly in metropolitan areas of New Zealand where SFN will be in use.	Req	TS 101 191 V1.4.1 (06/04) Mega-frame for Single Frequency Network (SFN) synchronization	
4.17a	Tolerance to Equal Amplitude SFN Signals	The PVR shall continue to correctly demodulate and decode the DVB-T signal in an SFN environment when there are two or more signals of equal amplitude present at the PVR input, provided the maximum time difference between the signals is less than 90% of the guard interval. It is assumed the amplitude of each signal is greater than that specified in 4.8	Req		
4.17b	FFT Window Positioning Strategy	Manufacturers are requested to advise of which of the 5 generic strategies described in [EBU SFN PVR Paper] is used to synchronise the start of the FFT time window when there are several SFN signals present at the PVR input. This information is requested to assist Freeview in modelling SFN coverage only.	Req	[EBU SFN PVR Paper] "OFDM PVRs - Impact on coverage of inter-symbol interference and FFT window positioning", R.Brugger & D.Hemingway, EBU Technical Review, July 2003	

Item No.	Resources	Reference/Detail		Notes	Manufacturers Response
4.18	Scanning for Multiplexers	On the initial scan the PVR may perform an automatic scan based on the NIT information or a full UHF based auto scan. It shall find all DTT multiplexers within its cell and shall tune in to the correct DVB structure, channel coding, modulation and shall display all services. After a scan the channel list shall contain only valid channels currently active on the network. It addition to an automatic search it shall be possible to perform a manual search where the channel number (id) or frequency is entered. New channels shall be added to the service list. No duplicated channels shall be displayed in the service list. Refer to the Freeview NZ Transmission Rules v2.5 for clarification around the reception of duplicate services and the Service_Availability_Descriptor.	Req	The PVR shall not perform a 'scanAdd' function thereby leaving old services within a channel list.	
5.0	**Over-Air Software Download**	The PVR shall support DVB System Software Update (SSU) to at least the simple profile. ETSI TS 102 006 refers.	Req		
6.0	**Service Information & Selection Summary**	After a PVR is installed it must offer the viewer all services that may be received in that geographic region compliant with the Freeview regional services requirement which utilises the service_availability_descriptor signalled within the SDT. The services being broadcast may change over time. To ensure that the viewer is always able to access all services being broadcast to the selected region, the PVR must detect and reflect to the viewer any such changes with minimal viewer involvement. All services have an associated (Logical) Channel Number. Use of the logical channel number ensures that the viewer becomes familiar with a specific remote control unit button number for each channel. Access to, and use of, accurate service information is essential if the viewer is to enjoy all of the content being broadcast. PVRs must offer a complete list of available services and information as carried in *'DVB S.I. EIT present/following'* about the current and following programmes. A comprehensive multi-day programme schedule will be broadcast in the '*DVB SI EIT schedule*' and as an HbbTV v1.5 application to the receiver. Refer to the Freeview NZ Transmission Rules v2.5 for clarification around the reception of duplicate services and the Service_Availability_Descriptor.			

Item No.	Resources	Reference/Detail		Notes	Manufacturers Response
6.1	Scanning for Services	The PVR shall be capable of automatically detecting changes in the services configuration of each broadcast transport stream provided that such changes are implemented by the broadcaster in accordance to the 'transmission rules' and are compliant with the DVB-SI standards, [ETSI EN 300 468], [TR 101 211]. The intent of this requirement is to allow the broadcaster to vary the services offering within the relevant broadcast transport stream(s) without the viewer needing to rescan the PVR. Refer to the Freeview NZ Transmission Rules v2.5 for clarification around the reception of duplicate services and the Service_Availability_Descriptor.	Req		
6.2	Logical channel numbers	Ability to locate, store and handle services with Logical Channel Numbers (LCNs) within the ranges of 1 to 799.	Req		
6.3	Identification of service changes	Automatic identification / storage of services or service changes, without the need for user intervention, by reference to the NIT and/or SDT. It shall be without disturbance to the viewer and shall not require a rescan.	Req		
6.4	Selection via service list	The initial displayed service list following a full automatic scan must present services in ascending order of LCN.	Req		
6.5	Selection via numeric entry	Service selection via numeric entry shall always select a service with a corresponding LCN regardless of any viewer favourites	Req		
6.6	Hidden services	Services identified as "hidden" in the LCN descriptor shall not appear in the service list presented to the viewer. In addition such services shall also be identified as selectable by numeric entry.	Req		

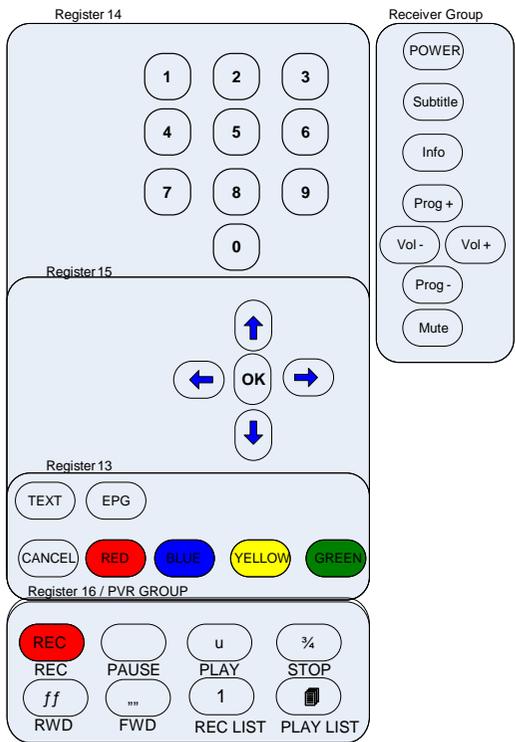| Item No.	Resources	Reference/Detail		Notes	Manufacturers Response
6.7	ESG "Now/Next"	'Now / Next' screen guide shall be derived using information from DVB SI EIT p/f tables as per EN 300 468. The presentation of the now/next banner is as per manufactures chosen user interface but it is desirable for the following information to be displayed in the bottom third of the screen. Programme Title (event name) Start time of now and next programme End time (or duration) of now and next programme Logical Channel Number Channel Name Date Current time Access to the programme synopsis (short event descriptor) by single (i) button press.	Req	The ESG "Now and next" should be displayed when the user changes channels for approx 2 secs and may also be launched using the i (info) button on the remote control. If a descriptor is missing from the EIT table – the PVR shall <u>not</u> display an error message.	
6.8	EPG "Schedule"	An 8-day EPG will be provided as an MHEG-5 application. This application will be invoked using the EPG or 'GUIDE' button on the remote control if the manufacturer chooses to implement the MHEG-5 middleware. An 8-day EPG will be provided as an HbbTV application. This application will be invoked using a configurable button on the remote control controlled by the application if the manufacturer chooses to implement the HbbTV middleware. An 8-day EPG "Schedule" will be offered via the DVB SI EIT schedule sub-tables which should be accessed via the "EPG" or "Guide" button. The manufacturer must comply with the requirements as laid out in Section 1.3 of this document.	Reg	If a native EPG based is resident in the receiver this can be invoked by the receivers menu system. Note Freeview broadcasts CRID data in the $EIT_{schedule\ and}$ EIT_{pf} information for recording devices. See section 5.12 of the Freeview Transmission Rules Document v2.5	

Item No.	Resources	Reference/Detail		Notes	Manufacturers Response
6.9	Huffman Compression	The receiver will be required to be able to decompress DVB SI strings compressed with Huffman compression. The receiver will be required to store at least two Huffman compression static lookup table. These tables will be of approximately 10KB in size each and will be used by the receiver as a reference library in order for the receiver to decompress the Huffman compressed DVB SI strings according to the FreeviewNZ Transmission Rules v2.5. Any DVB-SI data that is stored on the receiver shall be stored in an decompressed format in order to make it available for other entities, such as the HbbTV middleware and the DVB-SI based EPG.	Req		
6.10	TDT / TOT	The PVR shall have a real time clock / calendar running continuously. The clock shall be updated by the incoming TDT and TOT table in the SI. The PVR shall display the local time.	Req	EN 300 468 Alternatively the PVR may perform its own 'DST' Computation to calculate the local time	
7.0	Copy Protection				
7.1	Digital Outputs	The PVR will provide HDCP digital content protection on the HDMI output. .	Req	HDCP shall be enabled at all times and a user option shall not be provided to disable this function	
7.2	Content Management	The PVR shall provide content management on the signalled content as defined in section 6.2 of the NZ Transmission Rules Document.	Req		
8.0	Set-up and I/O				

Item No.	Resources	Reference/Detail		Notes	Manufacturers Response
8.1	Easy to use and simple documentation	PVRs shall be simple to set up and operate and be provided with clear easy to understand user documentation in line with that requirement. D-Book Section 26.	Req		
8.2	Support package	The following peripheral items should be included within a baseline PVR package:			
		♦ An RF lead/cable for connection of loop-through connector from output of first tuner into the RF input of second tuner (male IEC connectors each end)	Req	Unless the loop through to the second tuner is provided internally	
		♦ Composite (CVBS) and stereo audio RCA cable. (1m min length)	Req		
		♦ Component video and stereo audio RCA cable(s) (1m min length)	Opt		
		♦ HDMI Cable	Opt		
		♦ SCART cable (1m min length, secure fixing type, fully connected; internal screening on appropriate connections. EN 50049);	Opt		
		♦ Remote control and batteries	Req		
		♦ An easy to understand user manual in English language.	Req		
8.3	Status	A basic status check may be invoked by a menu driven option or a user selected key. The OSD is to present the reception quality, signal strength indicator, Channel ID and Video and Audio PIDs	Opt		
9.0	**Outputs**				
9.1	Primary output	HDMI (HDCP)	Req	Support for AC-3 via the HDMI is strongly recommended but remains optional	

Item No.	Resources	Reference/Detail	Notes		Manufacturers Response
9.2	Secondary output	RCA (phono) providing: Component YPbPr	OPT	Shall only provide SD video resolution (max: 720x576P) output. Shall meet the characteristics in ITU report 624-4	
9.3	Secondary Output	RCA (phono) providing composite (CVBS) video	Req	Shall meet the characteristics in ITU report 624-4	
9.4	Secondary output	TV SCART with both composite (CVBS) and RGB or YPbPr selectable Audio output (L,R). SCART shall support widescreen switching on pin 8.	Opt	Shall only provide SD video resolution (max: 720x576P) output. EN 50049-1	
9.5	Analogue Phono Audio	RCA Audio left (Colour – white) & Right (Colour – Red) connectors	Req		
9.6	Dolby Digital	S/PDIF for pass through of Dolby Digital (AC-3) Either an Optical and/or Coaxial Digital Audio Output(s)	Req	Manufacture are requested to state connector type	
9.7	UHF Modulator	RF Connector – 75 ohm, IEC 169-2, Male/Female Frequency – 470 to 860 MHz TV Standard PAL BG/I/DK Preset Channel – 22 Tuneable to UHF channels 21 to 69	Opt		
9.8	RF loop-through	RF Loop through connector	Req		
9.9 See 9.12 below	IP connection	RJ 45 (Ethernet IEE802.3)	Req	The PVR shall have an Ethernet connection to support any future two-way IP based connectivity.	

Item No.	Resources	Reference/Detail	Notes		Manufacturers Response
9.10	Data Interface	The PVR shall have a data interface to perform software upgrades and should comply to one of the following options;- An RS232 connector 9 pin D sub Universal Serial Bus RJ 45 (Ethernet IEE802.3) Memory Stick	Req		
9.7	NETWORK INTERFACE	To support the HbbTV (ETSI 102 796 v1.2.1) middleware. It shall be of at least 100BaseT (IEEE 802.3u) speed or higher. This does not preclude an additional Wi-Fi (IEEE 802.11b/g/n/ac) network interface.	Req	Ethernet or IEEE 802.11 The network interface shall also adhere to the content management usage rules as defined in section 6.2 in the Transmission Rules Document	

Item No.	Resources	Reference/Detail		Notes	Manufacturers Response
9.12	Remote Control	A Remote Control is to be supplied with the PVR. It is suggested that the remote control should follow D-Book chapter 25. The basic key functions and button labels should be as drawn below. Note: this is not a recommended layout.	Req	The EPG button will launch a schedule service based around the available data broadcast in the EIT schedule sub-tables. The TEXT or another suitable labelled button on the remote is to initially launch a DVB Teletext service. The coloured buttons will launch any available HbbTV Interactive application when broadcast. All other buttons as D Book Chapter 25 "Remote Control Key Labelling The multimedia buttons (Play, Stop, Pause etc) should be able control media stored or made available to the receiver as well as control media being streamed via the HbbTV engine.	

Item No.	Resources	Reference/Detail		Notes	Manufacturers Response
10.0	**Maintenance & upgrade** **Summary**	To allow for software changes in either, PVRs must be upgradeable in a practical manner, i.e. over-air download. The process of upgrading should cause minimal disruption to the viewer. However, to minimise the diversity of deployed software builds and to most efficiently use the available broadcast capacity, the PVR must detect and act upon the broadcast of a relevant software download within 24 hours of its transmission commencing.			
10.1	Auto-upgrade	PVRs shall be capable of automatic (i.e. not user initiated) software upgrade by over-air download with minimal interruption to the viewer and within 24 hours of availability of the download under normal operating conditions.	Req	DVB Specification for System Software Update in DVB Systems TS 102 006 ver 1.3.1. See DTT Freeview Transmission Rules Document section 9.	
10.2	Download mechanism	Support for the use of DVB SSU, to at least the simple profile as defined in ETSI TS 102 006 is required.	Req		
10.3	Downloads in any carrier signal.	PVRs shall be able to handle the presence of software downloads in any NIT referred carrier signal.	Req		
10.4	Middleware	A compliant HbbTV v1.5 ETSI TS 102 796 v1.2.1 engine.	Req	Including MPEG DASH and MPEG CENC	
11.0	**Compliance**	A receiver shall comply with:			
11.1	DVB	ETSI standards as listed in the relevant sections of this specification and the DVB-T Freeview Transmission Rules document.	Req		
11.2	Freeview NZ	Compliance with DVB-T Freeview Transmission Rules document – including PVR extensions.	Req		
11.3	HD MHEG 5	Recievers shall support the HDVideoExtensions and HDGraphicsPlaneExtensions as defined in D BOOK ver 6.2.1 section 14.11 and related sections plus the additional NZ extensions as detailed in section 11.1 of the NZ Transmission Rules Document.	Req	Refer to section 11.2 of the NZ Transmission Rules Document v2.0 for the full MHEG-5 Engine requirements	

Item No.	Resources	Reference/Detail		Notes	Manufacturers Response
~~11.4~~	~~MHEG 5 Interaction Channel~~	~~PVRs' shall support the MHEG 5 Interaction channel Extensions and the ICStreamingExtensions as defined in the D-Book ver 6.2.1 sections 17.7 and related sections.~~	~~Req~~		
11.3	HbbTV	Receivers shall support the HbbTV v1.5 specification according to the ETSI TS 102 796 v1.2.1, the FreeTV OP-61 specification and the FreeviewNZ Transmission Rules v2.5	Req		
11.4	HbbTV DRM	Receivers with HbbTV middleware shall implement a DRM solution consisting of at a minimum, either Microsoft Playready or Marlin. A receiver may implement both or additional DRM solutions such as Apple's FairPlay etc if they so choose. MPEG CENC shall also be supported.	Req		
11.5	Resident EPG	A firmware based resident 7 day EPG utilising the data present in the DVB-SI EIT/Schedule in order to present the programme schedule for each service listed within the receiver's service_list. This EPG must comply with the requirements as listed in the PVR Functional Requirements.	Req		
11.5	Energy standards	A new Australian and New Zealand energy standard for digital television PVRs is currently being drafted. PVRs will need to comply with this standard once ratified.	Req	Manufactures to state PVR power consumption in normal operating mode and standby mode.	
11.6	AS/NZS CISPR 14-1 OR EN55013	EMC emissions Household appliances, electric tools and similar equipment EMC emissions broadcast receivers	Req		
11.7	EN55020	Broadcast receiver product immunity	Opt		

Item No.	Resources	Reference/Detail		Notes	Manufacturers Response
11.8	AS/NZS 60065:2003	Audio, video and similar electronic apparatus - Safety requirements	Req		
11.9	AS/NZS 61000.3.2:2007	Electromagnetic compatibility (EMC) - Limits - Limits for harmonic current emissions (equipment input current less than or equal to 16 A per phase)	Opt		
11.10	AS/NZS 61000.3.3:2006	Electromagnetic compatibility (EMC) - Limits - Limitation of voltage changes, voltage fluctuations and flicker in public low-voltage supply systems, for equipment with rated current less than or equal to 16A per phase and not subject to conditional connection	Opt		
11.11	AS/NZS 61000.4.2:2002	Electromagnetic compatibility (EMC) - Testing and measurement techniques - Electrostatic discharge immunity test	Opt		
11.12	AS/NZS 61000.4.4:2006	Electromagnetic compatibility (EMC) - Testing and measurement techniques - Electrical fast transient/burst immunity test	Opt		
11.13	AS/NZS 61000.4.5:2006	Electromagnetic compatibility (EMC) - Testing and measurement techniques - Surge immunity test	Opt		
11.14	AS/NZS 61000.4.11-2005	Electromagnetic compatibility (EMC) - Testing and measurement techniques - Voltage dips, short interruptions and voltage variations immunity tests	Opt		

4   Key Elements of Software

A number of software elements, in addition to those required for basic services, will need to be available or developed prior to launch. They are:

4.1   EPG

An 8-day EPG service will be broadcast on all Freeview multiplexes as a DVB SI EIT schedule as well as an HbbTV application.   These Applications will enable the user to navigate through all platform services with the HbbTV application also providing the ability to look back in time and access media via a "reverse" EPG. This reverse EPG will link to a broadcasters own HbbTV VOD application. The user experience of the EPG application should be consistent across all receivers.

4.2   Subtitles

According to EN 300 743 v1.3.1– Digital Video Broadcast (DVB); Subtitling Systems.

4.3   Interactive Services

These services will be developed utilising HbbTV applications.

4.4   Software Upgrades

A service for providing firmware updates to PVRs will be available on the home transport stream using the DVB specification for SSU.

4.4.1.   All conforming PVRs shall be capable of a systems software update using the simple profile defined in – ETSI TS 102 006.

4.4.2.   Manufacturers shall ensure that the PVR offered shall only respond to a unique OUI code, (Organisation Unique Identifier). This means that the PVR offered shall not react to any other OUI from any other manufacturer nor react to any other OUI from the same company which relates to a different model PVR.

4.4.3.   The default DVB-SSU mode for PVRs shall be with DVB-SSU "enabled".

4.4.4.   For Conformance testing manufacturers will be required to deliver two ASI transport streams containing relevant converted binary image files, together with all relevant NIT and PMT data necessary for their PVR to properly undergo a successful DVB-SSU operation.   One stream will

replace the software in the PVR as demonstrated by a new version number, or some other visible indicator, the other will restore the PVR to its then current configuration.

4.5   Logical Channel Numbering

The logical channel numbering specification used is based on the Australian and French variation to the UK specification. For more information see "Transmission Rules For The Freeview DTT Network ver 2.0 document

4.6   PVR Functional Requirements

4.6.1.   Overview

The PVR functions as specified in 4.6.2 below are modelled on those in the 'DTG functional specification for Digital TV recorders' as used for 'Freeview Playback' in the UK. It expands on these functions so as to specify the minimum booking, recording, and playback functions required for a conformant Freeview NZ PVR. It specifies which functions will be presented to the user as part of the HbbTV EPG application, the interaction between the EPG and the PVR, and which functions are required to be performed by the PVR itself.

In the following sections a number of references to "Recording List" and "Playback List" are made. The Recording List is the list of programmes or series that have been booked for recording but that has not yet been recorded. The Playback List is the list of content that has already been recorded or is in the process of being recorded.

The required information for the PVR to be able to make scheduled recordings will exist in two places; the first being the FreeviewNZ HbbTV EPG application and the second being the DVB SI EIT/schedule data. The PVR shall be able to launch a DVB SI EIT/Schedule based EPG (using the PVR's own firmware EPG) from the EPG/Guide button and an HbbTV EPG from the green colour button on the remote control. Both will allow the receiver to make recording bookings but the functionality is different for the two environments.

The DVB SI EIT schedule based EPG will allow single event programme booking and series bookings based on the TVAnytime CRID information carried in the DVB SI EIT/Schedule data, whereas the HbbTV EPG will only allow single event, time based, programme bookings to be made.

The HbbTV v1.5 ETSI TS 102 796 v1.2.1 specification currently does not include the ability to handle the interaction of TV Anytime CRIDs between the HbbTV engine and the SI/PVR engine. A partial set of Schedule Recording API's was implemented that allowed a static recording event to be passed from the HbbTV engine to the PVR engine but a manufacturer may choose to implement the full Scheduled Recording APIs as per the OIPF-T1-R2 Specification Volume 5 Declarative Application Environment v2.3 as the FreeviewNZ HbbTV EPG application will contain the Programme and Series ID CRIDs.

The detailed HbbTV engine and SI/PVR engine signalling instructions are as specified in the Freeview Transmission Rules Document ver 2.5, ETSI TS 102 796 v1.2.1 and OIPF-T1-R2 Specification Volume 5 - Declarative Application Environment v2.5.

Where an HbbTV PVR is unable to handle the CRID data carried in the EPG data stream, the HbbTV engine will pass the timing information of the booking to the PVR via the Scheduled Recording APIs as defined in Annex A of the ETSI TS 102 796 v1.2.1 specification and the OIPF-T1-R2 Specification Volume 5 Declarative Application Environment v2.3. The PVR will then enter a recording booking into its PVR engine according to this data.

Where a receiver is utilising the DVB SI EIT Schedule information in order to make programme or series bookings/recordings, then the receiver shall take advantage of the TVAnytime CRID information that accompanies the programme in order to allow the PVR to set accurate programme and series bookings.

4.6.2. PVR Functions

Item No.	Resources	Reference/Detail		Notes	Manufacturers Response
1	**Programme bookings – DVB SI Resident EPG**				
1.1	Book	The EPG shall handle the booking of a programme and send a 'PVR_make booking' instruction to the PVR. The PVR shall return a return code to the EPG according to the success or failure of the operation, as described in Table 12.6 Arguments, of the Freeview DTT Transmission Rules ver 2.2 Document. This information may be used to inform the user of the outcome via the EPG.	Req	Any successful booking made via the EPG shall indicate success via an onscreen icon [R] against that programme listing.	
1.2	Cancel	The EPG shall handle the cancellation of a previously booked programme by sending a 'PVR_cancel booking' instruction to the PVR. The PVR shall return a return code to the EPG according to the success or failure of the operation, as described in Table 12.6 Arguments, of the Freeview DTT Transmission Rules ver 2.2 Document. This information may be used to inform the user of the outcome via the EPG.	Req	The EPG shall display a "are you sure you want to cancel this programme booking?" dialog before the 'cancel booking' instruction is sent. For a successful cancelled booking the EPG shall indicate success by no longer displaying the onscreen icon [R].	
1.3	List	A successful programme booking shall be listed in the Recording List until the time at which the programme has started or finished recording. At the time of recording the entry shall be removed automatically from the Recording List and an entry shall be made in the Playback List. Once in the Playback List all information about the programme shall be obtained from EIT p/f.	Req		
2	**Programme bookings – HbbTV based EPG**				

Item No.	Resources	Reference/Detail	Notes		Manufacturers Response
2.1	Book	The HbbTV EPG shall pass the following properties to the PVR engine via the HbbTV API when a programme is booked for recording: startPadding endPadding name description startTime duration state parentalRatings channel	Req		
2.2	Book	Based upon the startTime and the channel data passed from the HbbTV EPG, the PVR should cross reference the DVB SI EIT/Schedule data and populate the recording list with the programme therein that has the corresponding startTime on that channel. This booking should be treated as per a normal DVB SI EIT/Schedule based recording.	Opt	If this is not implemented by the PVR, then the PVR should book a programme recording as a time based recording based upong the properties passed from the HbbTV EPG.	
2.3	List	A successful programme booking shall be listed in the Recording List until the time at which the programme has started or finished recording. At the time of recording the entry shall be removed automatically from the Recording List and an entry shall be made in the Playback List. Once in the Playback List all information about the programme shall be obtained from EIT p/f.	Req		

Item No.	Resources	Reference/Detail		Notes	Manufacturers Response
3	**Series bookings – DVB SI Resident EPG**				
3.1	Book	The EPG shall handle the booking of a programme that is also part of a series. If the viewer books a programme that is also part of a series the EPG will present them with a dialog that will allow them to make the choice between recording the programme only and recording the series only. The EPG will then send a 'PVR_make booking' instruction to the PVR. The PVR shall return a return code to the EPG according to the success or failure of the operation, ~~as described in Table 12.6 Arguments, of the Freeview DTT Transmission Rules ver 2.0 Document.~~ This information may be used to inform the user of the outcome via the EPG.	Req	~~Any successful series booking made via the EPG shall indicate success via an onscreen icon [S] against all programmes in that series.~~ If a programme that is part of a series has already been booked for recording (i.e. not as part of the series) and this is subsequently rebooked as a series the original programme booking shall be removed from the booking list automatically and the series used instead. This logic shall be handled entirely by the PVR meaning the EPG shall NOT need to send a Cancel Programme message before sending a Book Series message to the PVR. The process of booking the series shall automatically cancel the previously made programme booking. For the initial version of the profile each programme may be signaled as being in zero or one series only (i.e. a programme cannot be part of two different series). As specified in [DBook] section 8.7.2.1 Series Recording – the PVR is expected to store and track a series for up to 13 weeks between occurrences and then discard it.	

Item No.	Resources	Reference/Detail	Notes		Manufacturers Response
3.2	Cancel	The EPG shall handle the cancellation of a previously booked series by sending a 'PVR_cancel booking' instruction to the PVR. This will cancel the series booking. The PVR shall return a return code to the EPG according to the success or failure of the operation, ~~as described in Table 12.6 Arguments, of the Freeview DTT Transmission Rules ver 2.0 Document.~~ This information may be used to inform the user of the outcome via the EPG.	Req	The EPG shall display a "are you sure you want to cancel this series booking?" dialog before the 'cancel booking' instruction is sent. ~~For a successful cancelled booking the EPG shall indicate success by no longer displaying the onscreen icon [S].~~	
3.3	Display	The display of programmes selected for recording shall include an indication if the programme is included as a consequence of being one programme or part of a series.	Req		
3.3	List	A successful series booking shall be listed in the Recording List and shall remain in the Recording List after each programme in the series is recorded. At the time of recording each programme in the series an entry shall be made in the Playback List for that programme and all programme information shall be obtained from EIT p/f. The Recording List entry for the series shall be removed automatically after a period of 13 weeks in which no programme from the series has been found.	Req		

Item No.	Resources	Reference/Detail		Notes	Manufacturers Response
4	**Alternate Instance bookings**				
4.1	Book	If a booking is made that causes a conflict, the requested booking shall be checked for alternate instances. If an alternate instance is available that enables the requested programme or series to be recorded at another time this shall be used instead of the selected instance of the programme or series. ~~An "Alternate instance booked" return code shall be passed back to the EPG. If the alternate instance conflicts and no further alternate instances of this event are available the requested booking shall fail and the PVR shall present a conflict resolution dialog~~. This shall occur subject to any device limitations (e.g. available space). Note: Previously booked programmes or series (that are causing the conflict) need not be checked for alternate instances. Alternate instance bookings shall be available for programme and series bookings.	Req	~~When a conflict is found for a requested booking the PVR shall check for an alternate instance that does not conflict and an "alternate instance booked" return code shall be passed back to the EPG. The EPG shall then display a warning to the viewer that although the event has been booked it may actually be recorded at a different time to that selected in the EPG.~~ ~~The EPG shall indicate that the alternate instance programme is to be recorded via an onscreen icon [R] (for programme bookings) or [S] (for series bookings) against that programme listing.~~	
4.2	Cancel	The cancellation of a previously booked programme that happens to have been booked as an alternate instance shall be handled the same as a programme booking cancellation.	Req	~~For a successful cancelled booking the EPG shall indicate success by no longer displaying the onscreen icon [R] or [S] as appropriate.~~	

Item No.	Resources	Reference/Detail		Notes	Manufacturers Response
5	**Split Event bookings**				
5.1	Book	A programme may consist of multiple events (for example, a movie divided into two parts by another programme). Split events shall be handled in the same way as standard programme bookings. No special message is required. All segments of the event shall be highlighted as being booked in the EPG.	Req	If a programme entry exists in the schedule twice as a complete programme and as a split event these shall be considered to be the same content and may be considered when conflict occurs and an alternate instance is available.	
5.2	Cancel	The EPG shall handle the cancellation of a previously booked programme by sending a 'PVR_cancel booking' instruction to the PVR. The PVR shall return a return code to the EPG according to the success or failure of the operation, as described in Table 12.6 Arguments, of the Freeview DTT Transmission Rules ver 2.5 Document. This information may be used to inform the user of the outcome via the EPG.	Req	The EPG shall display a "are you sure you want to cancel this programme booking?" dialog before the 'cancel booking' instruction is sent. For a successful cancelled booking the EPG shall indicate success by no longer displaying ~~the onscreen icon [R] or [S] as appropriate.~~ the programme as being to be recorded.	
5.3	Playback	Split events when recorded may be stored as separate entries to enable the viewer to start watching the programme from the start of any part. If the split events are stored as one entity then a marker point is to be set at the beginning of the second event for quick access to the user. Each part shall be linked so that when the viewer plays them back in sequence they do not have to manually select the subsequent parts.	Req		

Item No.	Resources	Reference/Detail		Notes	Manufacturers Response
5	**Recommendations bookings**				
5.1	Book	The EPG shall handle the booking of a programme that includes recommendations. If the user books a programme that includes recommendations the EPG will present them with a dialog that offers them the choice of booking the recommended programme(s) and the requested programme or just the requested programme. If the user agrees to book a recommendation that is a series the PVR should book that series. If a recommended programme or series includes alternate instance information, this shall be used to minimise any conflicts. The EPG will then send a 'PVR_make booking' instruction to the PVR for each programme or series listed as a recommendation as well as the requested programme booking. The PVR shall return a return code to the EPG according to the success or failure of the operation, as described in Table 12.6 Arguments, of the Freeview DTT Transmission Rules ver 2.0 Document. This information may be used to inform the user of the outcome via the EPG.	Req	Any successful booking made via the EPG shall indicate success via an onscreen icon [R] or [S] (depending on whether it is a programme or series booking) against that programme listing. Recommendations are simply ways of linking programmes in scope of the current EPG. Recommended programmes and series are therefore booked in exactly the same manner as standard programmes and series and they must therefore adhere to the same rules as standard programmes and series. A recommended programme must exist in the scope of the current EPG. A recommended series must include at least one programme in that series in scope of the current EPG. Recommendations shall not be self referential so shall not reference either the current Programme or the current Series. It shall be possible to recommend another programme AND the series in which that programme is included as long as the recommended series does not also include the current programme. The programme only or the series only shall be booked using the logic described in 2.1.	

Item No.	Resources	Reference/Detail	Notes		Manufacturers Response
5.2	Cancel	The EPG shall handle the cancellation of a previously booked programme by sending a 'PVR_cancel booking' instruction to the PVR. The PVR shall return a return code to the EPG according to the success or failure of the operation, as described in Table 12.6 Arguments, of the Freeview DTT Transmission Rules ver 2.0 Document. This information may be used to inform the user of the outcome via the EPG.	Req	The EPG shall display a "are you sure you want to cancel this programme booking?" dialog before the 'cancel booking' instruction is sent. For a successful cancelled booking the EPG shall indicate success by no longer displaying the onscreen icon [R] or [S] as appropriate.	
5.3	Conflict	If a booked programme also includes recommendations the programme booking shall be made first and any conflict resolution performed. Each recommended programme or series booking shall then be made one at a time as separate bookings. Conflict resolution shall be performed on each as it is booked. It is therefore possible to book a complete list of recommendations or a partial list only if some of the listed programmes conflict with previously made bookings. All recommendations are therefore handled in the same way as individual programme or series 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.	Req		
5.4	List	Since recommendations are booked in the same manner as standard programmes or series no special indication that they were booked or subsequently recorded via a recommendation is required.	Req		

Item No.	Resources	Reference/Detail		Notes	Manufacturers Response
6	**Conflict Resolution**				
6.1	Back to back bookings	The PVR shall be able to record back-to-back programmes on the same service without registering this as a conflict.	Req		
6.2	Displaying a conflict	A conflict which is detected at the time of making a booking shall be indicated immediately, together with details of the cause, so that the user can take appropriate action.	Req	All conflict resolution shall be handled via the PVR GUI. The EPG shall therefore never receive a "conflict" return code as these must always be handled through the PVR by cancelling one or more bookings.	
6.3	Default action	The default action taken by the PVR (with no user interaction) shall be made clear to the user in the manual. It is recommended that should the user not respond to a conflict resolution request that any scheduled recordings take precedence over viewing of a service or an OTR. There shall be a mechanism for informing the user of failed or incomplete recordings (in the playback list).	Req		

Item No.	Resources	Reference/Detail		Notes	Manufacturers Response
7	**One Touch Recording (OTR)**				
7.1	Record	The recorder shall incorporate a One-touch Recording (OTR) function which allows the user to start a recording, while watching live TV, with one button press on the remote control. The OTR button shall be the REC or ® - record button on the RCU.	Req	The OTR button shall always be available to the viewer regardless of whether the EPG is active or not. When pressing the OTR button the standard OTR screen shall be displayed for a few seconds indicating that the current service is being recorded. The front panel shall indicate the recording state for the period of recording. ~~If the EPG application is running it shall be stopped when the OTR screen is displayed. The EPG shall be available again via the EPG key after the temporary OTR screen has stopped being displayed.~~	
7.2	Duration	The duration of the recording operation shall be based on EIT p/f, subject to any device limitations (e.g. available space).	Req		

Item No.	Resources	Reference/Detail		Notes	Manufacturers Response
7.3	Conflict	OTR shall not be delayed by further requests for user interaction unless to proceed would affect a recording that is either already underway or scheduled to start before the end of the OTR operation.	Req		
		If a conflict occurs when the OTR button is pressed a dialog shall be displayed in which the viewer may make the choice to cancel one of the conflicting programmes or partially record the OTR programme. If no choice is made the default action shall be to partially record the OTR programme. The same dialog shall be displayed if the OTR button is pressed and there is no immediate conflict but a schedule change means a conflict will now occur during the OTR period. The default action shall be to partially record the OTR programme stopping the OTR at the point at which the conflict occurs. The PVR shall indicate to the viewer the partially recorded state of OTR programme in the playback list.			
		If an OTR event is a split event, each part of the split event shall be recorded separately.			
7.4	Programme identification	The OTR function is event based and shall be controlled by EIT P/F.	Req		
		The 1st press of the OTR button records until the end of the current programme (including any end time off-set)			

Item No.	Resources	Reference/Detail		Notes	Manufacturers Response
7.5	Continuous Recording	The OTR function may include an additional feature whereby a 2nd press gives 3 options – Record current service to: 1. End of present programme (display name) 2. End of following programme (display name) 3. After Hours and Minutes (user entry) Thereby providing the user with a simple mechanism to record the present and following programme of the current service.	Opt		

Item No.	Resources	Reference/Detail		Notes	Manufacturers Response
8	**Pause and Rewind live TV**				
8.1	Pause	The user shall be able to pause live TV. It shall be possible to pause for at least 30 minutes, subject to any device limitations (e.g. available space) or recording conflicts.	Req		
8.2	Rewind	The user shall be able to rewind live TV. It shall be possible to rewind at least 30 minutes (but preferably one hour) on the service that is currently tuned-in. Chase playback should then be possible – see 11.3	Opt	This implies that the PVR has a caching feature whereby the current service is constantly being recorded to the HDD in a 30 minute to one hour buffer. If the user changes services then the buffer is emptied of the old service content and the new service starts caching.	
8.3	On / Off	If 8.2 'caching' is implemented it is also suggested that the user should be able to switch this feature on or off.	Opt	Default should be set to 'on'.	

Item No.	Resources	Reference/Detail		Notes	Manufacturers Response
9	**Accurate Recording**				
9.1	Start / Stop	The PVR shall incorporate a default mechanism for controlling the starting and stopping of a recording based on the broadcast EIT p/f.	Req	The PVR shall also allow the user to specify start/stop time off-set periods – see 12.1.	
9.2	Updated EIT p/f	The PVR shall track changes to the start time and end time of the event. The start of an event is indicated by its transition to the present event for the specified service. The end of an event is indicated by the event being replaced by a different event as the present event for that service. When the PVR is not in passive standby and a schedule change occurs, the affected programmes in the schedule of recordings and any recordings in progress shall be updated. In standby, the PVR shall monitor the EIT p/f sufficiently frequently and for sufficient duration to allow a programme to be recorded successfully even when the start time is brought forward by up to ten minutes and the schedule information is updated at least five minutes before the new start time. NOTE: Passive standby is defined as that state in which the PVR is inactive as far as the user is concerned and no broadcast signal is being decoded.	Req	It is permissible for a recording to start before the start of an event and to finish after the event, but must not create unnecessary conflicts with the requirement for a back-to-back recording capability. Note: Freeview broadcasters are not currently interfacing their presentation automation systems (on-air schedules) to the Freeview SI/EPG system. However this is a planned future enhancement and therefore conformant PVR's are required to implement the accurate recording function.	

Item No.	Resources	Reference/Detail		Notes	Manufacturers Response
10	**Schedule of Recordings**				
10.1	Recording List	A mechanism for displaying programmes (and series) selected for recording shall be available, showing a minimum of scheduled date, programme (or series) title, service name, start time, and end time (or duration). The programme or series synopsis shall also be available via one RCU button press (preferably the 'info or i' button).	Req		
10.2	Modifications	The PVR shall allow the user to delete a programme (or series) from the Recording list.	Req		
10.3	Information source	Programme and series title and synopsis are sent across the API from the EPG at the time of booking. While the scheduled date, service name, start time, and end time (or duration) shall be obtained from EIT Schedule and SDT. For series bookings the time of the next programme in the series shall be displayed. This mechanism shall include a default message if there are no events in scope of the booked series within the current schedule. The PVR shall regularly check EIT schedule for any update to the date/time information associated with each event in the Recording List and update the list to reflect the schedule.	Req		

Item No.	Resources	Reference/Detail		Notes	Manufacturers Response
10.4	Content recorded	The PVR shall be able to record at least the following essential signal components: a. The video (if a TV service) b. The audio, as selected by the user c. The subtitles, as selected by the user Where the components above are recorded separately, the user shall be able to switch them on or off during playback.	Req	On-screen informational messages or menus generated by the recorder shall not be recorded with the programme content.	
10.5	Recording in progress	The PVR shall indicate to the user when a recording is in progress via the front panel display of the PVR (not via OSD). The Recording list should also highlight a programme that is in the process of recording.	Req	This is to ensure that the user knows that the PVR is actively recording.	
10.6	Record and Replay	The PVR shall be capable of replaying and recording simultaneously.	Req		
10.7	Update EPG	The PVR shall create an "PVR_ListBookings" Engine Event each time a change to the Recording List is made. Refer to Table 12.8 Arguments, of the Freeview DTT Transmission Rules ver 2.0 Document. for details of this Engine event.	Req	This shall enable the EPG to update its screen if changes to bookings are made via the PVR rather than via the EPG.	

Item No.	Resources	Reference/Detail		Notes	Manufacturers Response
11	**Replay functions**				
11.1	Playback list	All information about each programme recorded shall be obtained from EIT p/f at the time of recording. This allows details of individual programmes to be obtained as they are recorded even if they were booked via a series booking. A mechanism for displaying recorded programmes shall be available, showing a minimum of date, programme title, service name, start time, end time (or duration), and whether this programme is part of a series booking. The playback list shall be ordered by date (default) with the option to re-order by programme name or viewed state. The programme synopsis and parental rating shall also be available via one RCU button press (preferably the 'info or i' button.	Req		
11.2	Information source	The playback list shall always obtain the above information from the EIT p/f at the time of recording thus enabling details for individual programmes to be obtained even if booked as a series.	Req		
11.3	Chase Playback	The user shall be able to start the playback of a programme for which the recording has not yet completed.	Req		

Item No.	Resources	Reference/Detail		Notes	Manufacturers Response
11.4	Fast Forward and Reverse	Fast playback at speeds up to at least x16 shall be possible in both forward and reverse directions. At all speeds, the user shall be presented with a series of images taken from the video stream as they are passed.	Req	PVR manufactures are discouraged from implementing a skip facility, however If there is a skip button available to the PVR remote, then a single skip interval, shall not be less than 600 seconds in the forward or reverse directions (e.g. provides a 10 minute chapter feature)	
11.5	Parental Ratings	A parental rating shall be carried in EIT/Schedule. This shall be obtained by the PVR when populating details of a recording in the playback list unless the recording is being passed by the HbbTV engine in which case the parentalRating property will be used. This shall be used to enable content locking such that a pass-code should be entered before the content may be viewed if the user's Parental Rating setting is lower than the programmes Parental Rating value. This shall be based on pre-set user preferences for parental control based on parental ratings codes.	Req	Service locking must be a function of the PVR as no additional signalling other than parental rating descriptors at the event level will be provided to enable this.	
11.6	Playback status	The playback list shall highlight if a programme has been viewed or not.	Req		

Item No.	Resources	Reference/Detail		Notes	Manufacturers Response
12	**Manual time off-sets**				
12.1	Start / Stop times	The PVR shall allow the user to set start and stop off-set time periods e.g. The default settings should be start 2 minutes before scheduled start time and stop 5 minutes after scheduled end time. The HbbTV engine shall also pass startPadding and enfPadding API calls when a recording booking is passed from the HbbTV engine to the PVR engine. These padding values shall override the PVR off-set values.	Req	This feature is especially important as Freeview broadcasters are not currently interfacing their presentation automation systems (on-air schedules) to the Freeview SI/EPG system for accurate programme start and stop times. However as per the functional requirement for 'accurate recording' in 9.1 above, the PVR shall regularly monitor EIT p/f. In doing so it can use the 'following' (f) programme start time as the time from which it creates the start time off-set.	

Item No.	Resources	Reference/Detail	Notes		Manufacturers Response
13	**Recording Capacity**				
13.1	Capacity information	The recorder shall be equipped with a means of indicating the available recording capacity. The basis for the indication shall be explained in the instruction manual and shall be in terms of percentage or time, based on a notional capacity requirement per hour of recording.	Req		
13.2 A	Capacity Management	Option A: If insufficient space is available on the HDD to record the scheduled programme the viewer shall be told to make space immediately before the scheduled time of recording. This may or may not coincide with the time the booking is made. If a number of recommendations are booked, each shall be handled in the same way as an individual programme booking. If a split event is booked the required space shall be calculated at the start of the first segment. If the insufficient space on the HDD to record the schedule programme then the manufacture may choose either option **1)** the booking is cancelled by the PVR and this shall then pass a "cancelled" message back to the EPG or **option 2**) the booking is continued and a message is displayed that indicates the program may not be completely recorded. In the play list this partial recorded programme should indicate that the recording is incomplete If this option is implemented the 'capacity warning' function at 13.3 must also be implemented.	Req	Option A or Option B is required (not both).	

Item No.	Resources	Reference/Detail		Notes	Manufacturers Response
13.2 B	Capacity Management	Option B: If the HDD is full so that the next recording cannot be completed, the oldest recorded programme in the playback list shall be deleted to make space. This will continue until enough space has been made to record the next scheduled programme. If this option is implemented the 'keep function' at 13.4 must also be implemented.	Req	Option A or Option B is required (not both).	
13.3	Capacity Warning	A 'capacity warning' function is required. This shall inform the user that they have reached 90% of the HDD available capacity or the remaining recording time is less than 10hours and "should consider deleting some recordings" to increase available space.	Req	If 13.2A above is implemented. For the calculation of recording time it should be assumed that for a HD or SD programme that the bandwidth is set to a minimum 12Mbps.	
13.4	Keep function	The viewer shall have the option to flag programmes to be kept regardless of the age of the recording. If all content is flagged to be kept and the HDD runs out of space subsequent recordings will fail.	Req	If 13.2B above is implemented.	

Item No.	Resources	Reference/Detail		Notes	Manufacturers Response
14	**Runaway Recordings**				
14.1	EIT p/f	The recorder shall incorporate a mechanism for handling a runaway recording (e.g. as could occur if the EIT p/f transition fails because of a fault in the distribution network). If the EIT p/f now event extends for more than two hours beyond the scheduled duration then the recorder may terminate the recording at any time.	Req		
15	**Manual Time based Recording**				
15.1	Manual Record	The PVR may have a time based 'manual' record feature which the viewer can use to select a service, a start time, and an end time for a 'manual recording'. Manual recordings shall be added to the Recording List and Playback list in the same way as EIT/MHEG based recordings.	Opt	As a back up or alternative to EIT/MHEG based recording. It shall not be necessary for the EPG to display booking made though this manual, time based PVR interface.	

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

See section 12 of the "Transmission Rules For Freeview DTT Network ver 2.0" Document