

FREEVIEW SPECIFICATION 2020

Free to Air Digital broadcast and IP TV

Abstract

This document covers the transmission rules and device profiles for the Freeview New Zealand TV platform including DVB-T, DVB-S, HbbTV and IP TV

Table of Contents

1	Introduction	7
2	General	8
2.1	Document History	9
2.2	Abbreviations	9
3	References	12
3.1	Normative references	12
3.2	Informative references	13
4	Updates	14
4.1	Updated	14
4.2	Removed	14
4.3	Added	14
5	SI/PSI	15
5.1	General	15
5.2	Descriptors	15
5.3	Table Cycle Rate	18
5.4	Field sizes	19
5.5	Program Association Table PAT	20
5.6	Conditional Access Table CAT	20
5.7	Program Map Table PMT	20
5.8	Bouquet Association Table BAT (DTH only)	22
5.9	Network Information Table NIT (DTH)	24
5.10	Network Information Table NIT (DTT)	24
5.11	Event Information Table EIT	25
5.11.1	EITp/f	25
5.11.2	EITp/f_actual	28
5.11.3	EITp/f_other	28
5.11.4	EITsch	29
5.12	Service Description Table SDT	30
5.12.1	SDT	32
5.12.2	SDT_other	32
5.13	DVB Identifiers	33

5.13.1	Service ID	33
5.13.2	Event ID	33
5.14	DTT DVB Identifiers.....	33
5.14.1	Original Network ID	33
5.14.2	Network ID.....	33
5.14.3	Private Data Specifier	34
5.14.4	Transport Stream ID	34
5.14.5	Network and Service acquisition	35
5.15	DTH DVB Identifiers.....	35
5.15.1	Original Network ID	35
5.15.2	Network ID.....	35
5.15.3	Transport Stream ID	35
5.15.4	Service Mapping	36
5.16	Logical Channel Numbers LCNs.....	36
5.16.1	Logical Channel Number Syntax.....	36
5.16.2	Allocation of LCNs'.....	38
5.16.3	Hidden services	38
5.16.4	DTT LCN conflicts	38
5.16.5	Signal Quality Matrix.....	38
5.17	FTA Content Management Descriptor	39
5.18	Huffman Compression	43
5.18.1	Compression strings.....	43
5.18.2	Decompression strings	43
5.18.3	Signalling of compressed strings	45
5.18.4	String Types	46
5.18.5	Decompression tables	46
5.18.6	Character set of decompressed strings.....	46
5.19	Time Date Table TDT.....	46
5.20	Time Offset Table TOT	46
5.21	Application Information Table AIT.....	47
5.22	Transmission Parameter Signalling TPS bits.....	47
5.23	Coverage Maps.....	47

5.24	Cell IDs.....	47
5.25	Triplets.....	48
6	Device profile	49
6.1	Introduction	49
6.2	Performance	49
6.3	DTT Tuning	50
6.3.1	Overview.....	50
6.3.2	Initial Scan.....	50
6.3.3	Addition or removal of services	51
6.3.4	Temporary removal of a service.....	52
6.3.5	Addition or removal of Multiplexers.....	53
6.3.6	Addition or removal of Transmitters from a Network.....	54
6.3.7	Retuning of Transmitters.....	54
6.4	DTH Tuning	54
6.5	Service component changes.....	55
6.6	Parental lock.....	55
6.7	Content Management.....	56
6.8	Time-exclusive services.....	56
6.9	Electronic Programme Guide EPG.....	56
6.10	Audio Encoding	58
6.10.1	MPEG1 Layer II.....	58
6.10.2	MPEG-4 HE-AAC	58
6.10.3	AC-3 Dolby Digital.....	59
6.10.4	E-AC-3 Dolby Digital Plus	59
6.11	Video Encoding	59
6.11.1	MPEG-2.....	59
6.11.2	AVC Video H264.....	59
6.11.3	HEVC Video H265.....	59
6.12	Language Support.....	59
6.13	Audio Description	60
6.13.1	Audio Settings Menu.....	61
6.14	Modulation and Radio Frequency RF.....	62

6.14.1	DTT.....	62
6.14.2	DTH.....	64
6.15	Video Broadcast Formats.....	65
6.15.1	High Definition HD	65
6.15.2	Standard Definition SD	65
6.16	DVB Subtitles	65
6.17	Input / Outputs IO	66
6.18	Software Upgrade	66
7	HbbTV.....	67
7.1	Freeview Broadcast-related Application description	67
7.1.1	Freeview application features	67
7.1.2	HbbTV app experience	67
7.1.3	Black list and white list.....	68
7.1.4	Guide key event.....	68
7.1.5	Support for Montserrat font	68
7.1.6	Server-side ad insertion.....	68
7.1.7	Video/broadcast embedded object	69
7.2	Descriptors	69
7.2.1	AIT	70
7.3	Freeview Broadcast-independent Smart Tile Application	70
7.4	Adaptive bitrate streaming	70
7.5	DRM	70
7.6	CENC.....	71
7.7	IP Video	71
7.8	Mouse and wheel events.....	71
7.9	Parental Control.....	71
7.10	PVR	71
7.11	HTTPS.....	71
7.12	Optional requirements	71
7.12.1	Media Synchronisation	71
7.12.2	Companion Screens	72
7.12.3	CI Plus	72

7.12.4	File System	72
7.12.5	File Delivery	72
7.13	How to test.....	72
7.14	HbbTV Application Performance	72
7.14.1	Memory usage	73
7.14.2	Reliability and resilience	73
7.14.3	OIPF configuration	73
7.15	Local System values.....	73
8	IP TV	74
8.1	Freeview Smart Tile Application	74
8.2	IP Live Streaming	74
8.2.1	Video	75
8.3	Initiating IP Streaming TV	75
8.3.1	Homepage or hub	75
8.3.2	Accessing IP TV	75
8.4	Service Discovery and Selection	75
8.5	Channel navigation.....	76
8.5.1	Access to Channel up / down key events	76
9	Approval process.....	77
9.1	Freeview Customer Experience.....	77
9.2	Unboxing and setup recommendations	77
9.3	Support.....	77
9.4	Certification Process Overview.....	78
10	Freeview Brand Guidelines	79

1 Introduction

The Freeview specification was first published in 2007 as part of the New Zealand digital switch-over. The specification was based on the latest DVB standards at the time and provided a common basis for manufacturers to build products for the market that could receive the new digital broadcast. Freeview was responsible for communicating with consumers about the digital switch-over and consumers have come to trust the Freeview brand as synonymous with television in New Zealand. Only products that pass certification based on the Freeview specification are able to be associated with the Freeview brand.

Since then, the evolution of technology has also seen the expansion of Freeview to be a platform for delivery of content to New Zealanders via digital terrestrial, digital satellite and internet protocol, proving consumers with access to live TV and on demand content. The Freeview specification will continue to be updated to support the growth and expansion of the Freeview platform.

This document has been developed to include all previous specifications of Freeview, including terrestrial and satellite transmission rules and all device profiles. It also includes detailed information about the Freeview On Demand HbbTV application, brand guidelines, and the certification process.

Several redundant items have been removed, and some items added, including those from the 2017 addendum, and an update to current specification references. The overall purpose is to make a single document clearly describing Freeview NZ requirements highlighting specifics to this market and referencing international standards wherever possible.

2 General

The Freeview platform covers Freeview Live TV and Freeview On Demand.

Freeview Live TV is the name given to the digital satellite and digital terrestrial free-to-air platforms for New Zealand. Launched in 2007 by the leading New Zealand free-to-air broadcasters TVNZ, MediaWorks, Māori Television and Radio New Zealand. The digital satellite network forms an umbrella-like coverage over the whole country using the Optus D1 satellite positioned at 160 degrees east longitude. The digital terrestrial network covers 87% of the population.

Freeview On Demand is the name given to the HbbTV platform. Launched in 2015 as an aggregated content platform specifically designed for delivering on demand videos from TVNZ, MediaWorks, and Māori Television to the big screen. Freeview On Demand is free for consumers and is available through both broadcast-related and broadcast-independent applications.

Freeview Live TV now offers more than 20 free-to-air TV and radio stations, available through both satellite and terrestrial platforms, including local content across regional stations and 7 high definition broadcasts. Freeview also broadcasts programme information for EPGs and PVR components for recorders. Freeview On Demand offers a large catalogue of SD and HD content from TVNZ, MediaWorks and Māori TV in a single aggregated application. The content library includes full season content, on demand only and catch up content streamed via the application using DASH with PlayReady DRM and server-side ads. Visit Freeview's consumer website at <http://Freeviewnz.tv> for a full overview of the service offering.

The digital terrestrial network has only H.264 (AVC) services currently whereas the satellite network currently transmits only MPEG 2 (MP&ML) services however HEVC HD is planned and is now mandatory for all satellite devices.

Both networks conform to DVB broadcast rules and standards. There is a legacy MHEG-5 EPG broadcast, an HbbTV EPG and On Demand application and SI EIT is broadcast for native programme guides.

This specification document details the requirements and clarifications to DVB and ETSI international standards describing the operational rules for a receiver over the lifetime of the network. This document is updated from time to time and the latest specification is available on the Freeview website.

<https://freeviewnz.tv/company/equipment-supply-chain/>

This document therefore describes which SI / PSI tables and descriptors will be transmitted on the Freeview DT and DTH networks and a guideline for how digital receiver manufacture should interpret this data. It also contains the full receiver profiles for TVs, STBs and PVRs, along with the approval process and brand guidelines.

2.1 Document History

Version	Date	Description	Author
1.0	16 July 2019	Published spec	Tim Diprose
1.1	12 Nov 2019	Minor updates	Tim Diprose
1.2	23 Jan 2020	Added SI native EPG / Guide requirements	Tim Diprose
1.3	30 Jun 2020	Updated Parental Rating details and ALA / ALB language descriptors	Tim Diprose
1.4	22 Oct 2020	Update +guide in UserAgent for HbbTV Guide function and clarify Parental Rating definitions	Tim Diprose

2.2 Abbreviations

AC-3	Dolby Digital (5.1 Channel)
AIT	Application Information Table
API	Application Programming Interface
AVC	H.264/MPEG-4 AVC (Advanced Video Coding), a digital video-compression format
BAT	Bouquet Association Table
BER	Bit Error Rate
C/N	Carrier to Noise Ratio
CA	Conditional Access
CAT	Conditional Access Table
CENC	Common Encryption
CID	Content Identifier Descriptor
CRID	Content Reference Identifier
CVBS	Composite Video Baseband Signal
DAD	Default Authority Descriptor
DASH	Dynamic Adaptive Streaming over HTTP
DII	Download Info Indication

Version: 1.4 | 20/10/2020

DSI	Download Server Initiate
DSM-CC	Digital Storage Media – Command and Control
DTT	Digital Terrestrial Television (same as DVB-T)
DTH	Direct to Home Television (same as DVB-S)
DTR	Digital TV Recorder (Now referred to as PVR)
DVB	Digital Video Broadcasting standards organisation
DVB-S	DVB-Satellite
DVB-T	DVB-Terrestrial
EBU	European Broadcasting Union
EIT	Event Information Table
EMM	Entitlement Management Message - authority for a receiver to decrypt
EPG	Electronic Programme Guide
EPN	Encryption Plus Non-Assertion
ES Loop	Elementary Stream Loop
ESG	Event Schedule Guide
ETSI	European Telecommunication Standards Institute
FTA	Free To Air
HBTV	Hybrid Broadcast Broadband TV
HD	High Definition
HDCP	High-Bandwidth Digital Content Protection
HDMI	High-Definition Multimedia Interface
HDTV	High Definition Television
HEVC	High Efficiency Video Coding, also known as H.264/AVC
HE-AAC	High-Efficiency Advanced Audio Coding
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
MHEG	Multimedia and Hypermedia information code Expert Group
MPEG	Moving Pictures Expert Group
MFN	Multiple Frequencies Network
NIT	Network Information Table
OSD	On Screen Display
OUI	Organisation Unique Identifier
PAT	Program Association Table

PVR	Personal Video Recorder
PID	Packet Identifier used in MPEG
PMT	Program Map Table
PSI	Program Specific Information
EIT p/f	EIT present / following
QAM	Quadrature Amplitude Modulation
QPSK	Quadrature Phase Shift Keying
RF	Radio Frequency
RST	Running Status Table
SD	Standard Definition
SDT	Service Description Table
SFN	Single Frequency Network
SI	Service Information
SIT	Selection Information Table
SSU	System Software Upgrade
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
S/PDIF	Sony/Philips Digital Interface
STB	Set-Top-Box
ST	Stuffing Table
TPS	Transmission Parameter Signalling
TS	Transport Stream
TDT	Time Date Table
TOT	Time Offset Table
Uimsbf	unsigned integer most significant bit first
UHF	Ultra-High Frequency
UNT	Update Notification Table
UTC	Universal Time, Co-ordinated
UTF	Unicode Transformation Format
VBI	Analogue video vertical blanking interval
YPbPr	Wideband Component Video Signal
WILL	Indicates an assumption about existing states or future events

3 References

References are either specific (identified by date of publication and/or edition number or version number) or non-specific. For specific references, only the cited version applies. For non-specific references, the latest version of the referenced document (including any amendments) applies.

3.1 Normative references

The following referenced documents are necessary for the application of the present document.

ISO/IEC 13818-1	Information Technology-Generic coding of moving pictures and associated audio information – Part 1 : Systems
ISO/IEC 13818-2	Information Technology-Generic coding of moving pictures and associated audio information – Part 2 :Video
ISO/IEC 13818-3	Information Technology-Generic coding of moving pictures and associated audio information – Part 3 : Audio
ISO/IEC 14496-10	Information Technology – Coding of audio visual objects – part 10 – Advanced Coding
EN 300 468	Digital Video Broadcasting (DVB); Specification for Service Information (SI) in DVB systems.
TS 101 211	Digital Video Broadcasting (DVB); Guidelines on implementation and usage of Service Information (SI)
EN 300 743	Digital Video Broadcasting (DVB); Subtitling Systems
TR 101 162	Digital Video Broadcasting (DVB); Allocation of Service Information (SI) codes for DVB
TS 101 154	Implementation Guidelines for the use of MPEG-2 Systems, Video and Audio in satellite, cable and terrestrial broadcasting applications.
EN 300 744	Digital Video Broadcasting [DVB]; Framing Structure, Channel Coding and Modulation for Digital Terrestrial Televisions Services Et Profil De Signalisation Pour La Diffusion De LA Numerique De Terre Nordig Rules Of Operation For Nordig Unified Receiver Network

D-Book 10	DTG : Digital Terrestrial Television - Requirements for interoperability
Digital TV Group	DTG Functional Specification for Digital TV Recorders
TS 102 796 V1.4.1 Errata #3	Hybrid Broadcast Broadband TV v2.0.1
ISO/IEC 23009-1	MPEG-DASH
ISO/IEC 23001-7	MPEG-CENC
TS 102 809	Digital Video Broadcasting (DVB); Signalling and carriage of interactive applications and services in Hybrid broadcast/broadband environments
OIPF-T1-R2 Volume 5	OIPF-T1-R2 Specification Volume 5 Declarative Application Environment v2.3. [CEA] 2014-A
OP-61	Free TV Operation Practice OP-61 – Implementation of Hybrid Broadcast Broadband TV by Australian Free-to-air Television Broadcasters
OP-41A	Free TV Australia Operational Practice OP-41 – Logical Channel Descriptor

3.2 Informative references

The following referenced documents are not necessary for the application of the present document but they assist the user with regard to a particular subject area.

EN 300 421	Framing Structure, channel coding and modulation for 11/12 GHz satellite services.
EN 300 429	Framing Structure, channel coding and modulation for cable systems.
ETS 300 472	Specification for conveying ITU-R System B Teletext in DVB bitstreams.
EN 301 192	Digital Video Broadcasting [DVB]; DVB Specification for Data Broadcasting.
IEC 62216-1	Digital terrestrial Television Receivers for the DVB-T System – Baseline Receiver Specification

4 Updates

Summary of key changes from older Freeview specifications to this one.

4.1 Updated

- Updated D-Book references to D-book 10
- Audio description mandatory
- HbbTV 1.5 - TS 102 796 v1.2.1 to HbbTV 2.0.1 ETSI TS 102 796 V1.4.1 Errata #3

4.2 Removed

- MHEG-5 (not allowed for new devices)
- EBU teletext and captions
- System Software Upgrade (SSU) not required
- Wide Screen Signalling (never used in NZ)
- Conditional Access (removed Igloo details)
- Minimum baseline for HW (needs to be fit for purpose)
- Network Change Notify Descriptor
- Message Descriptor
- EN 300 706v1.7.1 - Enhanced Teletext Specification

4.3 Added

- MPEG-DASH - ISO/IEC 23009-1
- MPEG-CENC - ISO/IEC 23001-7
- HEVC mandatory for all devices
- IP TV streaming
- HbbTV application detail
- CAT – details carried for Sky
- 1080P50 – mandatory on all receivers
- Parental lock – mandatory
- Certification process

5 SI/PSI

5.1 General

This section defines which SI tables and which descriptors in these SI tables shall be broadcast on the Freeview 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 to be referenced are EN 300 468 and TR 101 211. 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 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 Transport Streams SI. All descriptors listed are mandatory to receive however any unrecognised descriptor should be ignored. The descriptor tag defines the structure of the contained data following the descriptor length

Definition of Acronyms Used in Table 1

-	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

Table 1- Freeview Descriptor List

Descriptor	Platform	Tag Value	NIT	BAT	SDT	EIT	TOT	PMT	Loop
Reserved		0x00-0x01	-	-	-	-	-	-	
Video stream descriptor	DTT/DTH	0x02	-	-	-	-	-	Mb	ES loop
Audio stream descriptor	DTT/DTH	0x03	-	-	-	-	-	Ob	ES loop
ISO 639_language_descriptor	DTT/DTH	0x0A	-	-	-	-	-	Mb	ES loop
System clock descriptor	DTT	0x0B	-	-	-	-	-	Ob	Program loop

Version: 1.4 | 20/10/2020

Descriptor	Platform	Tag Value	NIT	BAT	SDT	EIT	TOT	PMT	Loop
Smoothing Buffer descriptor	DTT/DTH	0x10	-	-	-	-	-	Ob	Program loop
ISO/IEC 13818-1 Reserved	DTT	0x14-0x3F	-	-	-	-	-	-	
Network name descriptor	DTT/DTH	0x40	Mb	-	-	-	-	-	Network loop
Service list descriptor	DTT/DTH	0x41	Mb	-	-	-	-	-	TS Loop
Satellite del system descriptor	DTH	0x43	Mb						Network loop
Bouquet name descriptor	DTH	0x47		Mb					
Service descriptor	DTT/DTH	0x48	-	-	Mb	-	-	-	Service loop
Linkage descriptor	DTT/DTH	0x4A	Ob	-	-	-	-	-	Network loop
Short event descriptor	DTT/DTH	0x4D	-	-	-	Mb	-	-	Event loop
Component descriptor	DTT/DTH	0x50	-	-	-	Mb	-	-	Event loop
Stream identifier descriptor	DTT/DTH	0x52		-	-	-	-	Ob	ES loop
Content descriptor	DTT/DTH	0x54	-	-	-	Ob	-	-	Event loop
Parental Rating Descriptor	DTT/DTH	0x55	-	-	-	Ob	-	-	Event loop
Local time offset descriptor	DTT/DTH	0x58	-	-	-	-	Mb	-	TOT loop
Subtitling descriptor	DTT/DTH	0x59	-	-	-	-	-	Mb	ES loop
Terrestrial delivery system descriptor	DTT	0x5A	Mb	-	-	-	-	-	TS loop
Private data specifier descriptor	DTT/DTH	0x5F	Mb		-	-	-	-	TS loop
Private data specifier descriptor	DTH	0x5F		Mb	-	-	-	-	TS loop
AC-3_descriptor	DTT/DTH	0x6A						Mb	ES loop

Descriptor	Platform	Tag Value	NIT	BAT	SDT	EIT	TOT	PMT	Loop
Frequency list descriptor	DTT	0x62	Mb	-	-	-	-	-	TS loop
Cell list descriptor	DTT	0x6C	Ob	-	-	-	-	-	Network loop
Cell frequency link descriptor	DTT	0x6D	Mb	-	-	-	-	-	TS loop
Application Signalling Descriptor	DTT	0x6F	-	-	-	-	-	Mb	ES loop
Data broadcast id descriptor HbbTV	DTT/DTH	0x123	-	-	-	-	-	Mb	ES loop
AC-3_descriptor	DTT/DTH	0x6A	-	-	-	-	-	Mb	ES loop
Service availability descriptor	DTT	0x72	-	-	Mb	-	-	-	Service loop
AAC descriptor (AAC_v2)	DTT/DTH	0x7C	-	-	-	-	-	Mb Mr	ES loop
Default authority descriptor	DTT/DTH	0x73	-	-	Mb	-	-	-	Service Loop
Content identifier descriptor	DTT/DTH	0x76	-	-	-	Mb	-	-	Event Loop
FTA content management descriptor	DTT/DTH	0x7E	-	-	Mb	Mb	-	-	Service Loop / Event Loop
Supplementary audio descriptor	DTT/DTH	0x7F	-	-	-	-	-	Mb	ES Loop
Logical channel number descriptor	DTT	0x83	Mb Mr	-	-	-	-	-	TS loop
Logical channel number descriptor	DTH	0x83	-	Mb Mr	-	-	-	-	TS loop
Forbidden		0xFF	Fb	Fb	Fb	Fb	Fb	Fb	

5.3 Table Cycle Rate

Table 2 - DTT Table Cycle Rate

Table	Table ID	PID	Cycle Time (seconds)
NIT act	0x40	0x10	2
SDT act	0x42	0x11	2
SDT oth	0x46	0x11	10
EIT pf act	0x4E	0x12	2
EIT pf oth	0x4F	0x12	10
EIT sch act (0-3)	0x50	0x12	30
EIT sch act (4-7)	0x51	0x12	30
EIT sch (8-11)	0x52	0x12	30
EIT sch oth (0-3)	0x60	0x12	60
EIT sch oth (4-7)	0x61	0x12	300
EIT sch oth (8-11)	0x62	0x12	300
TDT	0x70	0x14	1
TOT	0x73	0x14	1
AIT	0x74		1

Table 3 - DTH Table Cycle Rates

Table	Table ID	PID	Cycle Time
NIT act	0x40	0x10	2
SDT act	0x42	0x11	2
SDT oth	0x46	0x11	10
BAT	0x4A	0x11	10
EIT pf act	0x4E	0x12	2
EIT pf oth	0x4F	0x12	10
EIT sch act (0-3)	0x50	0x12	30
EIT sch act (4-7)	0x51	0x12	60

Table	Table ID	PID	Cycle Time
EIT sch (8-11)	0x52	0x12	60
EIT sch oth (0-3)	0x60	0x12	30
EIT sch oth (4-7)	0x61	0x12	60
EIT sch oth (8-11)	0x62	0x12	60
TDT	0x70	0x14	10
TOT	0x73	0x14	10
AIT	0x74		1

5.4 Field sizes

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 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 within native SI.

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

Table 4 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"
Event Name	40	Example: "The Rugby World Cup 2011"
Short Event Description	200	
Component Description	32	
Application Name	32	

All "Name" fields shall contain meaningful data.

"Description" fields may be left empty at the broadcaster's discretion.

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.

5.5 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.

5.6 Conditional Access Table CAT

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

For DTH, EMM PIDs shall be carried within the Freeview Transport Streams on behalf of Sky to enable Sky STBs and other Sky receiving devices to function correctly.

- CA_descriptor: descriptor_tag 0x09
- CA_system_ID 0x096A
- CA_descriptor: descriptor_tag 0x09
- CA_system_ID 0x0958

5.7 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. There shall be a separate program_map_PID for each service.

The EITp/f component_descriptor signalling shall 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. Receivers should continually monitor the PMT for change.

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 networks shall support the languages in the table below.

Table 5 - Language Support

Language	3-Character Language Code
Alternative language A	'ala'
Alternative language B	'alb'
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]
Subtitling_descriptor	Descriptor_tag 0x59 Mandatory whenever DVB bitmap subtitles are transmitted. Refer to section 6.16 for DVB subtitles to be included within a service.
Application_Signalling_Descriptor	descriptor_tag 0x6F Mandatory whenever used in reference to a Stream_type 0x05 elementary stream and identifies it carries an AIT.
Data_broadcast_id_descriptor	When used for the purposes of an HBBTV application it shall be used in conjunction with Data_broadcast_id of 0x123.

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.
E-AC-3_Descriptor	Descriptor tag 0x7A. The E-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.
AAC_descriptor (AAC_V2)	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
Private_data_specifier	Mandatory whenever private defined descriptors are used, as specified in TR 101 211.
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 an audio component which transmits an audio description broadcast mix on a Freeview service. For more details see Audio Description, section 6.13.
HEVC Video Descriptor	Descriptor tag 0x38. The HEVC Video Descriptor shall be used to identify an HEVC video component in the elementary stream. For its inclusion in a service PMT refer to ISO/IEC 13818-1

5.8 Bouquet Association Table BAT (DTH only)

All services within Freeview will be defined within one or more bouquets of the bouquet association table (BAT). Each bouquet shall have its own bouquet_id. Each service that is defined within a bouquet shall be assigned a logical channel number using the descriptor_tag 0x83. Within each bouquet the logical channel numbers shall be unique for each service.

The purpose of the bouquet association tables within the Freeview service is to restrict the distribution of regional content via satellite to just the relevant geographical region.

The BAT shall be transmitted in each transport stream in the DTH network. The BAT shall be encoded according to ISO/IEC 13818-1, EN 300 468 and ETR 101 211.

- BAT table_id 0x4A shall be transmitted
- BAT shall always be transmitted on PID 0x0011.
- The BAT shall be transmitted at least every 10sec.
- It is mandatory to transmit the Bouquet Association Tables for all Freeview services.
- The BAT tables will group relevant Network / Originating Network ID services according to the geographic location of Freeview viewers.
- All services within the bouquet shall be assigned a logical channel number using the logical_channel_descriptor 0x83.

There are eleven bouquet IDs assigned to Freeview. They are;

- 0x1000 AUCKLAND
- 0x1100 WAIKATO
- 0x1200 CENTRAL
- 0x1300 WELLINGTON
- 0x1400 CHRISTCHURCH
- 0x1500 DUNEDIN
- 0x1600 RESERVED REGION 7
- 0x1700 RESERVED REGION 8
- 0x1800 RESERVED REGION 9
- 0x1900 RESERVED REGION 10
- 0x2000 Engineering Test Bouquet

Service_list_descriptor	A service_list_descriptor (0x41) shall be inserted for each transport stream that is contained within each bouquet. This descriptor shall list all services that are relevant to Freeview that are contained within that transport stream.
Bouquet_name_descriptor	A bouquet_name_descriptor (0x47) shall be inserted for each bouquet that is defined for Freeview.
Private_data_specifier_descriptor	Descriptor Tag 0x5F. This is mandatory whenever private descriptors are used. For the Freeview logical channel descriptor then the private_data_specifier_value shall be 0x0000 0029.
Freeview_Logical_channel_descriptor	A Freeview_logical_channel_descriptor (tag 0x83) shall be inserted in the second descriptor loop of the BAT. This descriptor shall list all services from the transport streams that are contained within the multiplex and specify the logical channel that is assigned to each of those services.

5.9 Network Information Table NIT (DTH)

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

A network is defined as several 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 Satellite Delivery System Descriptor shall be used in each Transport Stream Loop of the NIT Actual. Each instance of the Delivery Descriptor shall describe the transmission properties for this Transport Stream.

A single Service List Descriptor shall be used in each Transport Stream Loop of the NIT Actual. Each instance of the Service List Descriptor will describe the Service_ID and the Service_Type of each service carried within this Transport Stream.

5.10 Network Information Table NIT (DTT)

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

A network is defined as several 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 Terrestrial Delivery System Descriptor shall be used in each Transport Stream Loop of the NIT Actual. Each instance of the Delivery Descriptor shall describe the transmission properties for this Transport Stream. The frequency field within the 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 Service List Descriptor shall be used in each Transport Stream Loop of the NIT Actual. Each instance of the Service List Descriptor will describe the Service_ID and the Service_Type of each service carried within this Transport Stream.

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 Private Data Specifier Descriptor shall be carried in each Transport Stream loop of the NIT Actual to specify private descriptors, such as the LCN descriptor. For the Freeview DTT logical channel descriptor then the `private_data_specifier_value` shall be 0x0000 0037.

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.

A single Cell Frequency Link Descriptor shall be carried in each Transport Stream loop of the NIT Actual. Each instance of the Cell Frequency Link Descriptor shall describe the relationship between a cell and the frequencies that are used in this cell for the transport stream described.

- NIT shall always be transmitted on PID 0x0010.

5.11 Event Information Table EIT

The EIT contains data concerning events or programmes such as event name, start time, duration, etc. Different descriptors allow the transmission of different types of information, e.g. genre, audio language etc.

5.11.1 EITp/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) currently table 28. If there is no content coding in conformance with table 28 in EN 300 468 present for an event, the default content description "unclassified" applies. Only support for <code>content_nibble_level_1</code> is mandatory, <code>content_nibble_level_2</code> is optional.
Component_descriptor	<p>A <code>Component_descriptor</code> (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 6 – EIT Stream Content and Component types which may be used on the Freeview 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 – legacy
0x03	0x02	associated EBU Teletext – legacy
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)

Stream Content	Component Type	Description
0x04	0x80 to 0xFF	reserved for Enhanced AC-3 audio modes (refer to En 300 468)
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

Stream Content	Component Type	Description
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
0x09	0x00	HEVC Main Profile high definition video, 50 Hz
0x09	0x01	HEVC Main 10 Profile high definition video, 50 Hz
0x09	0x04	HEVC Ultra High Definition Video

5.11.2 EITp/f_actual

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 shall be carried for all services listed within the SDT Actual/Other in which the EIT_schedule flag is set containing limited CID data for all services for the dedicated use of PVR devices.

EIT Schedule Other shall be carried for all services listed within the SDT Actual/Other in which the EIT_schedule flag is set containing limited CID data for all services for the dedicated use of PVR devices.

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.

5.11.3 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”.

Version: 1.4 | 20/10/2020

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.

5.11.4 EITsch

To limit the EITschedule bandwidth broadcast on each DTT multiplexer, EITschedule_actual and EITschedule_other tables are activated on Transport_streams:-

- 0x19 TVNZ Auckland multiplexer,
- 0x1d TVWorks multiplexer
- 0x21 Kordia1 multiplexer
- 0x22 Kordia2 multiplexer
- 0x023 MaoriTV multiplexer
- 0x26 Hawkes Bay TV 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 the same service_ids, event_ids and associated CID data, differing in advertorial content only. EITschedule_actual data is not activated on these multiplexers.

The TVWorks regional multiplexer's transport_stream_ids 0x1e, 0x1f and 0x21 are deemed identical to transport_stream_id 0x1d since they are made up from 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 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.

- Table_id 0x60 EIT_other_day_0..3
- Table_id 0x61 EIT_other_day_4..7

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. 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.
Parental_rating_descriptor	Descriptor tag 0x55, provides the recommended age rating and identifies the country (New Zealand).
FTA_Content_Management_Descriptor	FTA_Content_Management_Descriptor (0X7E) as defined in ETSI EN 300 468 shall be broadcast to convey the content management policy for HD content. The expected behaviour is defined in Section 5.17
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. The value of the CRID shall exactly match the CRID value as broadcast in the MHEG EPG application.

5.12 Service Description Table SDT

The SDT contains data describing the services in the system e.g. names of services, the service provider etc.

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 SDT service types that could be used on the Freeview Network are as listed in Table 7.

Table 7 – SDT Service Types available on the Network

Service Type	Description	Satellite	Terrestrial
0x01	SD MPEG-2 (Satellite platform only)	Yes	No
0x02	Digital Radio Service	Yes	Yes
0x0A	Advanced Codec digital radio service	Planned	Yes
0x0C	Data Broadcast Service	Yes	Yes
0x16	Advanced codec SD digital television service	Planned	Yes
0x19	Advanced codec HD digital television service	Planned	Yes
0x1F	HD HEVC	Planned	No plans
<p>Note#1 0x01 – digital television service shall not be used as refers to MPEG2 SD material</p> <p>Note#2 0x03 – Teletext Service shall no longer be used</p>			

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 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.

Default_Authority_descriptor

For PVR use

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. Every service on the network shall be allocated a Default_Authority_Descriptor.

5.12.1 SDT

An SDT Actual and Other shall be carried for all Transport Streams 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.

For services that offer recordable programmes, the Default Authority Descriptor should be carried in the SDT Actual and Other to define the CRID Authority. This will reduce the overhead of a CRID string as the CRID Authority will not need to be broadcast for every programme within that service.

The Service Availability Descriptor shall be carried in the SDT Actual and Other for services that are deemed to be localised in nature. Eg. They are not national services. The Service Availability Descriptor will describe the availability of services on a cell-by-cell basis. See also TPS bits.

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.

5.12.2 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.

5.13 DVB Identifiers

5.13.1 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. Each service shall be associated with a 2-byte service_id. The service_id is equivalent to the program_number used in PAT and PMT. The allocated service_ids on both the Sky and Freeview networks shall be unique.

5.13.2 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

Where Content Identifier Descriptors are used to carry CRID's for events, event_id shall also be included to ensure receivers can resolve rescheduled event recording as specified in D-Book section 8.11.3

5.14 DTT DVB Identifiers

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

Original_network_id, and
Service_id

5.14.1 Original Network ID

The Freeview Original_network_id is 0x222A as compliant with TR 101 162 and shall be common across all multiplexes

5.14.2 Network ID

The Freeview network_id is from 0x3401 to 0x3500, TR 101 162. 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.

5.14.3 Private Data Specifier

The Freeview allocated Private_data_specifier = 0x0000 0037, TR 101 162. 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.

5.14.4 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 8 - Transport_stream_ids allocation

Multiplexer Operator	Region	Transport_stream_ID
TVNZ	Auckland	0x0019
	Central	0x001A
	Wellington	0x001B
	South Island	0x001C
TVWorks	Auckland	0x001D
	Central	0x001E
	Wellington	0x001F
	South Island	0x0020
Kordia (National Multiplex with injection of local services)	National Multiplex (K1)	0x0021
	National Multiplex (K2)	0x0022
	Maori TV	0x0023
	Reserved 3	0x0024
Other Multiplexes	Reserved 1	0x0025
	Hawke's Bay TV	0x0026
	Reserved 3	0x0027
	Reserved 4	0x0028

5.14.5 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.

If a Service Availability Descriptor is associated with a duplicated service, then this should be actioned first so that the service is discarded in the cells where the service is not available and should therefore 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 HBBTV application.

Once the Service Availability Descriptor has been taken into account, then for services that are identical, the service with the lesser signal quality will be discarded and will not form part of the service line-up.

5.15 DTH DVB Identifiers

The tuning of Freeview branded STBs / PVR is based upon NIT signalling in SI. The Freeview network will mostly include services that originate from within its own transport streams, however some services may originate from within Sky Digital transport streams by commercial agreement between all relevant parties

Only services which are listed in the Freeview NIT (Network_id=0x2F) and with a Freeview LCN descriptor within the Freeview Bouquet Association Tables will be relevant to Freeview.

5.15.1 Original Network ID

The Freeview original_network_id is 0x2F, the Sky Digital Original_network_id is 0xA9. TR 101 162.

5.15.2 Network ID

TR 101 162 [10]. The Freeview network_id is 0x2F, the Sky Digital network_id is 0xA9. TR 101 162.

5.15.3 Transport Stream ID

The transport_stream_id shall uniquely define a transport stream within the network. All transport streams within both the Sky and Freeview networks will carry a unique transport_stream_id Freeview currently operate transport_stream_id's 21 and 22.

Version: 1.4 | 20/10/2020

5.15.4 Service Mapping

There are two satellite operators within the same physical network within New Zealand. Also sharing the same satellite at the same orbital position will be Sky Digital, the digital pay network of the Sky Network Television Limited Company of New Zealand.

The NIT-actual table of each Freeview transport stream, of which there will be two at the commencement of the Service, will identify and describe all of the Freeview services. It will list the two transport streams that are actually generated from the two satellite multiplex sets that are operated by Freeview, as well as all transport streams that are operated by Sky Digital that contain services that are also accessed by Freeview.

5.16 Logical Channel Numbers LCNs

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 except on DTH where the same service is available in different geographic regions, in different bouquets. Some services, which differ in regional advertising interstitials only, will be assigned the same LCN.

For example, the version of TVONE which has advertisements which are of interest primarily to the people of Christchurch and surrounding areas, will appear within bouquet_id=0x1400 with LCN=1. The version of TVONE however which has advertisements relevant primarily to the people of Waikato, and with a different service_id to that of the above TVONE, will appear within bouquet_id=1100, but also with LCN=1

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

5.16.1 Logical Channel Number Syntax

The syntax and semantics of the Freeview_logical_channel_descriptor is indicated in the table below.

Table 9 - 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 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. For current LCNs on the Freeview network check www.freeviewnz.tv.

5.16.2 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.

5.16.3 Hidden services

Services identified as "hidden" in the LCN descriptor shall not appear in the service list presented to the viewer. These hidden services shall be selectable by numeric entry.

5.16.4 DTT LCN conflicts

Duplicated services of lower received quality shall be discarded by the receiver in favour of the best quality service.

- Due to coverage overlaps

Regional variants of a service shall be allocated the same Logical Channel Number. In DTT 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.

- Due to parent / translator transmitter overlap

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).

5.16.5 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 10 provides a logical set of coverage overlap scenarios and recommended receiver behaviour.

Table 10 - 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 sig		Discard Channel with weakest signal			

5.17 FTA Content Management Descriptor

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.

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 on analogue standard definition receiver outputs. Receivers which provide analogue definition outputs shall be restricted to SD resolutions only.

Receivers shall respond to the content management signalling in accordance with the measures defined in the Table 11 below.

Freeview Specification 2020



Table 11 - Content Management Summary

Content Management State	FTA Content Management Descriptor		Local Environment (e.g. within a single household)						Wider Sharing		
	Do_not_scramble	Control_remote_access_over_internet	Record on PVR	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 ok (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 ok 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 PVR recording)			Unlimited Copies – with no encryption	Second generation copies not permitted	Unrestricted and to any device	Not permitted

Freeview Specification 2020



Table 12 - Content Management Signalling

			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						
			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			
State	Short Name	Description						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.

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.
- AACCS (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 AACCS, 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. 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 - Content Management Signalling. 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.

5.18 Huffman Compression

Huffman compression shall be used for all EIT schedule data on the DVB-T platform and for any new HD channels launched on the DVB-S platform.

String compression may be used on any field encoded as per EN 300 468 Annex A, but Freeview NZ will be limiting the string compression of the DVB SI to just the EIT string fields, namely the Short_Event_Descriptor fields.

5.18.1 Compression strings

Strings shall be compressed using sets of static Huffman trees defined by Freeview NZ. The compression trees allow the encoding of any sequence of bytes except those containing the value 0x00 (0). They are optimised for English text in character sets that have byte values 0x00-0x7F (0-127) representing characters as defined in 7-bit ASCII. These include the ISO/IEC 6937 Latin alphabet defined by EN 300 468 Annex A, all versions of ISO-8859 and UTF-8. All bytes in the range 0x80-0xFF (128-255) can be encoded but are not compressed.

An escape character shall be used to indicate that the following byte is not compressed. This shall have the value 0x1B (27), that corresponds to an ASCII ESC. All encoded strings with the exception of empty strings shall be terminated with the value 0x00 (0) which corresponds to ASCII NULL. Empty strings shall be encoded as uncompressed empty strings.

There shall be Huffman trees for each byte in the range 0x00-0x7F (0-127). A byte is encoded using the tree for the byte preceding it. The tree for byte zero shall be used to encode the first byte. Huffman trees may contain codes for any byte in the range 0x00-0x7F (0-127). All Huffman trees shall contain an encoding for the escape character but may contain encodings for no other bytes.

The rules for encoded strings are:

- The 8 bits following a compressed escape character contain an uncompressed byte.
- If the uncompressed byte is of value 0x80-0xFF (128-255) the 8 bits directly following it also contain an uncompressed byte. Otherwise the following bits contain a compressed Huffman code.
- If the byte sequence to be encoded contains the escape character value 0x1B (27) then this can be represented as a compressed escape character followed by an
- Uncompressed escape character. The following character is then compressed.
- After the NULL terminating character (which may be compressed or uncompressed) the string shall be padded with bits of the value 0 so that it is byte aligned.
- The compression tables are available from Freeview NZ.

5.18.2 Decompression strings

Decompression of strings uses one or more static lookup tables. These tables must be stored in the receiver. They shall not be broadcast. Different lookup tables will be optimised for strings of different types and lengths. Each individual string can be compressed with the most appropriate table.

Freeview NZ will use two lookup tables. Each will be a maximum of 10 kilobytes in size. These tables are available electronically from Freeview NZ.

Each byte in the table shall specify either an offset into the table or the uncompressed character. In order to decode a compressed string, the receiver will first need to look at an offset in the lookup table that will depend on the previous character. An offset of zero should be used for the first character of a string. This offset will contain the root of the corresponding Huffman tree. The receiver shall then iteratively follow a chain of offsets, each one representing a node of the Huffman tree, until a decoded character is found.

Table 13 - Decode Table

Syntax	No. of bits	Mnemonic
Decode table () {		
For (i=0;i<128;i++){		
Byte_offset_of_char_i_tree_root	16	uimsbf
}		
For (i=0;i<128;i++){		
For (j=0;j<N;j++){		
Left_child_is_leaf	1	Bslbf
If (left_child_is_leaf==1){		
Lsbs_of_decoded_byte	7	uimsbf
} else {		
Left_child_word_offset	7	uimsbf
}		
Right_child_is_leaf	1	Bslbf
If (right_child_is_leaf==1){		
Lsbs_of_decoded_byte	7	uimsbf
} else {		
Right_child_word_offset	7	uimsbf
}		
}		
}		
}		

The following text describes an algorithm that can be used to decode a compressed string given a decode table in the form described in Table 13 - Decode Table.

- If the previous byte was a compressed escape character of value of 0x1B (27) or an uncompressed byte of value 0x80-0xFF (128-255) then the following 8 bits represent the current decoded byte.
- If the previous condition does not apply the following procedure should apply. This should only occur if the previous byte was in the ranges 0x00-0x1A (0-26) or 0x1C-0x7F (28-127), was an uncompressed escape character 0x1B (27) or was the first byte of the string.
 - The decoder shall find the value of the `byte_offset_of_char_i_tree_root` field for the value of 'i' where 'i' is the previously decoded byte. If there is no previous byte because the string decoding has not yet started, then the value of 'i' to be used shall be zero. The value of this field is an offset in bytes from the start of the decode table, indicating the root of the decode tree.
 - If the first bit of the encoded string is zero, the decoder shall look at the offset into the decode table specified by the `byte_offset_of_char_i_tree_root` field. This is the value of the root node in the tree. If the value of the first bit of the encoded string is one, the decoder shall look at offset `byte_offset_of_char_i_tree_root+1` into the decode table. This is the value of the right child of the current node in the tree.
 - If the first bit of the byte at the given offset is zero the value specifies a further offset into the table, specified as an offset in two-byte words from the start of the current Huffman tree. If the next bit of the encoded string is zero, then the decoder should move to this offset in the tree and repeat. This is the left child of the current node. The location of this byte is then $(\text{byte_offset_of_char_i_tree_root} + (2 * \text{value_of_current_leaf}))$ from the start of the decode table. If the next bit of the encoded string is one, then the decoder should move to the byte after this offset in the tree and repeat. This is the right leaf of the current node. This location of this byte is then $(\text{byte_offset_of_char_i_tree_root} + (2 * \text{value_of_current_leaf}) + 1)$ from the start of the decode table.
 - If the first bit of the byte at the given offset is one, then the remaining 7 bits contain the least significant 7 bits of the decoded byte. The most significant bit of the decoded byte shall have value zero.
- If the current decoded byte is a null character of value 0x00 (0) then the decoded string has terminated, and all subsequent bits can be ignored. The decoded string does not contain the null character.

5.18.3 Signalling of compressed strings

This uses a first byte of value 0x1F to indicate that the encoding of a string is defined by an identifier called the `encoding_type_id`, which is the second byte of the string. The `encoding_type_id` is defined in Section 2.4.5. The signalling extends the mechanism used in the current version of Annex A of EN 300 468 used to indicate the character code table.

If the first byte of the string does not have value 0x1F then the string is not compressed and shall be decoded as described in the current version of Annex A of EN 300 468.

Version: 1.4 | 20/10/2020

5.18.4 String Types

If the first byte of the text field has value 0x1F then the following byte carries an 8-bit value (uimsbf) containing the encoding_type_id. This value indicates the encoding scheme of the string. Allocations of the value of this field are found in TR 101 162.

Two values of encoding_type_id have been allocated by Freeview NZ. These are 0x01 and 0x02.

5.18.5 Decompression tables

The two values of encoding_type_id shall be used to signal which of the two decompression tables shall be used to decompress the string. Either table can be used on any field in any descriptor. The decoder shall use the appropriate decompression table to decompress the string. The mappings are listed in the table below:

Table 14 - Decompression Table

Encoding_type_id	Meaning
0x01	Decompress string using Freeview NZ decompression table 1
0x02	Decompress string using Freeview NZ decompression table 2

5.18.6 Character set of decompressed strings

The bytes from a decompressed string contain only the string itself. There is no signalling of the character code to be used to display the string. The byte sequence output by the string decoder is a UTF-8 encoded string.

5.19 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.

5.20 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.

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

5.21 Application Information Table AIT

Table_id 0x74 – AIT is mandatory in a transport stream if an HBBTV application is associated with a service carried within that transport stream. The elementary stream (Stream_Type 0x05) carrying the AIT will be referenced within a service's PMT using the Application_Signalling_Descriptor.

The descriptors that constitute the AIT are as described in the ETSI TS 102 796 V1.4.1 Errata #3 specification section 7.2.3.1; Broadcast Signalling; Table 5.

5.22 Transmission Parameter Signalling TPS bits

The TPS bits shall be used to inject the Cell_ID at each DTT 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.

5.23 Coverage Maps

For the latest coverage maps please visit <https://www.freeviewnz.tv/faq-library/about-digital-tv/coverage-maps/>

5.24 Cell IDs

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.

For the latest Cell IDs list visit <https://www.freeviewnz.tv/company/equipment-supply-chain/>.

5.25 Triplets

For the latest Triplets list visit <https://www.freeviewnz.tv/company/equipment-supply-chain/>.

6 Device profile

6.1 Introduction

This profile covers the use of internet connected and non-connected set-top-boxes (STBs) and digital TVs. Personal Video Recorders (PVRs) are covered in the PVR Device Profile 2020.

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. This will reduce the risk of problems between the interoperability of the transmitted SI and the receiver response.

All items listed are mandatory unless otherwise stated. Legacy requirements like SSU and MHEG have been removed or are mentioned for clarity.

This device profile 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. Changes and additions have been made in this document to suit the requirements for Freeview New Zealand.

It is a requirement that all internet enabled TV's, STBs or PVRs whether via ethernet or wireless communications, implement the HbbTV v2.0.1 specification as laid out in the ETSI TS 102 796 V1.4.1 Errata #3.

Freeview NZ have applied Huffman compression to the broadcast DTT DVB SI strings in order to reduce bitrate usage. Freeview NZ applies Huffman compression to the EIT schedule short_event_descriptor. The receiver will be required to store two Huffman compression lookup tables as they will not be broadcast.

When HD broadcasts start on DTH, Huffman compression will also be used on the short_event_descriptor for HD content.

6.2 Performance

The processing power and memory configuration of the receiver must be suitable for the routine operation of FTA HD digital Terrestrial reception (DVB-T) or digital Satellite (DVB-S2), together with the embedded operation of HbbTV v2.0.1 according to ETSI TS 102 796 V1.4.1 Errata #3 and FreeTV OP-61. 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 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.

6.3 DTT Tuning

6.3.1 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.

All 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.

6.3.2 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.

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”.

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 stated in section 6.14. 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 stores the frequency and the cell_id (based on the TPS parameters) for the multiplex
 - It stores the services which are not associated with a local cell (i.e. national) in the SDT.

It stores the localised services which are identified by the value of the cell_id field as defined in the Service_Availability Descriptor in the SDT which are equal to the TPS value of the received multiplex. Services which are identified by the value of the cell_id field as defined in the Service_Availability Descriptor in the SDT which are NOT equal to the TPS value of the received multiplex shall not be stored.

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 channel shall only be stored and displayed once. The uniqueness of a channel is defined by its Original_network_id and Service_id only.

Once the Service_Availability Descriptor for a service is taken into account (if one exists) and 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 or lack of a PMT) it shall not be displayed.

Every service on the Freeview network shall be allocated an LCN. Within the channel list of the receiver the service shall be listed in order of its LCN numerical value. Service selection via numeric entry shall always select a service with a corresponding LCN regardless of any viewer favourites. 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.

6.3.3 Addition or removal of services

The number of services active in any of the broadcaster's multiplexers will inevitably change.

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 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 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.

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

When an existing 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.

Service Present in				
PAT	PMT	SDT	SDT Running status	State of Service
NO	NO	NO	-----	End state of service

6.3.4 Temporary removal of a service

Temporary removal of a service from a multiplex occurs when the service moves to a non-running status (i.e. during overnight 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.

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

6.3.5 Addition or removal of Multiplexers

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. A multiplex is deemed to have been removed if it is no longer referenced in the NIT.

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.

6.3.6 Addition or removal of Transmitters from a Network

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 prioritise 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.

6.3.7 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.

The receiver should recognise the change of version_number of the NIT table and the change to 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.

6.4 DTH Tuning

On the initial scan the receiver shall perform an automatic scan based on the Freeview NIT information found on the "home transponder" at 12.483GHz. It shall find all transport streams and services referenced within the NIT and shall tune in to the correct DVB structure, channel coding, modulation. However, the receiver shall only display services that are referenced in the regional Freeview BAT selected by the user during initial setup. Services not listed within the regional BAT shall not be displayed. See section 5.8 for more information.

In addition to an automatic search it shall be possible to perform a manual search where the tuning parameters are entered manually. New channels shall be added to the service list. No duplicated channels, nor encrypted channels shall be displayed in the service list.

6.5 Service component changes

Receivers shall continually monitor the PSI (Program Association Table PAT and Program Map Table PMT) for changes and act accordingly.

6.6 Parental lock

All devices **shall** provide a parental lock system with a pin code and use the **New NZ translation**. Codes 0 x 0D and 0 x 0F have been added to allow ratings of 16 and 18 to be used.

DVB Rating:	Old NZ Translation:	New NZ Translation:	When locked to PG and a code of 08 or higher is broadcast the device shall require a pin to view the content.
0 x 00	undefined	undefined	
0 x 06	G (to 9 years)	G (General)	
0 x 08	PGR (to 11 years)	PG (Parental Guidance)	
0 x 0C	AO (to 15 years)	M (Mature Audiences)	
0 x 0D		16 (People under 16 should not view)	
0 x 0F		18 (People under 18 should not view)	

Table 15 - Parental Rating – Expected Receiver Behaviour

Parental Rating code	New Zealand Parental Rating	DTV receiver Parental Lock setup by user					
		Undefined	G and above	PG and above	M and above	16 and above	18
0x00	Undefined	Show	Show	Show	Show	Show	Show
0x01		Show	Show	Show	Show	Show	Show
0x02		Show	Show	Show	Show	Show	Show
0x03		Show	Show	Show	Show	Show	Show
0x04		Show	Show	Show	Show	Show	Show
0x05		Show	Show	Show	Show	Show	Show
0x06	G	Show	Block	Show	Show	Show	Show
0x07		Show	Block	Show	Show	Show	Show
0x08	PG	Show	Block	Block	Show	Show	Show
0x09		Show	Block	Block	Show	Show	Show
0x0A		Show	Block	Block	Show	Show	Show

0x0B		Show	Block	Block	Show	Show	Show
0x0C	M	Show	Block	Block	Block	Show	Show
0x0D	16	Show	Block	Block	Block	Block	Show
0x0E		Show	Block	Block	Block	Block	Show
0x0F	18	Show	Block	Block	Block	Block	Block

6.7 Content Management

The receiver shall provide HDCP digital content protection on the HDMI connector(s). HDCP shall always be enabled and a user option shall not be provided to disable this function.

If the receiver has internal storage for recording programmes or an external storage device (USB Drive, HDD, etc.) can connect to the receiver then it shall provide content management on the signalled content as defined in section 5.17 or provide a more robust method to secure the broadcast content.

6.8 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.

The receiver 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.

6.9 Electronic Programme Guide EPG

- All devices shall display a native Guide via EIT schedule. Huffman compression is required to decode programme names, see 5.18 for more details. The MHEG-5 Guide is no longer allowed for new devices.
- When the device is network connected the preferred method is to display the Freeview HbbTV Guide. For more details see 7.1.5.

Channel banners

- When the user changes the TV channel the channel name and number should be displayed.
- For smart TVs the banner should be located in the top half of the screen to avoid clashing with the HbbTV mini-guide.

Other programme information may also be displayed in the channel banner or by pressing the info button

- Programme title
- Parental rating
- Closed captions symbol

- Audio description symbol
- Programme synopsis

8 Day TV Full Guide

- The 8-day TV guide uses the DVB-SI information to display programme information for all Freeview channels.
- A user should be able to easily access the guide (via a Guide button for example) and easily navigate between channels and days.

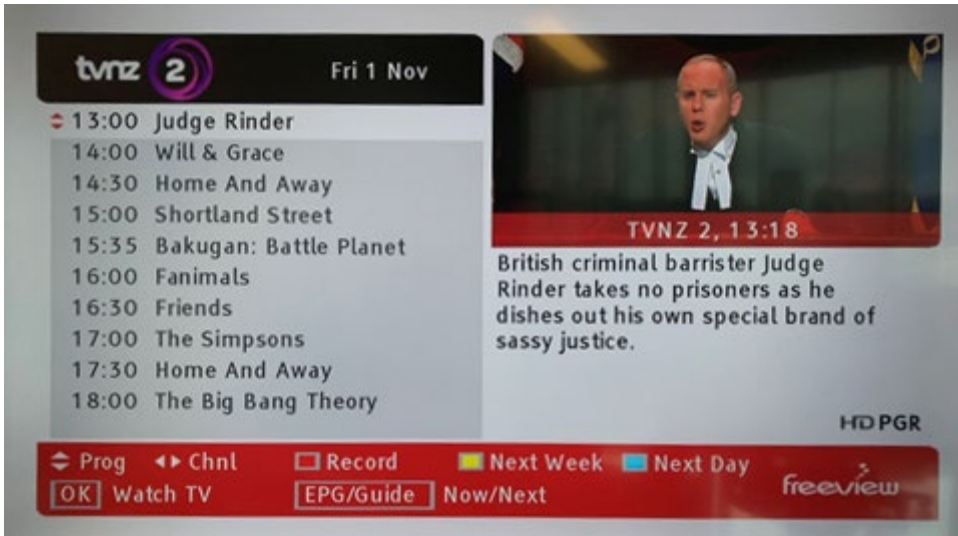
There are 2 design templates – a Channel view and a Time view:

- The Channel view lists all the programmes for the day and a user can up and down through the channels or forward/back through the days.
- The Time view shows all the programmes on during a timeslot across all channels. A user can scroll up/down through channels and forward/back through time. They should also have options to skip forward/back 24 hours.

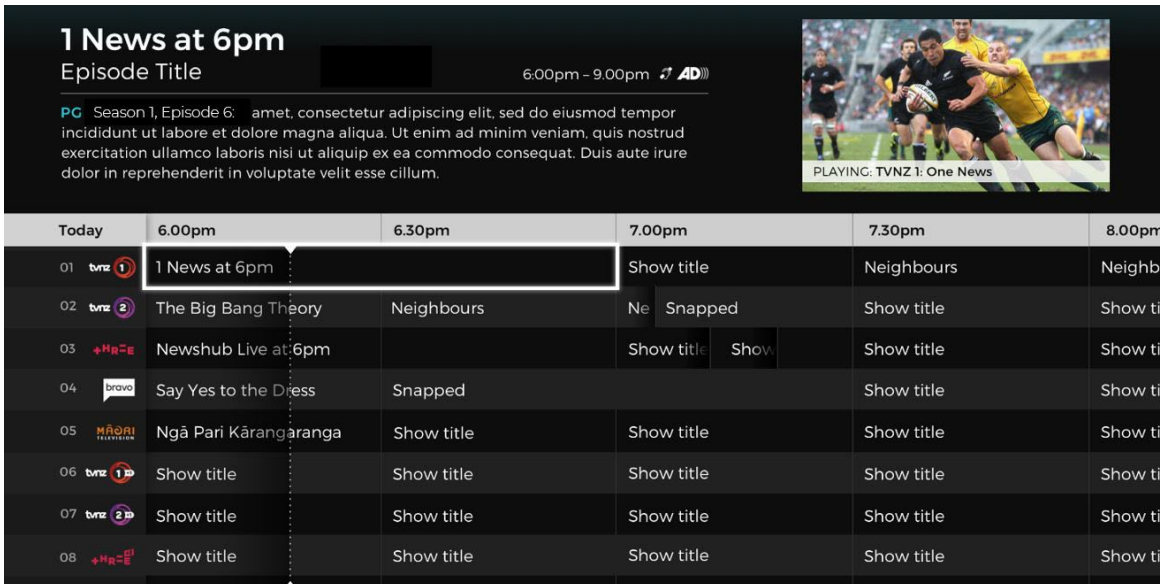
When a user highlights a programme they should see:

- When it is on
- Programme name
- Synopsis
- Closed Captions icon
- Audio Description icon

Channel View Example



Time view design example



6.10 Audio Encoding

Items listed are mandatory for all devices.

6.10.1 MPEG1 Layer II

- Musicam, audio mode stereo
- Sampling Rate 32, 44.1 & 48KHz
- ISO/IEC 11172-3

6.10.2 MPEG-4 HE-AAC

- MPEG-4 (mono and stereo level 2 bitstreams only)

Version: 1.4 | 20/10/2020

- HE AAC audio for services will be encoded for the stereo pair
- ISO/IEC 14496 part 3 level 2

6.10.3 AC-3 Dolby Digital

- Dolby Digital - 32, 44.1 & 48KHz
- Pass Through on S/PDIF and down-mix to stereo Pair
- Dolby Technical Bulletin 11 - use RF Mode to boost audio levels by 11 dB to align with HE-AAC levels.
- ETSI TS 102 366 and signalled by TS 101 154, Annex C
- The DVB specified AC_3_descriptor shall be included in the PMT for this elementary stream
- Stream id shall be set to private stream type 1
- Stream type set 0x06 (PES packet private data), include PTS

6.10.4 E-AC-3 Dolby Digital Plus

- ETSI TS 102 366
- Planned to be used with HEVC when HD starts on satellite

6.11 Video Encoding

Items listed are mandatory for all devices.

6.11.1 MPEG-2

- MPEG 2 MP@ML – only used on the satellite platform

6.11.2 AVC Video H264

- Only H.264 AVC encoded video shall be transmitted on the DTT terrestrial network.
- ISO/IEC 14496-10 - 2005 (Information Technology – Coding of audio visual objects – part 10 – Advanced Coding) as constrained by ETSI TS 101 154

6.11.3 HEVC Video H265

- It is likely that HEVC HD broadcasts will start on the satellite platform soon
- Part 2 - ISO/IEC 23008-2, ITU-T H.265
- D-book 10 ref 22.3.1.2
- HEVC is constrained by ETSI TS 101 154 clause 5.14 HEVC IRDs and Bitstreams
- Only HEVC progressive video frame rates we be required

6.12 Language Support

The receiver is to support selection of a primary and secondary audio language within the menu based on the ISO 639 language descriptors associated with the audio-streams in the ISO/IEC 13818 MPEG2 transport stream. Refer to section 5.7 for more details.

The receiver shall automatically choose the primary audio language if available and if not, choose the secondary if available. The user shall be able to select the primary and secondary language via the menu and select the preferred audio language while watching a given service.

6.13 Audio Description

Receivers shall present audio description and provide the minimum user controls. (D-Book 10 including section 4.5.3.1 & 4.5.5)

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 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 section 6.4.9 and Annex J.

Since Audio Description was not specified in the original New Zealand specifications then the language code "ita" (Italian) is signalled in the `ISO_language_descriptor` for legacy receivers.

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

Freeview will not use editorial classifications

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

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

6.13.1 Audio Settings Menu

All receivers shall support the Supplementary_audio_descriptor and 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

Table 16 - Editorial Classification

Editorial_Classification	Description	Proposed Receiver Behaviour
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 a 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>

6.14 Modulation and Radio Frequency RF

6.14.1 DTT

Tuner / Decoder	In accordance to EN300 744 Rev R1.6.2
RF Input connector	IEC 61169-2
Input Impedance	75 ohm nominal
UHF frequency range	514 Mhz to 682 Mhz
Receiver Noise Performance	Better than 7dB
Channel Bandwidth	8Mhz (Signal Bandwidth 7.61MHz). The receiver shall be able to receive carriers within an offset of up to 50KHz from the nominal centre frequency
Interference Immunity	Values as stated in Table 15, 18, 20 and 21 ITU-R BT.1368-12
FFT Size	Shall be capable of detecting and presenting services transmitted using 2K and 8K carriers.
Input Signal Level	30.4 Gaussian dBμV

Required signal power (dBμV) for 2x10 ⁻⁴ post Viterbi		
Modulation	Code Rate	Guassian dBμV
QPSK	1/2	15.2
	2/3	17.0
	3/4	18.0
	5/6	19.0
	7/8	19.8
16-QAM	1/2	20.9
	2/3	23.3
	3/4	24.7
	5/6	25.7
	7/8	26.1
64-QAM	1/2	26.6
	2/3	28.8
	3/4	30.4
	5/6	31.9
	7/8	32.8

Modulation on the DTT network will all be set to the parameters below.

- Allocated Bandwidth (per Transport Stream) : 8Mhz
- Transmission Mode : 8K
- Modulation : COFDM 64 QAM
- Code Rate : 3/4
- Guard Interval : 1/16
- Transport Stream Data Rate : 26.346 Mbit/s

6.14.1.1 UHF Channel Allocation

The Ministry for Industry, Business and Innovation (MBIE) has auctioned the spectrum above 698MHz for use with cellular mobile services. There is a potential for LTE cell phones using these frequencies to cause interference to DTT broadcasting. To prevent this, a guard band has been implemented around the allocated spectrum.

Channel	Channel Limits (MHz)	DTT Centre Frequency (MHz)
24	498 - 502	Guard Band
25	502 - 510	506 / Guard Band
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

Channel	Channel Limits (MHz)	DTT Centre Frequency (MHz)
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	700 / Guard Band
49	694 - 698	Guard Band

6.14.2 DTH

RF/IF Frequency Range	950MHz to 2150MHz
Input Signal Level / Receiver Sensitivity	-65dBm to -25dBm
Supply LNB current	Up to a maximum of 500mA with overload protection; with a minimum capability of 300 mA
Supply LNB volts	Vertical polarisation: 13Vdc Horizontal polarisation: 18Vdc
Signalling	13/18V and 22kHz tone switching
DiSEqC™	Support for 1.0, 1.1, 2.0 or 2.1
Demodulation	QPSK - DVB-S standard, ETSI (EN 300 421) DVB-S2 8PSK demodulation ETSI (EN 302307)
Input Symbol Rates	2 MS/s to 45 MS/s
Spectral Inversion	Auto
Forward Error Correction Codes	½, 2/3, ¾, 5/6 7/8, Auto
LNB L.O.	The default LO frequency shall be 11.300GHz. The user may change the LNB LO of the receiver to 10.750GHz if required (via set up menu)

The Freeview DTH network is made up of Freeview specific transponders as well as transponders related to different networks, specifically, SkyNZ.

The Freeview Network_ID is 0x2F

Version: 1.4 | 20/10/2020

Freeview Transponders with N_ID=0x2F

- 1) Freq: 12.456GHz, S.R: 22.500Msys/s, FEC: $\frac{3}{4}$, Horizontal polarisation
- 2) Freq: 12.483GHz, S.R: 22.500Msys/s, FEC: $\frac{3}{4}$, Horizontal polarisation

Sky Transponder with N_ID=0xA9

- 3) Freq: 12.519GHz S.R: 22.500Msys/s FEC: $\frac{3}{4}$ horizontal polarisation. (Currently has unencrypted Prime, Prime+1, Edge TV and Bravo plus 1)

The receiver must be able to tune to these and any transponders referenced within the Freeview NIT in both vertical and horizontal polarisations.

6.15 Video Broadcast Formats

6.15.1 High Definition HD

All broadcasts will be in 16:9 widescreen. If the original content is 4:3 this will be pillar-boxed with black bars into 16:9 format.

- 1080P50 – 1920x1080 (HEVC) – now mandatory on all receivers
- 1080i25 – 1920x1080 (H.264)
- 720p 1280x720 (HEVC / H.264)

6.15.2 Standard Definition SD

- 576i25 – 720x576 (MPEG2 / H.264)

6.16 DVB Subtitles

All receivers shall be capable of decoding and presenting HD DVB subtitles in accordance to EN 300 743.

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 – 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 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".

Version: 1.4 | 20/10/2020

6.17 Input / Outputs IO

All devices shall have the following ports. HDMI out is not required for TVs.

- Ethernet RJ45 IEEE802.3 or WiFi IEEE802.11
- Universal Serial Bus – USB
- HDMI – shall have HDCP on for all HD broadcasts

6.18 Software Upgrade

- The System Software Upgrade SSU is not required for devices from 2020 onwards however this service will still be available to use for legacy receivers.
- All devices with Network capability are required to support NWDL.
- All devices are required to support USB upgrade.

7 HbbTV

All connected devices must adhere to HbbTV 2.0.1 ETSI TS 102 796 V1.4.1 Errata #3.

Freeview maintains a broadcast-related HbbTV application that is signalled in the Freeview AIT. To be Freeview compliant a Smart TV must support the broadcast-related HbbTV application.

Freeview also maintains a broadcast-independent "Smart Tile" application based off the HbbTV application but not using any of the broadcast services. The Smart Tile allows consumers to launch Freeview IP-based services from the Apps page of a smart TV. Manufacturers are encouraged to include the Smart Tile as a featured app.

7.1 Freeview Broadcast-related Application description

The Freeview HbbTV broadcast-related application provides end users with guides to what is on Live TV and access to a catalogue of video on demand content. The Freeview HbbTV application is sole HbbTV app signalled via the AIT on all the Freeview free-to-air channels on both Satellite and Terrestrial broadcasts. The mini-guide auto-starts and is available to the user as soon as the app is loaded. The Red and Green buttons are used as shortcuts to parts of the app.

7.1.1 Freeview application features

The key features of the Freeview HbbTV broadcast-related application are:

1. A mini-guide that is displayed on screen during channel change or when the user presses a button on the D-Pad of the RCU. The mini-guide provide details on the current programme as well as what programmes are coming up on that channel. The user can scroll up and down through channels and change channels. On Devices that support +PVR - recording can also be set via the mini guide.
2. A TV Guide - this is a full 8-day EPG that can be used to see what is on and set recordings via +PVR.
3. An On Demand catalogue consisting of belts of show tile images that the user can scroll through to select a show. There are also Genre based pages and channel pages. The catalogue contains catch up AVOD from the free-to-air broadcasters as well as box sets and other VOD content.
4. Playback of the AVOD content (DRM and non-DRM) using server-side ad insertion for insertion of ads
5. Login and Registration - required to playback content

7.1.2 HbbTV app experience

To ensure the best experience for users the following user experience and interface design requirements should be followed:

1. **Clear space for the Freeview mini-guide.** The mini-guide appears along the bottom of the screen during channel change or when the d-pad is pressed while watch live TV. Clear space for the mini guide is recommended to avoid any clash with a native channel banner.

2. **Smooth performance of the app.** The HbbTV environment should have sufficient resources to enable the app to load quickly and scrolling and animations should work smoothly.
3. **Error free playback of AVOD.** To ensure the DASH content plays smoothly, the manufacturer must follow the relevant specifications correctly and accurately pass playstate events and transitions to the HbbTV player. Scrubbing should work correctly. Ads should play correctly.

7.1.3 Black list and white list

The Freeview application will load a config file with a black list / white list that is based on the User Agent string of the device. All devices must comply with the user agent syntax described in ETSI TS 102 796 V1.4.1.

HbbTV/1.4.1 (<capabilities>; <vendorName>; <modelName>; <softwareVersion>; [<hardwareVersion>; <familyName>; <reserved>)

The Whitelist contains matching expressions for User Agents. When the expression matches the user agent, the app will continue to load based on the config parameters. When the expression does not match, the app will not display and will remain hidden.

7.1.4 Guide key event

It is highly recommended that the Guide key load the Freeview HbbTV Guide page. This can be enabled by following the instruction below and for Freeview to add the User Agent to enable this feature.

The HbbTV app is listening for the key event with constant KeyEvent.VK_GUIDE which has decimal value of 458. The detection of this event is initialised with the mask value KeySetMask.OTHER (dec 1024)

- To enable this function, add '+guide' into the UserAgent
- If the device is not connected to the internet it should load the native guide instead

7.1.5 Support for Montserrat font

The Montserrat font must be supported. The font is downloaded at app launch and should be cached by the browser for optimum performance.

7.1.6 Server-side ad insertion

Playback of video streams with ads is used.

SSAI dynamically stitches targeted ads into content on the server and delivers both as one continuous stream. This delivers a better viewing experience by eliminating buffering.

- Single URL
- CDN agnostic
- Content security with encryption and DRM

7.1.7 Video/broadcast embedded object

The application uses the methods and events defined to change channels on the broadcast and to detect channel changes made via the remote. Support for this is mandatory as per 7.13.1 of OIPF-T1-R2 Volume 5. Specifically the onChannelChangeSucceeded and the onPlayStateChange events must be generated.

7.2 Descriptors

The framework for the signalling and carriage of interactive applications is as defined in the specification ETSI TS 102 796 V1.4.1 Errata #3; Digital Video Broadcasting (DVB); Signalling and carriage of interactive applications and services in Hybrid broadcast/broadband environments. For detailed reference please refer to these documents.

Every service on the Freeview platform shall reference an elementary stream carrying an AIT carrying an HBBTV application.

The following descriptors are mandatory and shall be transmitted in the elementary stream loop of the PMT to indicate that a component carries the AIT:

Application_signalling_descriptor	descriptor_tag 0x6F Mandatory whenever used in reference to a Stream_type 0x05 elementary stream and identifies that it carries an AIT.
-----------------------------------	---

The following descriptors are mandatory when a service references a DSM-CC object carousel carrying an HBBTV application and shall be transmitted in the elementary stream loop of the PMT:

Stream_identifier_descriptor	Descriptor_tag 0x52 Mandatory whenever associated with a DSM-CC object carousel carrying an HBBTV applications.
------------------------------	---

Carousel_ID_descriptor	descriptor_tag 0x13 Mandatory whenever associated with a DSM-CC object carousel carrying an HBBTV applications.
------------------------	---

Data_broadcast_id_descriptor	Descriptor_tag 0x66 Mandatory whenever associated with a DSM-CC object carousel carrying an HBBTV applications. When used for the purposes of HBBTV it shall be used in conjunction with Data_broadcast_id of 0x0123.
------------------------------	---

7.2.1 AIT

Where HBBTV applications are associated with services within a Transport Stream, an AIT shall be delivered in an elementary stream of the Actual Transport Stream. The elementary stream carrying the AIT shall be referenced in the PMT of a service with which the HBBTV application is to be associated via the Application_Signalling_Descriptor. A single AIT can describe one or more HBBTV applications and more than one elementary stream can be used to deliver multiple AITs within the Transport Stream although it is recommended to not use more than three elementary streams to carry AITs due to unpredictable responsiveness.

An Application Descriptor (descriptor_tag 0x00) shall be contained within every "application" descriptor loop of the AIT in order to define the application profile.

An Application Name Descriptor (descriptor_tag 0x01) shall be contained within every "application" descriptor loop of the AIT in order to distinguish the application and should be informative to the user.

A Transport Protocol Descriptor (descriptor_tag 0x02) shall be contained within the "application" (inner) descriptor loop of the AIT for each application and will specify whether the application is broadcast via a DSM-CC carousel (Protocol_ID 0x0001) or via HTTP (Protocol_ID 0x0003). The selector_bytes of the Transport_Protocol_Descriptor shall be used to describe the URL where the application can be found.

A Simple Application Location Descriptor (descriptor_tag 0x15) shall be contained within the "application" (inner) descriptor loop of the AIT for each application where it contains multiple directories and will specify the initial path to the application.

All sections of the HBBTV AIT shall be broadcast at least once every second and receivers shall be checked for changes to the AIT as signalled by an update of the version number in the AIT sub-table.

7.3 Freeview Broadcast-independent Smart Tile Application

Support for Broadcast-independent applications as per 5.3.5 of TS 102 796 V1.4.1 is required.

See section 8.1 for more information on the Freeview Smart Tile application.

7.4 Adaptive bitrate streaming

MPEG Dash will be used as specified in Annex E of ETSI TS 102 796 V1.4.1 Errata #3.

7.5 DRM

Microsoft PlayReady DRM SL3000 shall be supported.

7.6 CENC

- MPEG CENC Common Encryption will be implemented to allow different DRM systems to decrypt the same content, therefore minimising versions of assets.
- ISO/IEC 23001-7

7.7 IP Video

- For UHD devices, HEVC encoded HD/UHD video over IP using MPEG-DASH 13.4.2/3 of D-book 10
- Live streaming using MPEG DASH - Section 7.3.2.1 of 102 796 V1.4.1 Errata #3 HbbTV 2.0.1

7.8 Mouse and wheel events

RCU that control a pointer shall use mouse and wheel events as defined in Section 10.2.2 of TS 102 796 v.1.4.1 Errata #3 to control the HbbTV application navigation.

7.9 Parental Control

Applications making use of Parental Rating Control shall where necessary, obtain the parental rating system value threshold set on the terminal and act accordingly based upon this rating whether that be streaming appropriate content to the receiver, allowing access to downloaded/recorded content or controlling access to the HbbTV application itself. The application, not the embedded player will control this.

7.10 PVR

HbbTV PVR enabled devices shall implement the following

- Support +PVR function in OIPF DAE specification
- Shall support the PVR features listed in Table A.1 of TS 102 796, i.e. those features with status M-P.

7.11 HTTPS

HTTPS must be supported with an updated set of trusted certificate authorities.

7.12 Optional requirements

The following features are not used by the Freeview application and support for these features is optional. These are described in HbbTV 2.0.1 TS 102 796 V1.4.1 Errata #3 but are not required for Freeview NZ certification.

7.12.1 Media Synchronisation

- Multi-stream synchronisation 10.2.8 of TS 102 796 V1.4.1 Errata #3
- Synchronising applications and content across devices - 10.2.8 of TS 102 796 V1.4.1 Errata #3 section 13

7.12.2 Companion Screens

Freeview NZ have no plans to use Companion Screen, so this is non-mandatory

8.2.6 of TS 102 796 V1.4.1 Errata #3.

- Application-to-Application Communication (see Section 14.5 of TS 102 796)
- Launching an HbbTV application from a Companion Screen (see Section 14.6 of TS 102 796)
- Discovering devices and their service endpoints (see Section 14.7 of TS 102 796)

7.12.3 CI Plus

CI Plus TS - Section 11.4 of 102 796 V1.4.1 HbbTV 2.0.1

7.12.4 File System

File System Acceleration - Section 7.2.7 of 102 796 V1.4.1 HbbTV 2.0.1

7.12.5 File Delivery

File Delivery Protocol - Section 7.2.8 of 102 796 V1.4.1 HbbTV 2.0.1

7.13 How to test

On request, Freeview can provide a transport stream recording that can be used to launch the HbbTV application. The application is not geo-blocked, however the majority of video on demand content will be geo-blocked.

If the application doesn't auto-load the User Agent under test may not have been whitelisted. Contact Freeview for the code to unlock.

Check that the app looks like this <https://www.youtube.com/watch?v=WT8HNxbe5j8&t=1s>

There are 5 main screens to check;

1. Mini Guide
2. Full Guide
3. On Demand page
4. Show Page
 - a. Check that content from TVNZ, 3Now and Maori TV all play
 - b. Check scrubbing forward and back
5. Search

Check navigation on all screens and playback features before submitting to Freeview for certification.

7.14 HbbTV Application Performance

The device must ensure enough resources are available to the HbbTV app for it to run smoothly. The app should load quickly. The HTML and CSS elements used to create the interface should render correctly and animation effects should be smooth.

7.14.1 Memory usage

The "destroy" method on each component class (i.e. a destructor) gets called when the component is no longer needed.

In addition to the mandatory memory usage requirements specified in Appendix A of ETSI TS 102 796 V1.4.1, the gc() method as per the OIPF on destructor methods gets called for each page component when it's destroyed.

7.14.2 Reliability and resilience

The device must perform reliably as specified in 9.8 of ETSI TS 102 796 V1.4.1. Terminals shall be resilient to transient error conditions that are likely to occur, as well as to conditions of low resource availability.

7.14.3 OIPF configuration

Requesting configuration from oipfConfiguration shall not cause an error and shall follow JavaScript best practice (i.e return an undefined).

7.15 Local System values

Ensure that the localSystem values are set for the following:

- deviceId (optional)
- modelName
- serialNumber (optional)
- hardwareVersion
- softwareVersion
- vendorName
- familyName

8 IP TV

Freeview IP Streaming TV enables viewers with high speed internet to watch Freeview Live TV channels on their smart TV without an aerial.

IP Streaming TV service is accessed via the Freeview Smart Tile app on a smart TV. The App downloads a list of available streaming channels and then connects to each broadcaster's streaming service over the internet.

Freeview IP TV certification is optional, except for IP-only devices seeking certification. Devices that receive Freeview IP Streaming TV certification can carry the Freeview IP TV branding and will be included in Freeview marketing material relating to IP TV.

For IP TV devices seeking Freeview certification the following requirements are mandatory.

8.1 Freeview Smart Tile Application

The Freeview Smart Tile app is launched from an app tile on the Home page or hub of the smart TV and only requires an IP connection to function. The app provides access to video streaming.

The app does not require a broadcast signal as per Broadcast-independent applications 5.3.5 of TS 102 796 V1.4.1

Deployment of the app will be subject to the manufacturer's app portal terms and submission processes.

The receiver shall, subject to any manufacturer's terms, pre-install or auto-install the app during setup.

8.2 IP Live Streaming

Each channel shall be delivered using a unicast IP stream. Each IP stream shall be delivered via HTTP using either:

- Live streaming using MPEG DASH - Section 7.3.2.1 of 102 796 V1.4.1 Errata #3 HbbTV 2.0.1, or
- HTTP Live Streaming (HLS)

Therefore, both are mandatory for the device.

8.2.1 Video

Each stream shall support multiple adaptive bitrate renditions with different bitrates and dimensions.

Feature	Supported capability
Live Streaming Type	HLS MPEG-DASH
CODECs	AVC (H.264) HEVC (H.265) – MPEG DASH only
Encryption	AES-128 CENC – MPEG-DASH only
DRM	PlayReady

8.3 Initiating IP Streaming TV

The terminal shall support at least one of the following methods for launching the Freeview Smart Tile app.

8.3.1 Homepage or hub

The app shall be launched from a tile on the primary view of the app homepage or hub. When the user presses the App button or Home button or equivalent, the Freeview Smart Tile app should be visible.

For IP-only devices the Freeview Smart Tile app shall occupy the equivalent Live TV position on the home page or hub.

8.3.2 Accessing IP TV

Freeview IP TV shall be listed as an input selection in the **device input list** or available as a **button on the RCU**.

When selected via the input list or pressing the RCU button the Freeview Smart Tile app will be launched.

8.4 Service Discovery and Selection

Service discovery and selection is managed by the Freeview Smart Tile application using the web-based Freeview IP TV channel discovery API.

For each channel the following shall be provided:

- Channel name
- Logical channel number
- URL
- Type – HLS or DASH
- DVB Triplet
- Region

8.5 Channel navigation

Channel navigation is performed using the RCU.

8.5.1 Access to Channel up / down key events

In addition to the mandatory key events listing in TS 102 796 v1.4.1 Errata #3, The terminal shall provide the Freeview Smart Tile app access to the channel up / down (P+ & P-) key events for channel navigation.

- VK_CHANNEL_UP
- VK_CHANNEL_DOWN

9 Approval process

9.1 Freeview Customer Experience

The purpose Freeview certification programme is to provide consumers and retailers with confidence that products with Freeview are consistent and provide a good experience for watching live free-to-air broadcast TV, video on demand, and recording. As well as the technical requirements outlined in the specifications, it is important that the user experience for the Freeview service on the products is a good experience. The Freeview HbbTV app provides a consistent experience for users across different devices and drives higher engagement and satisfaction.

9.2 Unboxing and setup recommendations

To help consumers set up a product after purchase, it is recommended to include simple clearly worded instructions in the box, either as part of the user manual or as an insert. The instructions should be specific to New Zealand set up guidelines and use language and images for the average consumer.

9.3 Support

Throughout the life of the product, the device should continue to correctly operate the Freeview service. In order to do this, Freeview requires a production sample of the device for the Freeview test lab. Any changes to the Freeview service and HbbTV app are regression tested using devices in the lab. From time to time Freeview will require support from the manufacturer to identify issues that cannot be easily solved. If Freeview identifies that an issue is due to an incorrect implementation of the the HbbTV (or related) standard, then the Manufacturer will need to fix the issue and update their middleware.

If the manufacturer makes updates to the software on the TV, they must ensure the Freeview service and HbbTV app continues to operate correctly. If any issues arise they must rectify them immediately.

9.4 Certification Process Overview

The following is a guide to the process for certification:

1. Notify Freeview of intention to certify a product - provide details of the organisation and products to be certified
2. Test product works with the Freeview service and HbbTV application using transport stream provided by Freeview
3. Submit product to Freeview approved testing facility for testing (RF / SI / HBBTV)
4. Provide a sample to Freeview for in-field testing
5. Resolve any defects
6. Certification agreement signed
7. Provide designs with Freeview brand treatment for approval
8. Provide details of the retail approach and product line-up
9. Swap the sample TV for a production model for the Freeview lab

Table 17 - Certification types

Marketing Terms	Certification Type	Testing required			
		RF / SI	HbbTV	IP TV	PVR
Live TV	Non-Smart	X			
Live TV, OnDemand	Smart	X	X		
Live TV, On Demand, Live Stream (TBC)	Smart with IP TV	X	X	X	
Live TV, On Demand, Record	PVR	X	X		X
Live Stream (TBC)	IP TV only			X	

10 Freeview Brand Guidelines

Freeview branding on product packaging must be in accordance with 'Freeview Brand Guidelines' and can be found on <https://freeviewnz.tv/company/equipment-supply-chain/>. These should only be applied after the Certification Agreement has been issued.

To ensure Freeview brand treatment is consistent across manufacturers, packaging and promotional collateral designs should be sent to Freeview for approval prior to production. This includes:

- application of Freeview logo/logo lock-ups
- promotional copy about the Freeview features
- disclaimers