1.   SCOPE

This Operational Practice specifies the operational parameters for use of the logical_channel_descriptor for Australian free-to-air Digital Terrestrial Television transmissions and assigns the allocation of Logical Channel Numbers (LCNs) to identify television and radio services carried on free-to-air DTTB transmissions[1].

This Operational Practice also makes recommendations to receiver manufacturers and broadcasters to cover situations where receivers find duplicate LCNs in reception overlap areas with varied reception quality or where there is no LCN. The informative Appendix A gives some background and suggested scenarios on how LCNs are used in Australia.

The logical_channel_descriptor specifications comply with the detail in the Australian Digital TV Transmission standard, AS 4599 [1]. The Australian specification, while based on the original development of the Logical Channel Descriptor[2] by the Digital TV Group [2], has variations and extensions in its implementation similar to its use in Europe, such as the NorDig specification[3].

2.   APPLICATION

The intention of the Logical Channel Descriptor is to provide a broadcaster assigned virtual channel number, or label, for each of the services available to the DTTB receiver. These services are defined by the "DVB triple", a combination of the original_network_id, transport_stream_id and service_id, whose values are allocated according to Free TV Operational Practice OP-40 [3].

LCNs are used in Australia to identify services, some of which may not be present at all times. Each individual DTTB service is allocated a Logical Channel Number by the broadcaster in accordance with the allocation table in this Operational Practice.

The logical_channel_descriptor is inserted in the second descriptor loop of the Network Information Table (NIT). The logical_channel_descriptor is assigned the tag value 0x83 within the DVB Service Information (refer to the Australian DTTB transmission standard, AS 4599 [1]). Within the Australian implementation of the DTTB system, the logical_channel_descriptor is treated as a public descriptor.

2.1   Visible and Non-Visible Services

While all DTTB services within a broadcast multiplex are allocated LCNs by broadcasters, not all services within a multiplex may be intended to be seen or selected by the viewer. Certain services such as Multimedia streams, Data streams or

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[1]   It should be noted that this Operational Practice does not apply to Viewer Access Satellite Services (VAST), where the functionality of LCNs is instead provided by a combination of bouquet and service_id numbers.

[2]   The Digital TV Group has claimed copyright of the use of the Logical Channel Descriptor and has granted approval for its use in Australia.

[3]   Refer http://www.nordig.org/

system software updates may need to be concealed from the receiver service list and made invisible to the viewer.

In order that the receiver can discriminate between (broadcaster intended) visible and non-visible services, the European EICTA receiver guidelines introduced the concept of a visible_service_flag.

The visible_service_flag utilises one bit of the former six bit reserved field in the service loop of the logical_channel_descriptor. The reserved bits are normally set to "1". By setting the least significant bit (b0) to "0", the service and the associated LCN, should not be visible or accessible to the viewer in the normal Service Lists and Electronic Program Guides. The remaining five bits of the reserved field continue to be set to "1".

As is the case in Europe, this method allows the introduction of a visible_service_flag into the Australian LCN Syntax in a completely backward compatible way.

When the visible_service_flag is set to '0', broadcasters prefer that the receiver should adopt the following behaviour;

- The service shall not be visible to viewer or selectable by the normal remote control interface,
- The LCN shall not be visible to viewer or selectable by the normal remote control interface,
- The service may be called by another applet (embedded or downloaded) executing in the receiver.

2.2 Logical Channel Number Syntax

The proposed new syntax and semantics of the logical_channel_descriptor is indicated in Table 1, as follows;

Table 1. Logical Channel Descriptor Syntax

Syntax	No. of bits	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 selectable (subject to the service type being suitable etc.) via the receiver service list. When set to '0' this indicates that the receiver is not expected to offer the service to the user in normal navigation modes however the receiver may provide a mechanism to access these services (for example, during the execution of an application, resident within the receiver).

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

logical_channel_number: this is a 10-bit field which indicates the broadcaster preference for ordering services. Table 3 provides an allocation of the LCNs agreed between Australian broadcasters.

3.   DTTB RECEIVER OPERATION

3.1   Table Repetition Rates

Australian broadcasters transmit the NIT and SDT table sections in accordance with the requirements of TR 101 211 [4] (i.e., at intervals not greater than 10 seconds), as referenced by AS 4599 [1]. It is highly recommended that receivers read the NIT and SDT tables at a similar rate.

3.2   Conflicts

3.2.1   Conflicts due to Coverage Overlaps

LCN allocations to broadcasters are intended to avoid an individual receiver receiving more than one service with the same LCN. In practice due to DVB-T coverage area overlaps, it is possible that similar services (i.e., different services with the same LCN) are received from different transmitters.

3.2.2   LCN Conflicts due to Parent Transmitters and Child-site Translators

Within a broadcaster's licensed service area, a parent transmitter may be augmented by additional translator channels to improve coverage. Inevitably, there will be overlaps between the parent and child-site translator services albeit on different frequencies and bands. Translator services may be identified by having the same SI and PSI as the parent, although received on different RF frequencies.

Broadcasters shall indicate the use of additional translator frequencies for the same service multiplex by setting the other_frequency_flag in the terrestrial_delivery_system_descriptor and listing the translator frequencies in the frequency_list_descriptor of the NIT (refer ETSI EN 300 468 [5]).

Consequently, the receiver could discriminate between duplicated services and LCNs by examining the link between parent and translator services in the frequency list descriptor of the NIT. In such cases duplicated services of lower received quality should be discarded by the receiver in favour of the best quality service instance (see section 3.2.3).

To maintain a channel identity, some broadcasters choose to use the same LCN for different program services in adjoining regions which will cause an overlap in reception conditions, conflicting services and LCN duplications. Generally, in these cases, each transmission will have the same original_network_id but different transport_stream_id and will not be linked in the frequency list descriptor of each transmission's NIT.

3.2.3   Signal Quality Matrix

If competing duplicate services (i.e. those that have the same LCN allocated) are received from different transmitters, then a receiver that complies with the Australian DVB-T receiver standard, AS 4933 [6], will place the service with the highest received quality in the correct LCN position and the other(s) made available to the user, for example stored at the next available unallocated number in the range 350 - 399, unless it is intentionally duplicated by the broadcaster as indicated by its presence in the frequency list descriptor of the NIT (see section 3.2.2), in which case it can be safely discarded.

After this allocation, to account for user regional viewing preference, the choice of service competing for a common service positioning should be user- selectable.

Table 2 provides a logical set of coverage overlap scenarios and recommended receiver behaviour in accordance with 3.2.1 and 3.2.2 above.

Table 2. DVB-T Coverage Overlap Scenarios

NIT Scan Action	Overlap Case 1 Translator fed by Parent Transmitter		Overlap Case 2 Overlapping regional services from same broadcaster		Overlap Case 3 Overlaps from different broadcasters	
	Parent Channel	**Translator Channel**	**Parent Channel**	**Other Transmitter Channel**	**Parent Channel**	**Other Transmitter Channel**
(Example) Channel	6	34	X	Any Other Channel	X	Any Other Channel
NIT Terrestrial_delivery_system_descriptor Other_frequency_flag	yes	yes	X	X	X	X
NIT frequency_list_descriptor	Listed	Listed	X	Not Listed	X	Not Listed
(Example) Transport_stream_id	0xAAAA	0xAAAA	0xAAAA	0xZZZZ	0xBBBB	0xCCCC
(Example) service_id	0xDDDD	0xDDDD	0xDDDD	0xEEEE	0xDDDD	0xEEEE
(Example) Duplicated LCN	5	5	2	2	5	5
Receiver Assumption	Same service		Different service		Different service	
Signal Quality (BER)	Choose Highest QOS		Choose Highest QOS		Choose Highest QOS	
Receiver Action 1	Discard channel with lowest QOS		Bump lowest QOS LCN to 350-399		Bump lowest QOS LCN to 350-399	
Receiver Action 2 (Optional)	No further action		Allow viewer to choose		Allow viewer to choose	
Legend	X = don't care QOS = Quality of Service (received signal quality) Values shown are typical examples					

3.3   Services without LCNs

If a service is found without an LCN, a receiver that complies with AS4933 [6] should allocate the next unused channel number between 350 and 399.

3.4   Allocation of LCNs

Table 3 indicates the function and range of LCN values used by Australian Broadcasters. They apply to both broadcaster-operated and self-help re-transmission services.

A broadcaster may allocate more than one LCN to a service. This allows the main digital service, defined by a single digit LCN, to also be allocated a 2-digit or 3-digit LCN; permitting the main digital service to be listed in a contiguous group of the broadcaster's services (refer to Appendix A for further detail).

Note on LCN use on VAST: LCN-type functionality on VAST satellite services is provided by a combination of bouquet and service_ID numbers. Where a VAST service is used as the source for a self-help terrestrial retransmission service, the SI/PSI associated with such re-transmission (including LCNs) will need to be re- authored to fully comply with this OP. The values used for such a self-help re- transmission shall match that of a designated broadcaster operated service in the same licence area.

Table 3. Allocated Logical Channel Numbers

Series (note (a))	Primary User (note (b))	Secondary User (note (c))	Allocated Single digit Number	Allocated 2-digit Numbers	Allocated 3-digit Numbers	Unallocated
1	TEN Network Metropolitan	Affiliates RC&E	1	10-19	100-149	150 - 199
2	ABC	ABC	2	20-29	200-299	
3	SBS	SBS	3	30-39	300-349	
	Receiver allocation				350-399 (note (e))	
4	Miscellaneous Multiplex Operator	Not allocated	Not Allocated	44 (note(d))	Not Allocated	4, 40-43, 45-49 400-449 450-499 (note (f))
5	Affiliates / Regionals	Affiliates Remote WA	5	50-59	550-599	500 - 549
6	Affiliates / Regionals	Affiliates Remote WA	6	60-69	650-699	600 - 649
7	SEVEN Network Metropolitan/ Regional Qld	Affiliates RC&E	7	70-79	750-799	700 - 749
8	Affiliates / Regionals	Affiliates Remote WA	8	80-89	850-899	800 - 849
9	NINE Network Metropolitan	Affiliates RC&E	9	90-99	950-999	900 - 949

NORMATIVE NOTES to Table 3:

(a)   The use of an LCN of 0 or, LCNs greater than 999, are not permitted under this Operational Practice.

(b)   The allocation of values to 'Primary Users' allows for the case where, due to licence area overlaps, discrete broadcasters that would otherwise operate with the same LCN can be accommodated, with each broadcaster being allocated a single digit LCN, and range of double-digit and triple digit LCN's that may be related to a "brand" number. The double-digit and triple-digit LCN's are intended to be unique in each service/coverage area.

(c)   The allocation of values to 'Remote areas' presumes that there is no overlap with 'Primary Users'.

(d)   Allocated to the community television service in each service area.

(e)   This region has been allocated for duplicated services and services without LCNs. Broadcasters should not allocate a LCN in the range 350 – 399. Refer to Clause 3.2 and 3.3 of this OP.

(f)   The LCN range 450 – 499 has been reserved for temporary use by broadcasters and non-broadcasters for licensed trial services. Trial services introduced by existing broadcasters may also be assigned within their allocated LCN range.

4.   REFERENCES

[1]	Australian Standard, Digital television – Terrestrial broadcasting Part 1: Characteristics of digital terrestrial television transmissions	AS4599.1 - 2015
[2]	Digital TV Group (DTG); Digital Terrestrial Television, Requirements for Interoperability	D-Book V12.7 October 2023
[3]	Free TV Australia Operational Practice 40 – Allocation of DVB Service Information Codes for Australia.	Issue 5 November 2020
[4]	Digital Video Broadcasting (DVB); Guidelines for implementation and usage of Service Information (SI)	ETSI TR 101 211 V1.9.1 (2009-06)
[5]	Digital Video Broadcasting (DVB); Specification for Service Information (SI) in DVB systems	ETSI EN 300 468 V1.18.1 (2023-12)
[6]	Australian Standard, Digital television – requirements for receivers for VHF/UHF DVB-T television broadcasts including ancillary services	AS4933.1 - 2015

Appendix A (Informative) – Implementation of Logical Channel Numbers in Australia.

A1. Introduction

Through the systematic use of Logical Channel Numbers, broadcasters can ensure that a viewer can quickly choose the desired program or service from a service list menu displayed on their DTV receiver. This innovation was developed by the Digital TV Group, called "Logical Channel Numbers" (LCNs) and now extends to the EICTA and NORDIG specifications.

If each DTV broadcaster includes a LCN tag number for each service and DTV receivers have the LCN facility, then the LCNs are assigned to remote control buttons.

The two fundamental system requirements are:

- The broadcasters must "tag" each of their services with at least one LCN;
- The receivers are equipped with firmware recognition of the LCN descriptor.

Real benefits to viewers are realised when the broadcasters agree to use the numbers in an orderly way that:

- offers broadcasters an opportunity to prioritize their services;
- is user-friendly and convenient, i.e., the numbers are arranged in a "logical" manner that is easy for a viewer to store and recall their "favourites";
- avoids service conflicts, i.e., all broadcasters agree not to use the same number in the same transmission area.

A2. Logical Channel Numbering

Each broadcast station may provide several types of service including a main service and several multi-view channels. Digital radio services, interactive television, data-broadcasting and other enhancement/information services may also be offered.

The possibility of large numbers of services requires digital TV receivers to expect up to 3 digits, entered via remote control, to select the LCN of a program service. The receiver's remote control interface will need to have inbuilt hysteresis, allowing sufficient time to capture a single, double or triple digit entry.

Without an organised system of user readable program numbering:

- a broadcaster has no control over the order and priority of the displayed services; and
- a receiver could assign random channel numbers as it discovers services, either during the initial set-up and tuning process, or in the process of finding new services.

Appendix A (Informative) – Implementation of Logical Channel Numbers in Australia.

This may result in an ad-hoc assignment of channel numbers. Consequentially, it will be difficult for viewers to find desired programs amongst the litany of other services, particularly if some of these services change from time to time.

Not all services will necessarily be operating simultaneously or continuously, due to broadcast regulatory constraints and/or the finite capacity of the digital terrestrial transport stream.

In the Australian implementation of the logical_channel_descriptor, a service can be identified by more than one LCN simultaneously (Clause 3.4 of this Operational Practice). This allows Logical Channel "place markers" to be present all the time, providing broadcasters with the ability to dynamically re-assign the logical channel number of an intermittent or absent service to another service that is present, even though that service may already have a LCN allocated to it.

This implementation of LCNs is of benefit to the broadcasters and viewers.

- For the viewer,
  - a familiar menu of numbered service listings is maintained; and
  - the receiver will not attempt to select an absent service with unpredictable results.
- For the broadcaster,
  - the service list can be efficiently maintained without the need to reserve (waste) valuable data bandwidth to maintain absent (empty) services.

A3. Implementation of Logical Channel Numbers in Australia

LCNs can range from 1 to 999 – the DTV receiver normally expects up to 3-digit channel number selection from the remote control.

To provide some recognised order to the various program choices, a scheme has been devised which allows services to be selected from

- a single button push – i.e., 1 to 9;
- a double button push sequence – 10 to 99 – or
- a triple button push sequence – 100 to 999.

Appendix A (Informative) – Implementation of Logical Channel Numbers in Australia.

A3.1 Services assigned a single digit LCN

Most broadcasters are allocated a single digit LCN to identify their main service – even though they may broadcast a range of services that require a range of, say, up to 10 LCNs in total. For example, if a viewer wishes to watch the ABC's main service – press 2, for Seven's main service – press 7. Metropolitan and regional broadcasters have adopted this scheme.

(1) selects TEN	(4) Reserved for future allocation	(7) selects Seven
(2) selects the ABC	(5) selects the TEN Affiliate	(8) selects Nine Affiliate
(3) selects SBS	(6) selects Seven Affiliate	(9) selects NINE

A3.2 Services assigned to 2- or 3-digit LCNs

Obviously, all other services are assigned a 2- or 3-digit LCN. The number range assigned to each network uses their single-digit LCN as the first digit – for example, the SBS would use LCNs in the range 30 to 39 – and similarly 300 to 349 in the case of 3-digit LCNs. In the ABC case, the range is 200 - 299. The use of 2- or 3-digit LCNs for each service is at the discretion of each broadcaster, so long as they assign LCN's from within their assigned LCN range.

Broadcasters mainly use their two-digit LCNs for multi-channels. They also typically assign one 2-digit LCN simultaneously to their single-digit LCN main service, so that viewers may discover their main service adjacent to their multi-channel services when navigating using the channel up/down buttons on their DTV receiver remote control.

Some broadcasters carry radio services within their multiplex and assign 3-digit LCNs to these services.