NorDig Rules of Operation

for NorDig I and II receiver networks

Version 0.9

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1 General

The NorDig Rules of Operation contain a set of minimum transmission rules, which are necessary - in addition to other applicable standards - to support the basic functionalities of the NorDig compliant receivers in primary and secondary networks. In general it is assumed that the transmissions targeted for the NorDig digital receivers are compliant with the NorDig I and NorDig II specifications and also including the NorDig II zapper. (The NorDig I is an IRD without or with legacy API [10]. The NorDig II is an IRD that includes the API DVB-MHP Interactive Broadcast Profile, as defined in DVB-MHP version 1.1).

These Rules of Operation therefore only contain further specification of the configuration of transmission parameters and the interpretation of signalling etc. in the NorDig receivers. The Rules of Operation is also a guideline for digital receiver manufacturers how to interpret the NorDig compliant transmissions. This specification specifies some rules for transmission of the NorDig standard API, DVB MHP 1.1, but not any for the legacy API's (like OpenTV or MediaHighway).

1.1 Document History

Version	Date	Comments
0.9	2002-05-30	This is the first approved version pf the NorDig Rules of Operation for NorDig I and II Receiver Networks

1.2 Abbreviations

API	Application Programming Interface
AIT	Application Information Table
BAT	Bouquet Association Table
Bslbf	bit string, left bit first
CA	Conditional Access
CAT	Conditional Access Table
DIT	Dithering Information Table
DTTV	Digital Terrestrial Television
DVB	Digital Video Broadcast
EIT	Event Information Table
EPG	Electronic Programme Guide
ESG	Event Schedule Guide
GUI	Graphical User Interface
IRD	Integrated Receiver Decoder
LSN	Local Service Network
MFN	Multiple Frequencies Network
NIT	Network Information Table
NVOD	Near Video On Demand
OUI	(IEEE) Organization Unique Identifier
PAT	Program Association Table
PMT	Program Map Table
PSI	Program Specific Information
p/f	present / following
RST	Running Status Table
SDT	Service Description Table
SFN	Single Frequency Network
SI	Service Information

SIT	Selection Information Table
ST	Stuffing Table
TS	Transport Stream
uimsbf	unsigned integer most significant bit first
UTC	Universal Time, Co-ordinated

2 PSI/SI

2.1 General

The subsequent sections identify the PSI/SI tables transmitted in all transport streams. *All services existing in the network may be identified through PSI/SI. Exceptions to this rule may occur for proprietary applications/services such as Business TV and data.*

An overview of descriptors of what is minimum required for broadcast in NorDig networks and what the NorDig IRD specification minimum specify the IRD to handle (of SI descriptors), is showed in Table 1, (not including the DVB MHP AIT descriptors). Additional broadcast outside this (additional descriptors etc), is up to each broadcaster to specify. Table also shows descriptors not yet required by NorDig in grey and ~~overlined~~.

Descriptor	Tag value	NIT	BAT	SDT	EIT	TOT	CAT	PMT
Reserved	0x00-0x01	-	-	-	-	-	-	-
video_stream_descriptor	0x02	-	-	-	-	-	-	mb Mr
audio_stream_descriptor	0x03	-	-	-	-	-	-	mb Or
~~Hierarchy_descriptor~~	~~0x04~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~
~~Registration_descriptor~~	~~0x05~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~
~~data_stream_alignment_descriptor~~	~~0x06~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~
target_background_grid_descriptor	0x07	-	-	-	-	-	-	Ob Or
video_window_descriptor	0x08	-	-	-	-	-	-	Ob Or
CA_descriptor	0x09	-	-	-	-	-	mb Mr	mb Mr
ISO_639_language_descriptor	0x0A	-	-	-	-	-	-	mb Mr
~~system_clock_descriptor~~	~~0x0B~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~
~~Multiplex_buffer_utilization_descriptor~~	~~0x0C~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~
~~Copyright_descriptor~~	~~0x0D~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~
~~Maximum bitrate descriptor~~	~~0x0E~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~
~~private data indicator descriptor~~	~~0x0F~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~
~~Smoothing buffer descriptor~~	~~0x10~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~
~~STD_descriptor~~	~~0x11~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~
~~IBP descriptor~~	~~0x12~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~
ISO/IEC 13818-1 Reserved	0x13-0x3F	-	-	-	-	-	-	-
network_name_descriptor	0x40	Mb Mr	-	-	-	-	-	-
service_list_descriptor	0x41	Ob Mr	-	-	-	-	-	-
~~stuffing_descriptor~~	~~0x42~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~
satellite_delivery_system_descriptor	0x43	mb Mr	-	-	-	-	-	-
cable_delivery_system_descriptor	0x44	mb Mr	-	-	-	-	-	-
~~VBI_data_descriptor~~	~~0x45~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~
~~VBI_teletext_descriptor (SIS-28)~~	~~0x46~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~
~~Bouquet_name_descriptor~~	~~0x47~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~
service_descriptor	0x48	-	-	Mb Mr	-	-	-	-
~~country_availability_descriptor~~	~~0x49~~	~~-~~	~~-~~	~~*~~	~~-~~	~~-~~	~~-~~	~~-~~
linkage_descriptor	0x4A	mb Mr	-	Ob Mr	*	-	-	-
~~NVOD_reference_descriptor~~	~~0x4B~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~
~~time_shifted_service_descriptor~~	~~0x4C~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~
short_event_descriptor	0x4D	-	-	-	mb Mr	-	-	-
Extended_event_descriptor	0x4E	-	-	-	Ob Mr	-	-	-
~~time_shifted_event_descriptor~~	~~0x4F~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~
Component_descriptor	0x50	-	-	-	Ob Mr	-	-	-
~~mosaic_descriptor~~	~~0x51~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~
stream_identifier_descriptor	0x52	-	-	-	-	-	-	Ob Mr
Descriptor	Tag value	NIT	BAT	SDT	EIT	TOT	CAT	PMT

Descriptor	Tag value	NIT	BAT	SDT	EIT	TOT	CAT	PMT
CA_identifier_descriptor	0x53	-	-	Ob Mr	Ob Or	-	-	-
content_descriptor	0x54	-	-	-	mb Mr	-	-	-
Parental_rating_descriptor	0x55	-	-	-	Ob Mr	-	-	-
teletext_descriptor	0x56	-	-	-	-	-	-	mb Mr
~~Telephone_descriptor~~	~~0x57~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~
local_time_offset_descriptor	0x58	-	-	-	-	Mb Mr	-	-
Subtitling_descriptor	0x59	-	-	-	-	-	-	mb Mr
Terrestrial_delivery_system_descriptor	0x5A	mb Mr	-	-	-	-	-	-
~~Multilingual_network_name_descriptor~~	~~0x5B~~	~~*~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~
~~Multilingual_bouquet_name_descriptor~~	~~0x5C~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~
~~Multilingual_service_name_descriptor~~	~~0x5D~~	~~-~~	~~-~~	~~*~~	~~-~~	~~-~~	~~-~~	~~-~~
~~Multilingual_component_descriptor~~	~~0x5E~~	~~-~~	~~-~~	~~-~~	~~*~~	~~-~~	~~-~~	~~-~~
private_data_specifier_descriptor	0x5F	mb Mr	-	mb Mr	mb Mr	-	-	mb Mr
service_move_descriptor	0x60	-	-	-	-	-	-	Ob Mr
~~short_smoothing_buffer_descriptor~~	~~0x61~~	~~-~~	~~-~~	~~-~~	~~*~~	~~-~~	~~-~~	~~-~~
Frequency_list_descriptor	0x62	Ob Mr	-	-	-	-	-	-
~~partial_transport_stream_descriptor~~	~~0x63~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~
~~data_broadcast_descriptor~~	~~0x64~~	~~-~~	~~-~~	~~*~~	~~*~~	~~-~~	~~-~~	~~-~~
~~CA_system_descriptor (note 2)~~	~~0x65~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	
data_broadcast_id_descriptor	0x66	-	-	-	-	-	-	mb Mr
~~Transport_stream_descriptor~~	~~0x67~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~
~~DSNG_descriptor~~	~~0x68~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~
~~PDC_descriptor~~	~~0x69~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~
AC-3_descriptor	0x6A	-	-	-	-	-	-	mb Mr
~~Ancillary_data_descriptor~~	~~0x6B~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~
~~cell_list_descriptor~~	~~0x6C~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~
~~cell_frequency_link_descriptor~~	~~0x6D~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~
~~announcement_support_descriptor~~	~~0x6E~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~
Application_signalling_descriptor	0x6F	-	-	-	-	-	-	mb Mr
service_identifier_descriptor	0x71	-	-	Ob Mr	-	-	-	-
user defined	0x80-0xFE	-	-	-	-	-	-	-
~~Viasat private: Logic_channel_dscriptor~~	~~0x82~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~
NorDig private: Logic_channel_descriptor	0x83	Ob Mr[1)]	-	-	-	-	-	-
~~EACEM private: Logic_channel_dscriptor~~	~~0x83~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~
~~EACEM private: Preferred_name_list_descriptor~~	~~0x84~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~
~~EACEM private: Preferred_name_identifier_descriptor~~	~~0x85~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~
~~EACEM private: EACEM_stream_identifier_descriptor~~	~~0x86~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~
~~Senda private: Channel_list_descriptor~~	~~0xF1~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~	~~-~~
Forbidden	0xFF	Fb	Fb	Fb	Fb	Fb	Fb	Fb

- *Descriptor not applicable to be inserted*
Mb Mandatory to Broadcast, always/all time
mb Mandatory to Broadcast if applicable, i.e. if certain criteria is met (e.g. if scrambling is used)
Ob Optional to broadcast, but recommended (if applicable)
Fb Forbidden to broadcast (may cause misinterpretation)
Mr Mandatory to receive and interpret if broadcast
Or Optional to receive and interpret (if broadcasted)
1) Note: Usage of this descriptor is highly recommended for NorDig I. It is to be noted that interpretation of this descriptor is mandatory for NorDig II receivers

Table 1 Overview over used descriptor in NorDig member's broadcast and reception

2.1.1 Text strings and field sizes of the descriptors

In NorDig transmission, text strings shall be coded using the 'Latin Alphabet number 5' as specified in ISO 8859-9 [*i.e. our Nordic characters*] (and then signalised with a first byte '0x05' in the text field) or optional using the 'Latin Alphabet' as specified in ISO/IEC 6937 (see EN 300 468 [1] Appendix A).

Broadcasters are strongly advised not to exceed the maximum recommended lengths for text fields defined in the following table. Note: The figures are given for the number of displayable characters that are required to represent the text field (including spaces but excluding any control codes). The number of bytes required will depend on the use of control codes and whether one or two byte character representation is used.

Name Field	Name Length	Comments and examples
Network Name	24	”Teracom_ Stockholm”
Service Provider Name	20	”Sveriges Television”
(Full) Service Name	22	”SVT Östnytt 24 timmar” Full name for display on the set-up menus
(Short) Service Name[1]	12	”SVT Östnytt” A short version for display on browse and listing display. Shortened from full name by using control codes, se below.
Event Name	40	”Ice hockey World Championship” It is allowed to add an episode title within the space: ”Ice hockey World Cup:Final”
Short Event Descripton	255	”From the final, Sweden - Finland. Commentator: Arne Hegerfors / Glenn Strömberg”
Extended Event descripton	255	This limitation is for all extended event information related to a specific event.
Component Descripton	32	See Event Name
Application Name	32	See Event Name

Control codes can be used to define how a name shall be shortened, see ETR 211 [2]. The control codes are

1. 0x86 short_name_on;
2. 0x87 short_name_off.

These codes may only be used in pairs.

Example, service name:
'The digital [0x86] Sport Channel [0x87]', full name: *'The digital Sport Channel'*, short name: *'Sport Channel'*.

Broadcaster are also strongly advised not to exceed the recommended maximum lengths of (unique) event data during a 24 h period defined below (not including repetitions) per service:

- For short event descriptors 9600 characters.
- For extended event descriptors 40960 characters.

[1] This shorter version of the service name may be needed as in some menus where more information has to be displayed there may be some lack of space on the TV set if all information shall be readable.

All name fields shall contain meaningful data. Description fields may be empty at the broadcaster's discretion.

Text string formatting name and description fields as defined in ETR 211 [2] section 4.6 may be used by broadcasters and shall be supported by receivers.

2.2 Program Association Table (PAT)

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.

2.3 Conditional Access Table (CAT)

CAT shall be transmitted whenever at least one service component in the transport stream is scrambled. CAT shall be transmitted on PID 0x0001.

2.3.1 Mandatory descriptors

CA_descriptor:	When inserted in the CAT, the *CA_descriptor* identifies the CA_System_Id of the CA operator as well as the EMM PID. It is allowed to insert private data into the *CA_descriptor*.

2.4 Program Map Table (PMT)

For each service in a transport stream there shall be a corresponding Program Map Table. PMT shall be encoded according to ISO/IEC 13818-1. There shall be separate program_map_PIDs for each service.

2.4.1 Mandatory descriptors

CA_descriptor:	A *CA_descriptor* shall be inserted whenever a service or service component is scrambled. CA_descriptor may be inserted both in the first (service level) and second (component level) descriptor loop. It is optional to insert any private data into the *CA_descriptor* in PMT.
Video_stream_descriptor	Mandatory whenever still pictures (i.e. MPEG stills) are transmitted
ISO_639_language_descriptor:	This descriptor shall be inserted for every audio component defined, if more than one audio stream with different languages is present within a service. The descriptor should be inserted in any case, also when there is only one language The audio_type is currently set to "Undefined", but any value defined by ISO/IEC 13818-1 is allowed. For dual mono components one *ISO_639_language_descriptor* shall contain two language codes. The first one refers to the left audio channel while the second one refers to the right audio channel.
Teletext_descriptor:	Mandatory whenever a teletext component is defined. The syntax shall be according to ETR 300 468.
Subtitling_descriptor:	Mandatory whenever DVB bitmap subtitles are transmitted.

Private_data_specifier	Mandatory whenever private defined descriptors is used, as specified in ETR 211. For NorDig private defined descriptors (e.g. NorDig Logic Channel Descritptor), then private_data_specifier_value shall be set to 0x00000029, (see ETR 162).
Data_broadcast_id_descriptor	Mandatory whenever transmission of DVB bootloader (system software update) is used. When used as DVB bootloader (System Software Update) data broadcast id descriptor, the data_broadcast_id shall be set to 0x000A. The id_selector_bytes shall be used as specified in the DVB bootloader spec [14]. Update_type 0x0 (proprietary update solution) shall not be used. The OUI value in the PMT shall match the OUI value in the NIT linkage to bootloader descriptor.
Application_Signalling_ Descriptor	Mandatory whenever a DVB MHP data application component is defined. To avoid transition states and mismatches with the AIT, it is recommended to not set the 'application_type' and 'verion_no' in this descriptor, (i.e. set to 0). The stream_type in the PMT for this component/PID shall be set to 0x05 (private_sections)

2.4.2 Optinal descriptors

Target_background_grid Descriptor	Used as specified in ETR 154
Video_window_descriptor	Used as specified in ETR 154
Stream_identifier_descriptor	Used as specified in ETR 211
Service_move_descriptor:	May be used when a service is moved from one transport stream to another. The syntax shall be according to ETR 300 468. As soon as the service is available in the new transport stream, a *service_move_descriptor* shall be inserted in the PMT in the original transport stream.
Data_broadcast_id_descriptor	May be used with transmission of other data. When used as MHP data broadcast id descriptor, the data_broadcast_id shall be set to 0x00F0 for MHP Object carousels and to 0x00F1 for MHP Multi Protocol Encapsulation

2.4.3 Data Broadcast Id descriptor for DVB bootloader (system software update)

IEEE OUI (as described in IEEE 802-1990 [5]) of the organization providing a system software update service on the transport-stream/service. DVB has defined OUI 0x00015A to signal that the stream is from any OUI.

2.5 Application Information Table (AIT)

For each service containing a DVB MHP application-(s) in a transport stream there shall be a corresponding Application Information Table. AIT shall be encoded according to DVB MHP 1.1 specification; ETSI TS

102 812. There shall be separate AIT PIDs for each service (Service ID). The minimum repetition rate of each AIT subtable is 1 seconds.

Stream_type for data application shall be set to 0x05, ITU-T Rec H.222.0 | ISO/IEC13818-1 private_sections.

An overview of DVB MHP AIT descriptors of what is minimum required for DVB MHP broadcast in NorDig networks is showed in Table 2. Additional AIT broadcast outside this (additional descriptors etc), is up to each broadcaster to specify. Table also shows descriptors not yet required by NorDig in grey and ~~overlined~~.

Descriptor	Tag value	AIT	PMT	SDT
Application descriptor	0x00	mb Mr	-	-
Application name descriptor	0x01	mb Mr	-	-
Transport protocol descriptor	0x02	mb Mr	-	-
DVB-J application descriptor	0x03	mb Mr	-	-
DVB-J application location descriptor	0x04	mb Mr	-	-
External application authorisation descriptor	0x05	mb Mr	-	-
Routing Descriptor IPv4	0x06	Ob Mr	-	-
Routing Descriptor IPv6	0x07	Ob Mr	-	-
DVB-HTML application descriptor	0x08	mb Mr	-	-
DVB-HTML application location descriptor	0x09	mb Mr	-	-
~~DVB-HTML application boundary descriptor~~	~~0x0A~~	~~*~~	~~-~~	~~-~~
Application icons descriptor	0x0B	Ob Mr	-	-
Pre-fetch descriptor	0x0C	Ob Mr	-	-
~~DII location descriptor~~	~~0x0D~~	~~*~~	~~-~~	~~-~~
~~delegated application descriptor~~	~~0x0E~~	~~*~~	~~-~~	~~-~~
~~Plug-in descriptor~~	~~0x0F~~	~~*~~	~~-~~	~~-~~
Application storage descriptor	0x10	Ob Mr	-	-
reserved to MHP for future use	0x11-0x5E	*	-	-
private data specifier descriptor	0x5F	mb Mr	-	-
reserved to MHP for future	0x60-0x7F	*	-	-
User defined	0x80-0xFE	*	-	-
Data broadcast id descriptor, (see ch 2.4 PMT)	0x66	-	Ob Mr	-
Application Signalling Descriptor, (see ch 2.4 PMT)	0x6F	-	Mb Mr	-
Service identifier descriptor, (see ch 2.7 SDT)	0x71	-	-	Ob Mr

- *Descriptor not applicable to be inserted*
Mb Mandatory to Broadcast, always/all time
mb Mandatory to Broadcast if applicable, i.e. if certain criteria is met
Ob Optional to broadcast, but recommended (if applicable)
Fb Forbidden to broadcast (may cause misinterpretation)
Mr Mandatory to receive and interpret if broadcast
Or Optional to receive and interpret (if broadcasted)

Table 2 Overview of descriptors in use for DVB MHP application

2.5.1 Mandatory descriptors

Transport_protocol_descriptor — Mandatory whenever an MHP application is defined and carried via OC, *it identifies the transport protocol associated with a service component and possibly provides protocol dependent information. These protocols may be*

	OC (object carousel) IP or the interaction channel.
Application_descriptor	Mandatory whenever an MHP application is defined. The 'application_profile' field lists the profiles and versions of these profiles on which this application may be executed. The 'service_bound_flag' field indicates whether or not this application may live on to an other service. The 'visibility' field is used to signalise whether or not an application shall be visible in the navigator or an EPG. The 'application_priority' field is used to set priority for simultaneously run application, if the platform have limited resources.
Application_name_descriptor	Mandatory whenever an MHP application is defined, it is an informative descriptor giving a name to the application
DVB-J_application_descriptor	Mandatory whenever an MHP DVB-J based application is defined.
DVB-J_application_location_descriptor	Mandatory whenever an MHP DVB-J based application is defined. The 'base_directory_byte' field contains a string specifying a directory name starting from the root of the file system. This directory is used as a base directory for relative path names. The 'classpath_extension_byte' contains a string specifying a further extension for the DVB-J class path. The 'initial_class_byte' contain a string specifying the name of the object in the file system that is the class implementing the Xlet interface.
external_application_authorisation_descriptor()	Mandatory whenever external applications are allowed to "survive" zapping from another service and to run on this one. (These applications cannot be launched from this service). Shall then be inserted in the first descriptor loop of the AIT. Service bound for applications listed in this descriptor, shall then in its originated service-(s) be set to '0', survive zapping.
DVB-HTML_application_descriptor	Mandatory whenever an MHP DVB-HTML based application is defined.
DVB-HTML_application_location_Descriptor	Mandatory whenever an MHP DVB-HTML based application is defined.

2.5.2 Optional descriptors

application_icons_descriptor()	May be used to reference associates an PNG-based image to the application
ip_routing_descriptors *routing_descriptor_IPv4* *routing_descriptor_IPv6*	May be used for multicast IP for MHP applications
prefetch_descriptor()	May be used. It is defined to enable

	implementations to start fetching files that will be required during the early part of an application 's life. Later in an application's life it can actively request file pre-fetching using API mechanisms. This descriptor do not have a relation to the API-based pre-fetching
application_storage_descriptor()	May be used. It advertises that an application can be stored and provides some indications of its properties. The descriptor contains among others the 'storage_property', 'version' and 'priority' fields. Along with this descriptor there must also be an Application Description File. The 'storage_property' field indicates whether this is a broadcast related application or a stand-alone application. The 'version' field provides the version number of the application. The 'priority' field indicates the priority of this application for storage relative to the other applications signalled in this service.
Application Description File	May be used, it is an XML-based file containing information on which files need to be stored etc. The name and the location of the file are defined by MHP v1.1. This file must be present whenever an application is supposed to be stored.

2.6 Network Information Table (NIT)

NIT shall be transmitted in each transport stream in the network. Both NIT_actual and NIT_other may be transmitted. NIT shall always be transmitted on PID 0x0010.

2.6.1 Mandatory descriptors

network_name_descriptor:	A *network_name_descriptor* shall be inserted for each NIT sub-table.
satellite_delivery_system_descriptor:	A *satellite_delivery_system_descriptor* shall be inserted for each transport stream in a satellite network. All transport streams in a network shall be defined in the appropriate NIT section.
cable_delivery_system_descriptor:	A *cable_delivery_system_descriptor* shall be inserted for each transport stream in a cable network. All transport streams in a network shall be defined in the appropriate NIT section. Reference to analogue services (PAL) may be used and then they shall be regarded as a "transport stream". The *cable_delivery_system_descriptor* for

	analogue services shall contain the correct centre frequency for the vision carrier, while the other parameters shall be set to zero (i.e. not defined). The *service_list_descriptor* for this "transport stream" shall list only one service with service type set according to Table 72 in EN 300 468 [6] (0x07, PAL coded signal). An example of these two descriptors is shown in Figure 1
terrestrial_delivery_system_descriptor:	A *terrestrial_delivery_system_descriptor* shall be inserted for each transport stream in a terrestrial network. All transport streams in a network shall be defined in the appropriate NIT section.
linkage_descriptor:	Currently the following *linkage_descriptors* are mandatory in the first descriptor loop (when applicable): • linkage_type 0x04: Linkage to transport stream which carries EIT schedule information for all of the services in the network (i.e. "barker" service see section 3.2) • Linkage_type 0x09: Used for signalling of DVB/ETSI system software download service (bootloader) transmission. • linkage_type 0x81: Used for signalling of NorDig system software download service (bootloader) transmission.
private_data_specifier	Mandatory whenever private defined descriptors is used, as specified in ETR 211. For NorDig private defined descriptors (e.g. NorDig Logic Channel Descritptor), then private_data_specifier_value shall be set to 0x00000029, (see ETR 162).

```
; ------ Cable Delivery System Descriptor (0x44) ------
DESCRIPTOR 0x44
 Descriptor Tag              : 0x44   ; (68)
 Descriptor Length           : 0x0B   ; (11)
 Frequency                   : 0x06312500    ;
 Reserved                    : 0x000 ;
 FEC Outer                   : 0x0    ;
 Modulation                  : 0x00   ; (0)
 Symbol Rate                 : 0x0000000     ;
 FEC Inner                   : 0x0    ;
END (OF DESCRIPTOR)

; ------ Service List Descriptor ------
DESCRIPTOR 0x41
 Descriptor Tag              : 0x41   ; (65)
 Descriptor Length           : 0x03   ; (3)

 ; ------ Service #1 ------
```

Service Id	: 0x0087	; (135)
Service Type	: 0x07	; (7)
END (OF DESCRIPTOR)		

Figure 1 Example of cable_delivery_system_descriptor and service_list_descriptor for analogue services

2.6.2 Optional descriptors

Service_list_descriptor:	A *service_list_descriptor* may be inserted for each transport stream defined in each NIT section. All services targeted for the network in a transport stream shall then be listed.
Logic_channel_descriptor	NorDig private descriptor. Inserted in 2nd descriptor loop. All services targeted for the network in the transport stream should then be listed. The use of this descriptor is highly recommended.
Linkage_descriptor:	Currently the following *linkage_descriptors* are optional in the 1st loop: • linkage_type 0x02: EPG service
Frequency_list_descriptor	Complete list of all alternative frequencies to the delivery_system_descriptor's frequency / centre_frequency.

2.6.3 Description of NorDig private descriptor

***Logical_channel_descriptor*:**
The *logical_channel_descriptor* is a privately defined descriptor (i.e. not DVB specified) intended for use in terrestrial networks. If used, this descriptor shall be inserted in the second descriptor loop in NIT. The descriptor is used to comply to the fact that some services are to the viewers related to a specific channel position. The use of the *logical_channel_descriptor* shall be as below:

1. It is not necessary to include all services in the network into the logic_channel_desriptor (Not included services will be "visible", but located last in the service list, without control of order). The numbers used may start at any value, and need not be continuos.

2. For each service type, the logical_channel_number shall be unique across the network (defined by the network_id). In areas where several network intersect and the same logical channel number is used by several services, only the service belonging to the preference network (see 3.5.1 for definition) will be assigned to its logical channel number.

2.7 Service Description Table (SDT)

SDT_actual is mandatory for each transport stream in the network. Transmission of SDT_other is optional. In case of reference to analogue services, SDT_other is mandatory

2.7.1 Mandatory descriptors

service_descriptor:	A *service_descriptor* shall be inserted for each

	service defined in the SDT. Service_type 0x81 shall be used for software download service.
private_data_specifier	Mandatory whenever private defined descriptors is used, as specified in ETR 211. For NorDig private defined descriptors (e.g. NorDig Logic Channel Descritptor), then private_data_specifier_value shall be set to 0x00000029, (see ETR 162).

2.7.2 Optional descriptors

CA_identifier_descriptor:	This descriptor is recommended to use whenever at least one service component is scrambled. *CA_system_id* is allocated by ETSI and is given by [10]. This may be used static (recommended), then it shall be set according to the services regular/normal scrambling status. Or it may be used dynamic, following the services scrambling status.
Linkage_decriptor	**0x01**, linkage to information service, may be used to reference to a DVB MHP super teletext service (i.e. a MHP data application service with nicer GUI that intend to replace an EBU teletext service/component. *(Targeting parallel transmission of both EBU teletext and MHP super teletext, where non-MHP receivers will launch the EBU teletext and where MHP receivers will launch the MHP super teletext service when pressing the "text"-button).* **0x03**, linkage to a CA replacement service, may be used to automatically link a receiver to another service, a replacement service, if the receiver is not able to descramble the original service. **0x05**, linkage to a service replacement service, may be used to automatically link a receiver to another service, a replacement service, when the running status is set to "not running" (0x01). The service that is linked/referenced to as a replacement service (with 0x03 or 0x05), shall not contain any (further) linkage 0x03 or 0x05, when the original service linkage criteria is fulfilled (i.e. when scrambling is true for 0x03 or when running status is "not running" for 0x05). A service shall not contain both linkage 0x03 and 0x05. The linkage shall be transmitted at least the interval for the replacement, but is recommended to be transmitted quasi-static. To be aware of when using linkage is that the receiver is still expected to display information of the original service

	(i.e. like that the IRD is still scanned to the original service, but replacing the elementary streams coming from the replacing service).
Service_identifier_descriptor	May be used for textual service identifiers in parallel with the Service_ID, Transport_stream_ID and the Original_Network_ID, for MHP IRDs.

2.8 Event Information Table (EIT)

It is mandatory to transmit EIT p/f sections for all “visible” services in the actual transport stream. With visible service means all services that are not listed in any NorDig Logic Channel Decscriptor as “hided”, i.e. visible_service_flag set to ‘0’. (Typically service like bootloaders etc will hided, for example). Transmission of EIT p/f for other transport streams is optional.

Transmission of EIT schedule information, for actual and other transport streams is optional. (EIT schedule information could be transmitted in only one transport stream, called the "Barker Channel", in the network). All transport streams in the network that has its EIT schedule information located on another transport stream shall contain a link to this EIT schedule information, implemented by a linkage_descriptor in the NIT. Linkage_type 0x04 is used for the EIT schedule information. (The parameter "service_id" in the linkage_descriptor is not applicable when linkage_type 0x04 is used, i.e shall be set to 0x0000 according to EN 300 468).

2.8.1 Mandatory descriptors

short_event_descriptor:	Contains title and possibly a short (less than 256 characters) text information about the event.
content_descriptor:	Classifies the event according to certain content classes specified by DVB [6].
private_data_specifier	Mandatory whenever private defined descriptors is used, as specified in ETR 211. For NorDig private defined descriptors (e.g. NorDig Logic Channel Descritptor), then private_data_specifier_value shall be set to 0x00000029, (see ETR 162).

2.8.2 Optional descriptors

extended_event_descriptor:	Contains an extended text information about the event and acts as a supplement to the *short_event_descriptor*.
parental_rating_descriptor:	Recommended age rating.
CA_identifier_descriptor:	This descriptor may be use whenever at least one service component is scrambled. *CA_system_id* is allocated by ETSI and is given by [10]. If used then it shall be used dynamically, i.e. following the services scrambling status. (Mainly targeting the ESG/EPG)

component_descriptor: Identifies the components (e.g. video, audio) associated with the service for the running event.

2.9 Time Date Table (TDT)

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 30 second.

2.10 Time Offset Table (TOT)

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 30 second.

2.10.1 Mandatory descriptors

local_time_offset_descriptor: Currently the following country_codes are defined in this descriptor:

- NOR
- SWE
- DNK
- FIN
- ICE

The parameter "country_region_id" is set to zero for all these countries.

3 Operational use for service mapping

The tuning of the NorDig IRD can either be based on the NIT signalling in SI or on scanning.

3.1 Use of DVB specific identifiers

The broadcaster shall make services uniquely identified in the broadcast through the combination of only original_network_id – service_id. (The IRD however identify a service uniquely through the combination original_network_id – transport_stream_id – service_id). These, and some other mandatory parameters, are described in the following sections.

3.1.1 Original_network_id

Each network operator originating broadcasting signals shall apply for a 2-byte *original_network_id* according to ETR 162 [10].

Original_network_ID within 0xFF00 – 0xFFFF (temporary_private_use), shall only be used for test and (shorter) demonstration transmission. IRD will not install or display services within these original_network_ids

3.1.2 Network_id

Each network operator shall also apply for a 2-byte *network_id (or for terrestrial networks range of network_ids)*, independent of originating signals or not. Allocation of *network_id* is done by ETSI, and allocated values are available in the ETSI document ETR 162 [10].

For terrestrial networks a unique *network_id* shall be allocated to each LSN[2] in the network. An LSN consists of all transport streams transmitted from the same emitting points and have the "same" coverage. The allocation shall comply to the ETR 162 [10] 4-colour-map approach , this gives the possibility to allocate up to 256 *network_ids* within the network.

Network_ID within 0xFF01 – 0xFFFF (temporary_private_use), shall only be used for test and (shorter) demonstration transmission. IRD will not install or display services within these network_ids.

3.1.3 Transport_stream_id

The *transport_stream_id* shall uniquely define a transport stream within the network. Each operator allocates *transport_stream_ids* on an individual basis. However, it is recommended that operators originating signals allocate a unique *transport_stream_id* for each transport stream in the network.

Within a given terrestrial network two transport streams are identified as identical as long as the transport streams contains the same set of services. This interpretation is to simplify the use of mobile IRDs.

3.1.4 Service_id

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. It is recommended that operators originating signals allocate a unique *service_id* for each service in the network (original_network_id).

[2] Local Service Network. Please refer to section 3.5.2 for further explanation.

3.1.5 Event_id

The *event_id* is a 16-bit field which contains the identification number of the described event. Each service provider is free to allocate *event_ids* within their service_id domain, with the restriction that an *event_id* shall be unique within the transmitted schedule. An *event_id* shall be associated with a single event within the schedule, i.e. if an event is rescheduled within the currently transmitted schedule, it shall not change its *event_id*. If the event is removed from the schedule (or rescheduled to outside the transmitted schedule) then its *event_id* shall be removed from the schedule. Any replacement event shall be allocated a new *event_id* unique within the transmitted schedule.
A recommended allocation method for new *event_id* in terrestrial networks is to use odd values for national events and even values for regional events, this to avoid that events that are inserted at different locations will be allocated the same *event_id*.

3.2 Barker Channel

Operators may provide a "barker channel", i.e. a transport stream containing complete EIT schedule information for all services from each operator. Usually the "barker channel" is a dedicated transport stream, and all other transport streams of that operator shall then contain a linkage to this "barker channel".

3.2.1 Link to EIT schedule

Generally the linkage to the EIT schedule is implemented by inserting a *linkage_descriptor* in the first descriptor loop in the NIT. Linkage_type 0x04 ("Transport Stream containing complete network/bouquet SI") is used for this purpose.

A problem occurs whenever multiple operators offer services from the same transport stream, since only one EIT schedule information service can be addressed by the linkage_descriptor in NIT. The problem may be avoided by careful planning of transport stream composition.

3.2.2 Link to bootloader software / download

Bootloading software download streams/services are identified by the original_network_id, transport_stream_id and service_id and are usually transmitted in a dedicated transport stream. Normally all transport streams contain a link to this transport stream. This link is implemented by a number of *linkage_descriptor* with linkage_type 0x81, inserted in the first descriptor_loop of NIT one per bootloader/download service (service_id).

An operator may choose to broadcast several bootloader software streams (“services”) under the same service_id, then they shall all be signalised inside one and the same bootloader descriptor using the loop inside the descriptor.

3.3 Specific service mapping for satellite networks

3.3.1 Multiple operators in the same physical network

One physical network (orbital satellite position) may be shared between multiple operators, e.g. each operator manages different transponders in the same physical network.

On satellite networks, NIT_actual on each transponder shall describe all transport streams operated by the operator of the actual transport stream as well as all transport streams operated by other operators in the same satellite network. NIT_other may describe transport streams operated by any other operator in another network (i.e. retransmission into secondary networks).

The principle of multiple operators in the same satellite network is best illustrated by an example.

Example: One satellite network *X-sat* consists of 4 transport streams. There are two independent operators managing these transport streams according to the following rule:

- TS1 - transport_stream_id 0x0001: operated by "Operator A"
- TS2 - transport_stream_id 0x0002: operated by "Operator A"
- TS3 - transport_stream_id 0x0003: operated by "Operator B"
- TS4 - transport_stream_id 0x0004: operated by "Operator B"

The network_id of *X-sat* is 0x0040, while the original_network_id of "Operator A" and "Operator B" is 0x0041 and 0x0051, respectively.

"Operator A" transmits EIT schedule information in TS1, while "Operator B" transmits EIT schedule information in TS3.

The physical network operator ("X-sat") is responsible for NIT generation. All transport streams shall be signalled in NIT_actual, both from "Operator A" and "Operator B" (refer to Figure 3). An example of the NIT transmitted in all transport streams is shown in Figure 3. Please note that link to EIT Schedule is not included in this example.

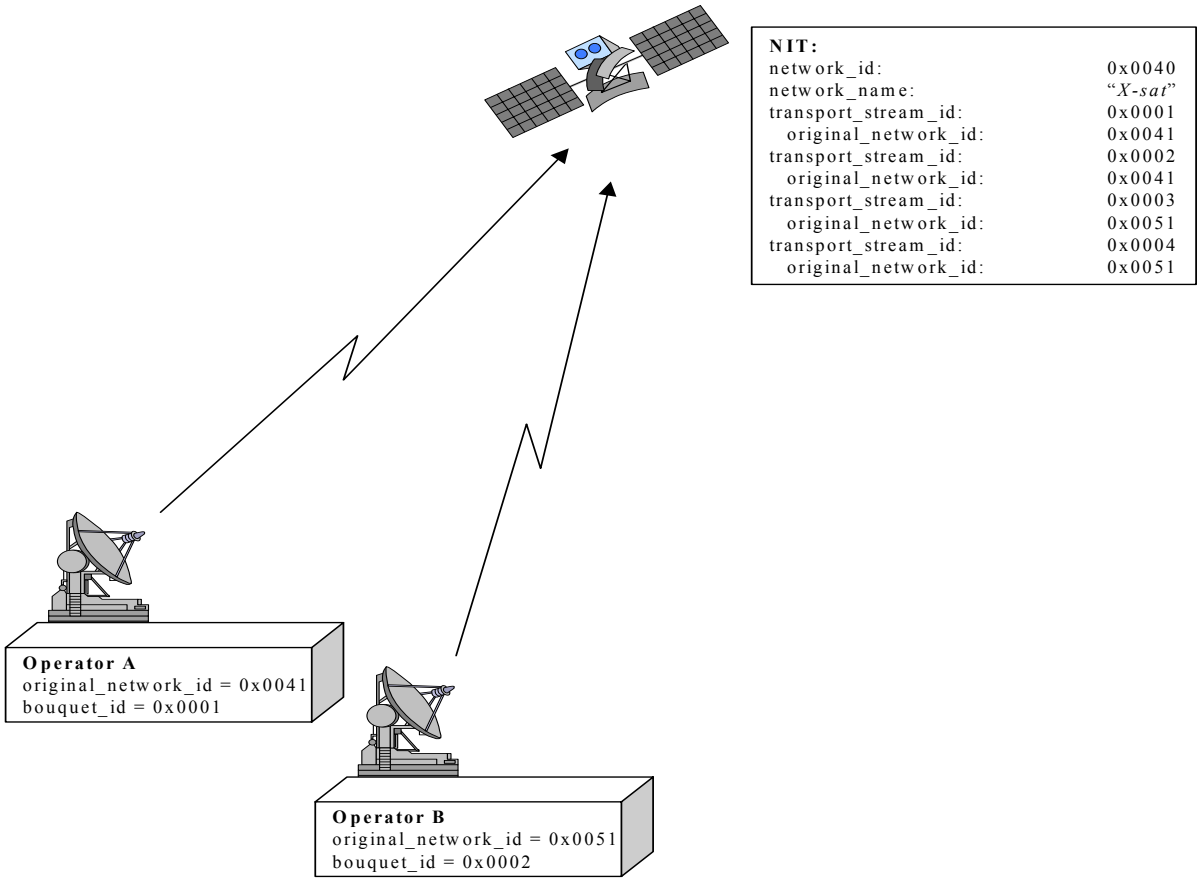

Figure 2 NIT transmission with multiple operators

```
network_information_section(){
      table_id    0x40        (NIT_actual)
      network_id  0x0040      (X-sat)
      #first loop descriptors{
            network_name_descriptor(){
                  network_name      "X-sat"
            }
            linkage_descriptor(){   # link to NorDig software
                        download
                  transport_stream_id     0x0001
                  original_network_id     0x0041
                  service_id              0x000A
                  linkage_type            0x81
                  private_data            <according to NorDig
                              specification>
            }
      }
      #transport stream definitions{
            transport_stream_id           0x0001
            original_network_id           0x0041      (Operator A)
            #second loop descriptors{
                  satellite_delivery_system_descriptor()
                  service_list_descriptor()
            }
            transport_stream_id           0x0002
            original_network_id           0x0041      (Operator A)
            #second loop descriptors{
                  satellite_delivery_system_descriptor()
                  service_list_descriptor()
            }
            transport_stream_id           0x0003
            original_network_id           0x0051      (Operator B)
            #second loop descriptors{
                  satellite_delivery_system_descriptor()
                  service_list_descriptor()
            }
            transport_stream_id           0x0004
            original_network_id           0x0051      (Operator B)
            #second loop descriptors{
                  satellite_delivery_system_descriptor()
                  service_list_descriptor()
            }
      }
}
```

Figure 3 Example of NIT from "X-sat"

An independent organisation should verify that NIT contains information about all transport streams transmitted from the physical network.

3.4 Specific service mapping for cable networks

Cable operators may use both NIT_actual and NIT_other due to two reasons:

1. Cable operators often distribute signals to several subnets located in different geographical areas. Different *network_id* is used to distinguish between these subnets.
2. Cable operators retransmitting signals from satellite may insert the network information as NIT_other via satellite.

3.4.1 Transmission of multiple NIT_other tables

Cable operators must be able to provide multiple NIT tables for different networks. The NorDig IRD should provide a menu for the user to enter the network number[3] of the physical network connected to. An example illustrates this:

Example: The satellite network *X-sat* transmits NIT_actual containing network information for the satellite network. In addition, NIT_other from *X-sat* contains network information for the following SMATV operators:

- "SMATV A": network_id = 0x0090
- "SMATV B": network_id = 0x0091

The following transport streams are transmitted in SMATV A:

- TS1 – transport_stream_id = 0x0001
- TS2 – transport_stream_id = 0x0002

The following transport streams are transmitted in SMATV B:

- TS3 – transport_stream_id = 0x0001
- TS4 – transport_stream_id = 0x0002

The NIT transmitted via satellite is indicated in Figure 4.

```
network_information_section(){
      table_id    0x40        (NIT_actual)
      network_id  0x0040      (X-sat)
      #first loop descriptors{
            network_name_descriptor(){
                  network_name      "X-sat"
            }
            linkage_descriptor(){   # link to NorDig software
                                    download
                  transport_stream_id     0x0001
                  original_network_id     0x0041
                  service_id              0x000A
                  linkage_type            0x81
                  private_data            <according to NorDig
                                          specification>
            }
      }
      #transport stream definitions{
            <Definition of transport streams in satellite network>
      }
}
network_information_section(){
```

[3] Network number is identical to *network_id*. The network operator is responsible for informing the users about the appropriate network number.

```
      table_id    0x41        (NIT_other)
      network_id  0x0090      (SMATV A)
      #first loop descriptors{
            network_name_descriptor(){
                  network_name      "SMATV A"
            }
            linkage_descriptor(){   # link to NorDig software
                                    download
                  transport_stream_id     0x0001
                  original_network_id     0x0040
                  service_id              0x000A
                  linkage_type            0x81
                  private_data            <according to NorDig
                                          specification>
            }
      }
      #transport stream definitions{
            transport_stream_id           0x0001
            original_network_id           0x0040
            #second loop descriptors{
                  cable_delivery_system_descriptor()
                  service_list_descriptor()
            }
            transport_stream_id           0x0002
            original_network_id           0x0040
            #second loop descriptors{
                  cable_delivery_system_descriptor()
                  service_list_descriptor()
            }
      }
}
network_information_section(){
      table_id    0x41        (NIT_other)
      network_id  0x0091      (SMATV B)
      #first loop descriptors{
            network_name_descriptor(){
                  network_name      "SMATV B"
            }
            linkage_descriptor(){   # link to NorDig software
                                    download
                  transport_stream_id     0x0001
                  original_network_id     0x0040
                  service_id              0x000A
                  linkage_type            0x81
                  private_data            <according to NorDig
                                          specification>
            }
      }
      #transport stream definitions{
            transport_stream_id           0x0001
            original_network_id           0x0040
            #second loop descriptors{
                  cable_delivery_system_descriptor()
                  service_list_descriptor()
            }
            transport_stream_id           0x0002
```

```
            original_network_id           0x0040
            #second loop descriptors{
                  cable_delivery_system_descriptor()
                  service_list_descriptor()
            }
      }
}
```

Figure 4 Satellite NIT

3.5 Specific service mapping for terrestrial networks

Terrestrial transmission is somewhat different from both satellite and cable transmission due to several reasons, particularly the following two:

- One network operator may cover the same geographical area from several transmitters, i.e. the same services may be received from different transmitters.
- The network may offer regional signals, i.e. signals receivable only in a part of the total network.

Due to these reasons, some special precautions have to be taken for terrestrial transmission. The following sections identify these precautions.

3.5.1 Definition of terrestrial network consepts

MFN: Multiple Frequency Network is a network that over a specified area transmits with several different frequencies and thereby has the possibility to transmit different transport streams over that area. This property is what we in this document call a **Scaleable Network (SN)**.

Preference Network: Can be seen as the main network of a viewer in an intersection area of several networks, this network is usually chosen by the user during installation of the NorDig IRD.

SFN: Single Frequency Network is a network where one transport stream is feeding several main-transmitters all transmitting on the same frequency. The transport stream has to be identical in all main-transmitters. This property, that the transport stream is identical over a bigger region, is what we have called a **Non Scaleable Network (NSN)** in this document. A NSN can be caused by a SFN or that only one multiplexer is feeding several frequencies.

3.5.2 Cross-Carriage of SI

It should always be possible to present all services and events (present and following) to the viewer, which the viewer has the possibility to receive within a Local Service Network (see below). This requires that all SI is cross-distributed over all frequencies in that specific region. The cross-carriage of SI is limited to the finest level of regionality, called a Local Service Network (LSN). The Local Service Network can be defined as the coverage area of a transport stream, i.e. if several transport streams covers exactly the same area they belong to the same Local Service Network. The cross carriage shall be limited within the Local Service Networks with the exception of region who have a mixture of SFN and MFN (see Figure 5).

The native service navigator, i.e. ESG, shall not display any service that the IRD can not receive, due to low RF level.

The definition that a service is possible to receive is that it is included in the *service_list_descriptor* in a received NIT_actual table. By using this definition the IRD can by a very simple algorithm decide whether or not to present the cross distributed service. Such an algorithm is presented in section 3.2.1, and is repeated here for convenience:

```
If Service_id is available in any received NIT_actual (service_list_descriptor)
            display the service in the (ESG/EPG )
else
            do not display the service
```

- The IRD should only display a service once, even if the same service is received from multiple transmitters. The IRD shall chose the service belonging to the ”preference network”, see definition in section 3.5.1. (For national service that have shorter local/regional news insertion, ads etc and when the content provider wishes that the viewer that can receive from several regions, shall be able to choose which local/regional window he wants to belong to, shall therefore have different service_id at the different regions).

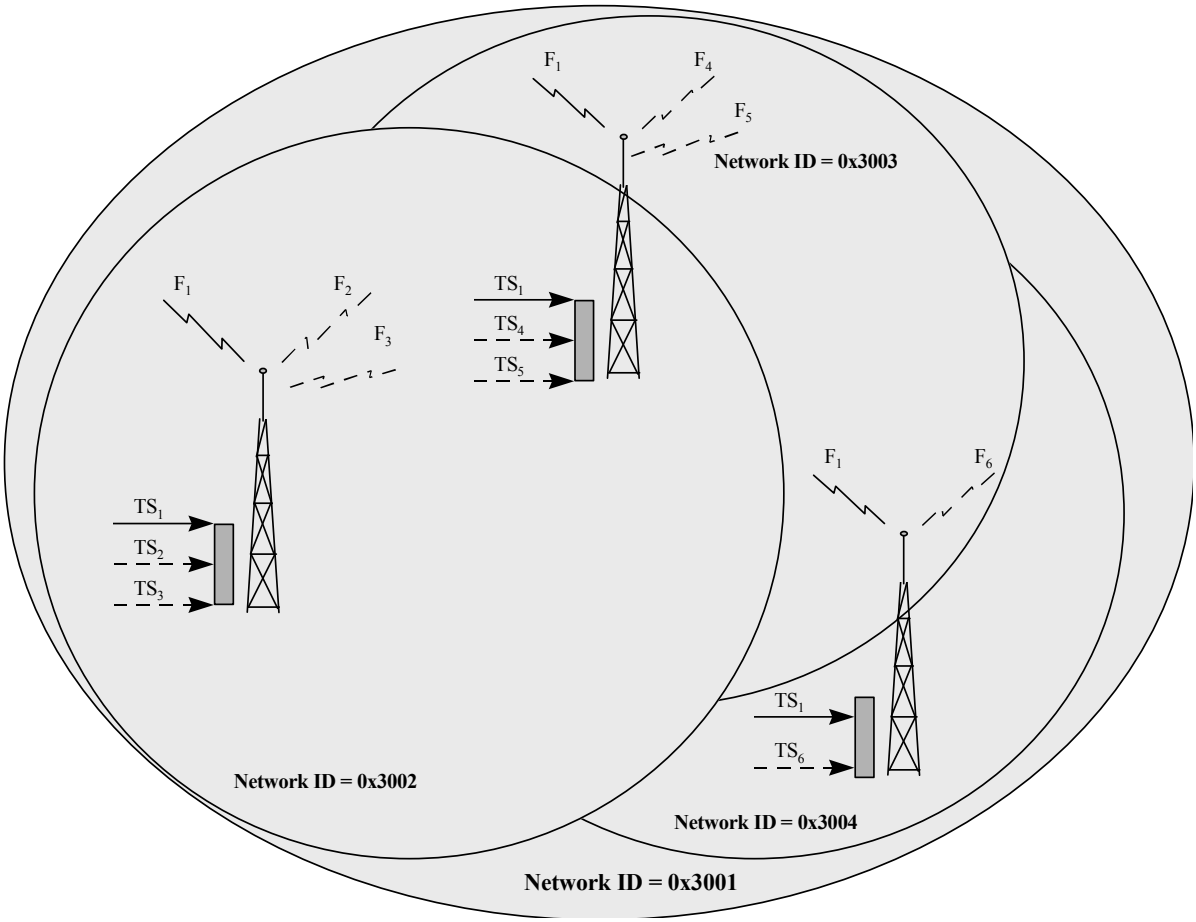

Figure 5 An example of the mixture of Multiple- and Single Frequency Networks

```
TS       = Transport Stream
SI_X     = The part of SI that will be cross-distributed, see below

for all Transmitting Sites ⊆ DTTV{
                    Cross distribute SI_X for all TS that is part of
                    the Transmitting site.
}
```

Due to limited bandwidth in the terrestrial network the cross distribution of the SI shall be limited to the following tables:

- SDT other for all services in the LSN, i.e. listed in the NIT (actual)
- EIT other (present and following) for all services listed within each SDT other. The EIT_present_following_flag shall be set to ”1”, which indicates that the EIT_present_following information for the services is present in the current TS.

The LSN can for the purpose of SI be treated as a single terrestrial network, unique within the network. The delivery system model is then similar to Figure 1 of ETS 300 468 [6]. This restriction is to optimise the use of the bandwidth within the terrestrial network. Depending on aerial installation and IRD location, a IRD may be able to receive multiplexes from more than one LSN. There is normally no cross-carriage of SI specified between LSN, and the IRD must therefore treat the LSN as independent networks. However, where a IRD finds the same combination of original_network_id / service_id in multiplexes received from different LSN the services may be considered to be identical.

As specified above there is an exception to the rule of no cross-distribution between LSN. The cross-distribution in the case of mixture of SFN and MFN will be limited to the SFN. The best way to explain this is probably by the example of Figure 5.

Example: One multiplexer, TS_1 (Transport Stream), is feeding three main-transmitters all transmitting on the same frequency, F_1, in a Single Frequency Network, i.e. a regional network. Each of these transmitter nodes has other transmitters that are transmitting on the frequencies F_2, F_3, F_4, F_5 and F_6. These three local transmitters are fed by their own multiplexers, TS_2, TS_3, TS_4, TS_5 and TS_6, respectively.
All the transport streams covering the same regional network will cross-distribute the SI[4] between them, just as specified before. But the SFN that covers several LSN will cross-distribute the SI from all the LSN it covers, and the SI from the SFN is cross-distributed to the MFN.

An overview of the Network Information Tables for TS_1 and TS_2 in our example is described below (only the interesting parameters are presented):

For TS_1:

```
Network_information_section() {
      table_id          0x40 ( actual )
      network_id        0x3001
      transport_stream_id   0x0001
            {
                  list of services
            }
```

[4] According to the cross-distribution restrictions that is specified above.

```
      network_information_section() {
        table_id          0x41 ( other )
        network_id              0x3002;    0x3003;    0x0004
   (one for each NIT other table)  ↓          ↓          ↓
        transport_stream_id   0x0002 -3;0x0004-5; 0x0006
   (for each NIT other table)
              {
                    list of services
              }
```

For TS_2:

```
   network_information_section() {
        table_id          0x40 ( actual )
        network_id        0x3002
        transport_stream_id   0x0002-3
              {
                    list of services
              }

      network_information_section() {
        table_id          0x41 ( other )
        network_id        0x3001
        transport_stream_id   0x0001
              {
                    list of services
              }
```

4 MPEG2 Video and audio Transmission

4.1 Still pictures

If still pictures are transmitted this shall be indicated by setting the "still_picture_flag" in the *video_stream_descriptor* in the PMT to "1". The *video_stream_descriptor* is mandatory in the PMT whenever still pictures are transmitted.

4.2 Multi-channel audio, AC-3 (Dolby Digital)

If AC-3 multi-channel audio is transmitted, it shall be encoded as described in ETR 154, Annex C (Guidelines for the Implementation of AC-3 Audio in DVB Compliant Transport Streams). 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)

5 DVB MHP Application Transmission

5.1 AIT, service bound

TBD later

5.2 AIT, multiple services

TBD later

5.3 Certification

All transmitted MHP application via NorDig broadcast networks, shall be signed with certification as described in DVB MHP 1.1 specification.

5.4 Timing of streaming events

TBD later

5.5 Application transmission bandwidth

Maximum bandwidth for transmitted applications are [TBD] kbit/s

6 Bootloader Transmission

6.1 System software updating

Within NorDig networks, three different models for updating the IRD's system software over-the-air are defined;

- via using the NorDig-specified way of signalling [13] or [12] or
- via using the more recent DVB specification with a standardized 2-layer DVB data carousel and signalling as described in the DVB specification [14] or
- via using proprietary solution.

The preferred model within NorDig networks for newer implementations is the DVB method.

6.1.1 NorDig system Software Updating

Due to lack of a common API for the NorDig I IRD there are some legacy system software implementations. These are regarded as specific for the different network operators. To obtain download of the different systems, the download signalling should contain a reference to a specific hardware version of the relevant manufacturer. The general procedures of the bootloading are described in NorDig I specification.

6.1.2 Proprietary system Software Updating

If an proprietary solution is used, it shall not in its transmission on in the IRDs interfere with other transmitted (MHP) applications or other receivers than the one targeting.

7 Teletext and Subtitling Transmission

7.1 Teletext

Two restrictions apply when considering transmission of teletext for on-screen display:

- The size of the text «packet» that can be handled correctly in the IRD.
- The time delay for presentation of text in real time.

For services intended for transcoding to PAL teletext must be inserted such that allowable lines in the recoded PAL signal are utilised. The exact line numbers to be used must be established in each particular case.

7.1.1 PES Packet Length

PES packets containing the teletext pages shall not exceed 1504 bytes in length. A maximum of two fields per PES packet shall be transmitted[5].
Reference [1] specifies the maximum number of stuffing bytes in the PES packet header to 32 bytes. This limitation is not valid for PES packets containing ITU-R teletext. When PTS data fields are omitted in the PES packet header, the number of stuffing bytes are 36.

7.2 Subtitling

Subtitling may be provided through ITU-R system B Teletext [8] or through the DVB Subtitling System [9].

7.2.1 ITU-R System B Teletext Subtitling

Use of a timing model (ie PTS data fields) for ITU-R teletext subtitles is optional. Thus, in order to ensure acceptable delay in the presentation of the subtitles the following rules must be observed:

- For a teletext service carrying a mix of text and subtitles no restriction other than that given in section 7.1 applies.
- In a subtitles-only teletext service the PES packets must be limited to contain those text pages that shall be displayed simultaneously (multiple language subtitling). Moreover those text pages must fill an entire PES packet, with the aid of stuffing bytes if necessary.

7.2.2 DVB Subtitling System

The use of a subset of DVB subtitling is supported by the NorDig IRDs.There are some limitations regarding graphics and character object handling, to reduce processor capacity and memory allocation.

Any broadcasted DVB subtiling shall minimum be of graphic objects of object_type ‘basic_object, bitmap’ (0x00).
The broadcasted DVB subtitling stream should not require more than 112960 pixels per frame for decoding.
The broadcasted DVB subtitling stream should not contain more than 128 objects per subtitle display

The region_level_of_compatibility (RLOC) should not be set to more than 4 bit (0x02). This will allow a decoder with restricted capasity to perform an 8-bit to 4-bit reduction. If RLOC is set higher than decoder capasity the region will not be visible.

(information:

[5] One TV frame consists of two fields, meaning that a teletext PES packet shall not contain more teletext lines than is inserted in one frame in the source PAL signal.

The use of non-modifying color flag is optional on decoder side.
A minimum set of transparent levels for black is defined in NorDig.)

8 Conditional Access

8.1 ECM

At least one ECM stream shall be allocated for each unique scrambled service/component. Both service scrambling (ie CA_descriptor inserted in the first descriptor loop in PMT) and component scrambling (i.e. CA_descriptor inserted in the second descriptor loop in PMT) may be employed

8.1.1 ECM repetition/cycle period

The ECM repetition/cycle period should be (less then) 100ms (recommended), but shall at least be less or equal then 500ms (this to ensure zapping time).

8.2 EMM

The broadcaster may broadcast all EMMs in all transport streams or /and use a barker channel.

8.3 Scrambling of AIT

AIT shall not be scrambled

9 References

[1] ISO/IEC 13818-1: "Information Technology – Generic coding of moving pictures and associated audio information – Part 1: Systems".

[2] ISO/IEC 13818-2: "Information Technology – Generic coding of moving pictures and associated audio information – Part 2: Video"?

[3] ISO/IEC 13818-3: "Information Technology – Generic coding of moving pictures and associated audio information – Part 3: Audio"?

[4] ETS 300 421: "Digital broadcasting systems for television, sound and data services; Framing structure, channel coding and modulation for 11/12 GHz satellite services".

[5] ETS 300 429: "Digital broadcasting systems for television, sound and data services; Framing structure, channel coding and modulation for cable systems".

[6] ETS 300 468: "Digital broadcasting systems for television, sound and data services; Specification for Service Information (SI) in Digital Video Broadcasting (DVB) systems".

[7] ETR 211: "Digital broadcasting systems for television, sound and data services; Guidelines on implementation and usage of service information (SI)".

[8]	ETS 300 472:	“Digital broadcasting systems for television, sound and data services; Specification for conveying ITU-R Teletext in Digital Video Broadcasting (DVB) bitstreams”.
[9]	ETS 300 743:	“DVB subtitling system”.
[10]	ETR 162:	Digital broadcasting systems for television, sound and data services; Allocation of Service Information (SI) codes for Digital Video Broadcasting (DVB) systems
[11]	ETSI TS 102 812	DVB MHP 1.1 “Digital Video Broadcasting (DVB); Multimedia Home Platform (MHP) Specification 1.1”
[12]	NorDig I	NorDig I, Digital Integrated Receiver Decoder Specification for use in cable, satellite and terrestrial networks, version 1.3 (excl or legacy API)
[13]	NorDig II	NorDig II, Digital Integrated Receiver Decoder Specification for use in cable, satellite and terrestrial networks, version 1.0 (incl DVB MHP 1.1, IP API)
[14]	DVB System Software Update (bootloader)	ETSI TS 102 006-1 V1.1.1, Digital Video Broadcasting (DVB); DVB Data Download Specification; Part 1: Simple Profile