

# ETSI TS 102 470-2 V1.1.1 (2009-12)

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*Technical Specification*

## Digital Video Broadcasting (DVB); IP Datacast: Program Specific Information (PSI)/Service Information (SI); Part 2: IP Datacast over DVB-SH

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**Reference**

DTS/JTC-DVB-246-2

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TV, video**ETSI**

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## Foreword

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**NOTE:** The EBU/ETSI JTC Broadcast was established in 1990 to co-ordinate the drafting of standards in the specific field of broadcasting and related fields. Since 1995 the JTC Broadcast became a tripartite body by including in the Memorandum of Understanding also CENELEC, which is responsible for the standardization of radio and television receivers. The EBU is a professional association of broadcasting organizations whose work includes the co-ordination of its members' activities in the technical, legal, programme-making and programme-exchange domains. The EBU has active members in about 60 countries in the European broadcasting area; its headquarters is in Geneva.

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The Digital Video Broadcasting Project (DVB) is an industry-led consortium of broadcasters, manufacturers, network operators, software developers, regulatory bodies, content owners and others committed to designing global standards for the delivery of digital television and data services. DVB fosters market driven solutions that meet the needs and economic circumstances of broadcast industry stakeholders and consumers. DVB standards cover all aspects of digital television from transmission through interfacing, conditional access and interactivity for digital video, audio and data. The consortium came together in 1993 to provide global standardisation, interoperability and future proof specifications.

The present document is part 2 of a multi-part deliverable covering the Digital Video Broadcasting (DVB); IP Datacast: Program Specific Information (PSI)/Service Information (SI), as identified below:

Part 1: "IP Datacast over DVB-H";

**Part 2: "IP Datacast over DVB-SH".**

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## Introduction

The contents of the present document specify the use of PSI and SI tables and related descriptors in DVB-SH networks, and more generally of all signalling elements relevant to the usage of DVB-SH network (TPS, Signalling Field, SHIP). TS 102 470-1 [8] is a corresponding document describing usage of PSI/SI information in IPDC in DVB-H systems.

The present document describes how the network infrastructure SHALL generate the signalling. In some cases, the behaviour of the receiver is also specified. More general description of receiver behaviour and not-directly PSI/SI related signal generation is FFS in DVB-SH the implementation guideline.

The use of PSI/SI tables and/or descriptors not mentioned within this clause is either not restricted for any particular network and specifying the use of such tables/descriptors is either outside of the scope of the present document, or can be applied for both DVB-H and DVB-SH networks and therefore can be found in [8].

Clause 4.1 provides some introduction to the PSI/SI in DVB-SH.

Clause 4.2 specifies content regionalization concept within a "partially available TS".

Clause 4.3 specifies MPE usage.

Clause 4.4 specifies the descriptors required and their usage.

Clause 4.5 specifies the PSI tables usage.

Clause 4.6 specifies the SI tables usage.

Clause 4.7 specifies the TPS and Signalling Field parameters and their usage.

Clause 4.8 specifies the Update Notification Table usage.

Clause 4.9 specifies the INT announcement usage.

Clause 4.10 specifies SHIP usage.

Clause 4.11 specifies the signalling field usage.

---

# 1 Scope

The present document provides focus on PSI/SI tables and descriptors used in DVB-SH Systems.

Used tables and descriptors are introduced, and their usage is described.

The present document defines the set of PSI/SI data a DVB-SH Receiver may expect to be available on a DVB-SH bearer (data transmission baseband) and the DVB-SH Network is expected to make available on the DVB-SH Bearer.

---

## 2 References

References are either specific (identified by date of publication and/or edition number or version number) or non-specific.

- For a specific reference, subsequent revisions do not apply.
- Non-specific reference may be made only to a complete document or a part thereof and only in the following cases:
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  - for informative references.

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NOTE: While any hyperlinks included in this clause were valid at the time of publication ETSI cannot guarantee their long term validity.

### 2.1 Normative references

The following referenced documents are indispensable for the application of the present document. For dated references, only the edition cited applies. For non-specific references, the latest edition of the referenced document (including any amendments) applies.

- [1] ETSI EN 300 468: "Digital Video Broadcasting (DVB); Specification for Service Information (SI) in DVB systems".
- [2] ETSI EN 301 192: "Digital Video Broadcasting (DVB); DVB specification for data broadcasting".
- [3] IETF RFC 1112: "Host extensions for IP multicasting".
- [4] IETF RFC 2464: "Transmission of IPv6 Packets over Ethernet Network".
- [5] ETSI TS 102 585: "Digital Video Broadcasting (DVB); System Specifications for Satellite services to Handheld devices (SH) below 3 GHz".
- [6] ETSI EN 302 583: "Digital Video Broadcasting (DVB); Framing Structure, channel coding and modulation for Satellite Services to Handheld devices (SH) below 3 GHz".
- [7] ETSI TS 102 594: "Methods for Testing and Specification (MTS); Internet Protocol Testing (IPT): IPv6 Security; Conformance Abstract Test Suite (ATS) and partial Protocol Implementation eXtra Information for Testing (PIXIT) proforma".
- [8] ETSI TS 102 470-1 (V1.1.1): "Digital Video Broadcasting (DVB); IP Datacast: Program Specific Information (PSI)/Service Information (SI); Part 1: IP Datacast over DVB-H".



## 2.2 Informative references

The following referenced documents are not essential to the use of the present document but they assist the user with regard to a particular subject area. For non-specific references, the latest version of the referenced document (including any amendments) applies.

- [i.1] ETSI TR 101 211 (V1.10.1): "Digital Video Broadcasting (DVB); Guidelines on implementation and usage of Service Information (SI)".

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## 3 Definitions and abbreviations

### 3.1 Definitions

#### 3.1.0 Introduction

For the purposes of the present document, the following terms and definitions apply (only those definitions which are specific to the present document and complementary to the definitions found in TS 102 470-1 [8] are listed here). In addition, definitions have been classified according to their nature and scoping in three categories: infrastructure, transport containers, tables and signalling structures.

#### 3.1.1 Infrastructure

**DVB-SH:** transmission system targeted to provide IP-based services to handheld terminals over hybrid global and local radio channels, as defined in EN 302 583 [6] and EN 301 192 [2]

**DVB-SH bearer:** link and physical layers into which IP packets are encapsulated according to DVB-SH specifications

**DVB-SH receiver:** equipment or system can receive IP based services provided over a DVB-SH bearer

**DVB-SH region:** group of cells transmitting same content on a partially available TS

**DVB-SH distribution network:** network that transports a TS from a central head-end to a network of DVB-SH repeaters

NOTE 1: The distribution network includes:

- the gateways, both at central (transmission gateway) and remote (reception gateway) places;
- the network itself, usually a satellite and/or an IP network.

NOTE 2: We distinguish between global and a local distribution network, depending on the coverage requirements:

- global distribution network enables to reach all repeaters (e.g. via a satellite coverage);
- whereas a local distribution network enable reach of only a subset of the repeaters.

**DVB-SH adaptation:** function of customizing a "complete TS" to a region while preserving the PSI/SI identification

NOTE 1: TS\_id is kept the same, only content is locally removed and this is signalled by using service\_availability\_descriptor.

NOTE 2: More generally SI tables are kept unique and identical in all regions, PSI are specific to each region.

NOTE 3: This adaptation function can be performed either on the head-end (central adaptation) or on the repeater (remote adaptation). The content removal can be done at SH or DVB service level.

**DVB-SH {adaptation; distribution}:** function combining together DVB-SH adaptation and distribution

NOTE 1: Different options are possible among which "adapt then distribute" and "distribute then adapt". Order can therefore vary between both elements so this common definition enables to describe all cases more generically. If needed the adapter/distribution element can be identified individually.

NOTE 2: The combination of both functions is not specified and left to implementation. However interfaces to and from these combined functions are specified.

**DVB-SH adapter:** equipment performing the DVB-SH adaptation function

**DVB-SH head-end:** group of equipments in charge of generating a SH-compliant TS and interfacing it with a distribution network

NOTE 1: A DVB-SH head-end can have a SH adaptation function in case of central adaptation.

NOTE 2: We distinguish between a global and a local head-end depending on the type of distribution network to which the head-end is connected.

**DVB-SH modulator:** function that takes at its input a SH-compliant TS with its SHIP signalling and modulates it according to DVB-SH waveform standard [6]

NOTE: The modulator synchronizes itself using a SHIP MPEG2 packet.

**DVB-SH repeater:** equipment in charge of modulating a TS according to DVB-SH physical waveform [6]

NOTE: By nature, this equipment includes a DVB-SH modulator. In addition, it MAY include:

- a DVB-SH distribution reception gateway in case the repeater is not co-located with the DVB-SH head-end;
- a DVB-SH adapter in case of remote adaptation (see figure 3).

**DVB-SH network:** DVB network that conveys DVB-SH bearers to DVB-SH receivers

NOTE: The DVB-SH network is composed of the infrastructure and the receivers. A generic overview of the DVB-SH infrastructure is presented in figure 1. Various options are also presented in figures 2 and 3.

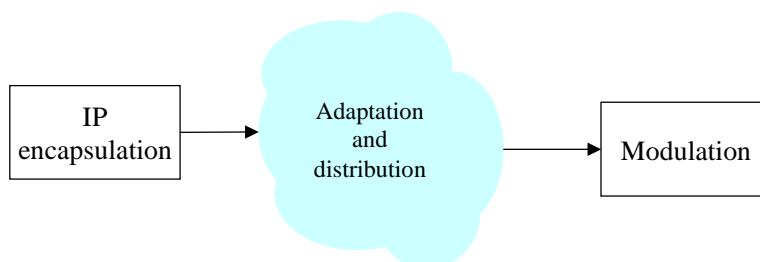


Figure 1: DVB-SH infrastructure synoptic

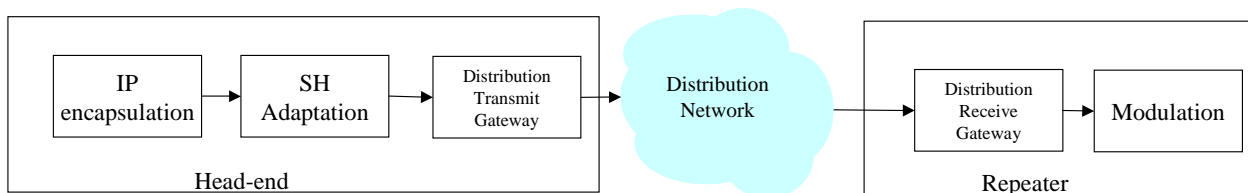


Figure 2: DVB-SH infrastructure in case of central adaptation

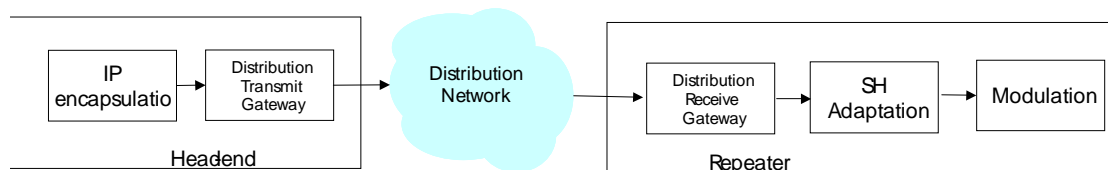


Figure 3: DVB-SH infrastructure in case of remote adaptation

### 3.1.2 Transport containers

**SH service:** fraction of the MPEG2 TS signalled to the modulator via the SHIP

NOTE: A SH service is an entity that can be processed by a modulator. SH service can be used for filtering purpose and regionalization.

**Partially available DVB/SH service:** DVB/SH service that is not present in all cells where the TS is modulated

NOTE 1: DVB service presence is informed by the service\_availability\_descriptor in SDT whereas the SHIP informs SH service presence.

NOTE 2: A partially available DVB/SH service carries local content. A synonym of a paDVB/SH service is a local DVB/SH service.

**Common DVB/SH service:** DVB/SH service that is present in all cells where the TS is modulated

NOTE 1: DVB service presence is informed by the service\_availability\_descriptor in SDT whereas the SHIP informs SH service presence.

NOTE 2: A common DVB/SH service carries common content. There can be zero, one or more of such common DVB/SH services in a given TS.

**Partially available TS:** TS that signals in the PSI/SI one or more partially available DVB/SH service(s)

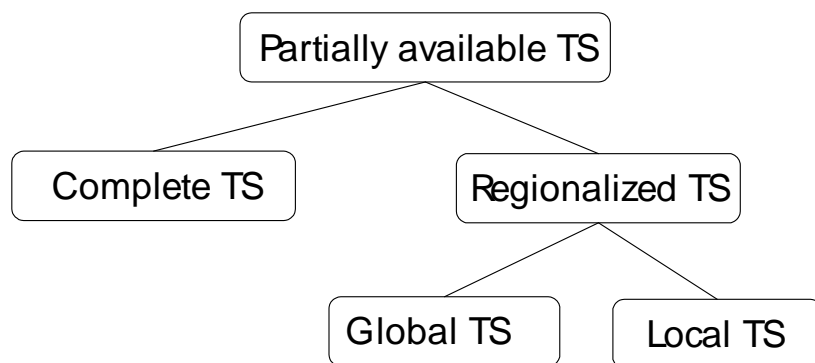
NOTE: This definition has nothing in common with the partial TS referred by the partial TS descriptor in [1].

**Complete TS:** partially available TS where all signalled services, including the paDVB/SH ones, are actually present

NOTE: Complete TS has to be considered for generating the PSI/SI information coherently (in particular the SI that is required to be unique). However complete TS MAY not actually exist in the network as such and is only conceptually present for supporting the signalling generation. Complete TS MAY not be appropriate for actual transmission over the air.

**Regionalized TS:** partially available TS where not all signalled services are actually present

NOTE: We distinguish between the "global regionalized TS" (aka "global TS") where only the common services are present, and the "local regionalized TS" (aka local TS) where only the common services and a fraction of the local are present.



**Figure 4: Partially available TS tree definition**

**IP/MAC notification service:** DVB service with a component carrying one or more INT sub\_tables

**IP/MAC partially available notification service:** IP/MAC notification service that is partially available

**MPE-IFEC section:** private section as specified in EN 301 192 [2]

### 3.1.3 Tables

**NIT\_actual:** NIT sub\_table describing the actual delivery network. NIT\_actual has table\_id value 0x40

**NIT\_other:** NIT sub\_table describing the other delivery network. NIT\_other has table\_id value 0x41

**INT deferred notification NIT:** NIT sub\_table containing a linkage\_descriptor with linkage\_type 0x0C

**INT notification NIT/BAT:** NIT or BAT sub\_table containing a linkage\_descriptor with linkage\_type 0x0B

**IP/MAC notification table:** sub\_tables as defined in EN 301 192 [2], clause 8.4.3

### 3.1.4 Signalling structures

#### 3.1.4.1 For NIT & BAT

**IP/MAC notification link structure:** structure defined in EN 301 192 [2], clause 8.2.1 and used in the direct linkage\_descriptor inside BAT or NIT, when linkage\_type is set to 0x0B

**Deferred IP/MAC notification link structure:** structure defined in EN 301 192 [2], clause 8.2.2 and used in the deferred linkage\_descriptor inside NIT, when linkage\_type is set to 0x0C

#### 3.1.4.2 For SDT & PMT

**IP/MAC notification info structure:** structure defined in EN 301 192 [2], clause 8.3.1 and used by the PMT related to the IP/MAC notification service inside the data\_broadcast\_id\_descriptor, when data\_broadcast\_id is set to 0x0B

**multiprotocol encapsulation info structure:** structure defined in EN 301 192 [2], clause 7.2.1 and used by SDT in data\_broadcast\_descriptor and PMT in data\_broadcast\_id\_descriptor, when data\_broadcast\_id is set to 0x0B

## 3.2 Abbreviations

For the purposes of the present document, the following abbreviations apply:

BAT	Bouquet Association Table
CA	Conditional Access
CAT	Conditional Access Table
CRC	Cyclic Redundancy Check
DVB	Digital Video Broadcasting
EIT	Event Information Table
ES	Elementary Stream
FEC	Forward Error Correction
FFS	For Further Specification
FFT	Fast Fourier Transform
INT	IP/MAC Notification Table
IP	Internet Protocol
IPDC	IP Datacasting
IPv4	Internet Protocol, version 4
IPv6	Internet Protocol, version 6
Mbps	Mega bits per second
MPE	Multi-Protocol Encapsulation
MPEG	Moving Picture Expert Group
MPE-IFEC	MPE Inter-burst Forward Error Correction (DVB-SH)
NIT	Network Information Table
OFDM	Orthogonal Frequency Division Multiple Access
PA	Partially Available
PAT	Program Association Table
paTS	partially available TS
PID	Packet Identifier
PMT	Program Map Table
PSI	Program Specific Information

RST	Running Status Table
SDT	Service Description Table
SFN	Single Frequency Network
SH	Satellite to Handheld
SHIP	SH frame Information Packet (DVB-SH) BROADCAST

NOTE: See TS 102 585 [5].

SI	Service Information
ST	Stuffing Table
TDM	Time Division Multiplex
TDT	Time and Data Table
TOT	Time Offset Table
TPS	Transmission Parameter Signalling
TS	Transport Stream
TSDT	Transport Stream Description Table

---

## 4 PSI/SI IG for DVB-SH Systems

### 4.1 Introduction to PSI/SI (informative)

PSI/SI usage for DVB-SH does not significantly deviate from the PSI/SI usage for DVB-H as specified in TS 102 470-1 [8]. In the particular case of SFN or in non-SFN when exactly same capacities are available on the different frequencies, the DVB-SH and DVB-H PSI/SI usages match on large extents so that they can even share the same introduction clauses 4.1.1 and 4.1.2.

In that latter case, the difference between DVB-SH and DVB-H mainly relies on the usage of descriptors needed for supporting signalling of SH novelties such as physical parameters (via `SH_delivery_system_descriptor`), MPE-IFEC (via `time_slice_fec_identifier_descriptor`) and their usage in the NIT and INT. These differences are described in the relevant clauses 4.4 (descriptors) and 4.6 (SI Tables).

However, a new concept called "content regionalization" can be provided by SH on the same TS (then called a "partially available TS") in some specific non-SFN modes (SH-B and SH-A non-SFN). The principle is that the actually transmitted content in the TS varies depending on the transmission location (`cell_id`) while preserving the SI, therefore simplifying hand-overs between satellite and terrestrial regions because the terminal does not need to parse SI each and every time. This concept therefore induces some impact on the PSI/SI side and needs special introduction in clause 4.2.

#### 4.1.1 PSI/SI and DVB network (SFN and non SFN with same capacities on different frequencies)

This clause is same as clause 4.1 in TS 102 470-1 [8].

#### 4.1.2 IP platform; IP flow and IP stream (SFN and non SFN with same capacities on different frequencies)

This clause is same as clause 4.2 in TS 102 470-1 [8].

### 4.2 Content regionalization in SH networks (non-SFN with different capacities on different frequencies) (normative)

This clause describes how content can be regionalized on a TS sent over a SH network on a hybrid frequency in a non-SFN context with different transmission capacities between satellite and terrestrial transmitters, while the latter are all SFN synchronized together. In such conditions, the terrestrial transmitters support different, and in general, increased capacity compared to satellite transmitter. Local content can therefore be injected in the different terrestrial cells in addition to the common satellite content repeated locally.

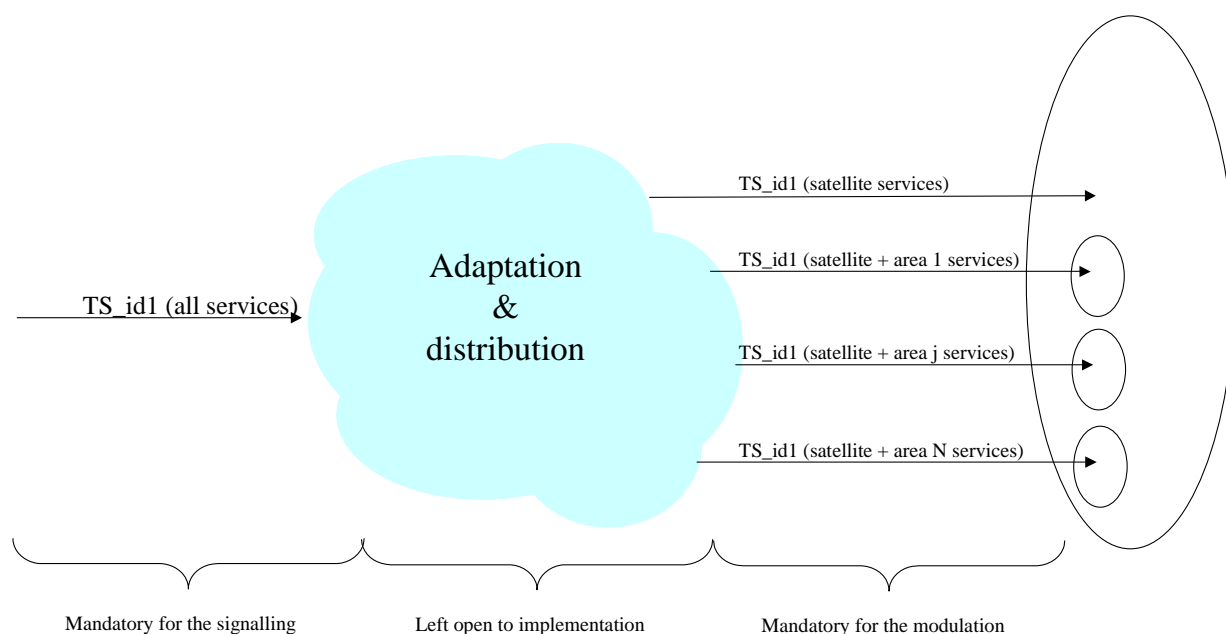
In order to prevent the terminal from parsing non-real time signalling (the SI) each time it performs a hand-over between a satellite and a terrestrial cell, a common SI is generated and transmitted in all cells and has to be acquired only once, real-time signalling (PSI) being the only location-dependent signalling to be acquired at each hand-over.

A "complete TS" is therefore defined in order to support SI unicity. Only the signalling part of the "complete TS" (to ensure unicity of signalling) SHALL be generated, other parts of complete TS (such as MPE data) is left to implementation. "Local TS" are the actual TS being modulated with the same SI as the "complete TS" but with their own specialized PSI. Since local TS are the ones to be actually modulated, these "regionalized TS" SHALL be fully generated in a mandatory way with the signalling and data). Therefore the interfaces {adaptation; distribution} function on one side, and modulation on the other side is mandated. {adaptation; distribution} functions themselves are not mandated and left open to implementation.

## 4.2.1 TS construction using time-slice bursts, DVB and DVB-SH services

### 4.2.1.1 Generalities (normative)

One particularity of SH networks is the possibility to provide content regionalization inside the same TS in the non-SFN case (global signal is not modulated on the same frequency as the local signal). The regionalization concept is summarized in figure 5.



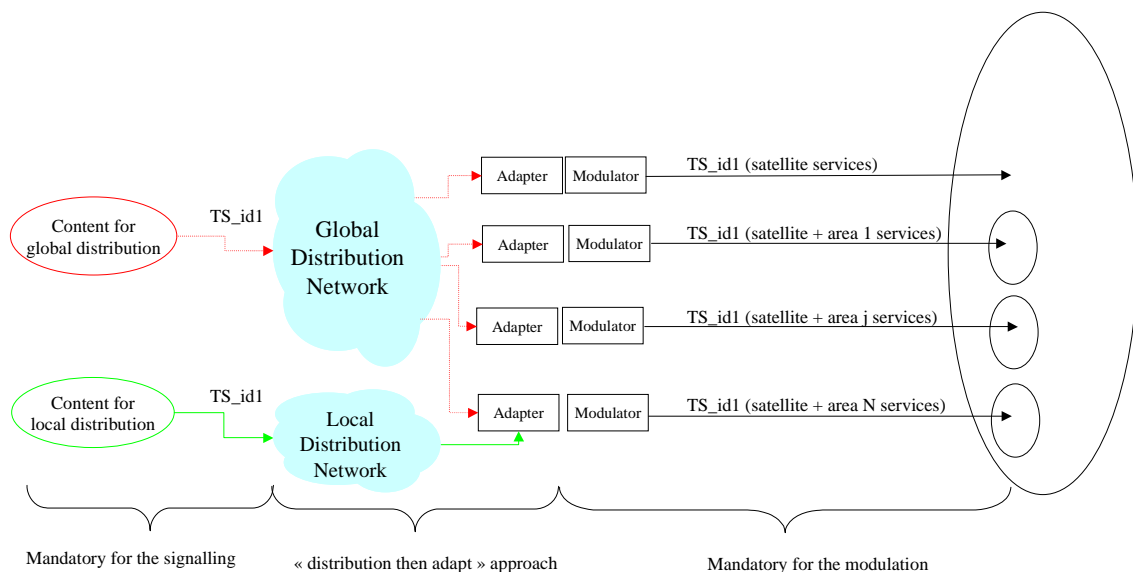
**Figure 5: Service regionalization concept**

It can be seen in this figure that regionalization is performed in 3 main steps:

- Step 1: A master "complete TS" is generated that signals all services on the PSI/SI level. Therefore PSI/SI coherence is ensured between all regionalized TS.
- Step 2: This "complete TS" is then distributed and adapted to all modulators of the system (the common and local ones). The adaptation function consists mainly in filtering out the content that does not pertain to the location. The order of operations performed during this step is left open to implementation. Different approaches are possible for performing this step.

One implementation illustrated in figure 6 consists in "distributing then adapting". This approach is better suited for local re-multiplexing cases where more flexibility (and therefore more complexity) is required at the repeater level. In particular, advanced processing at section level can be done on the common satellite service repeated locally to avoid duplication of unnecessary MPE-IFEC sections, or enable replacement of satellite MPE-IFEC sections with complementary sections:

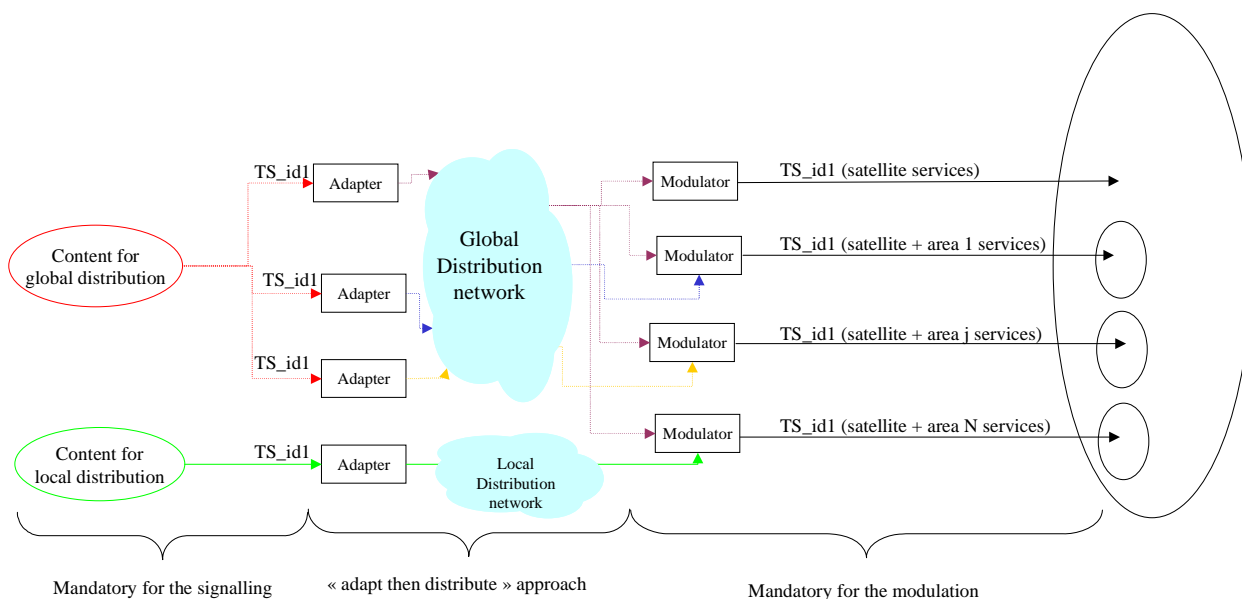
- The "complete TS" is distributed to the different repeaters as it is with all services actually included. Individual services are transported only once over the distribution network. Content can be distributed over a global or a local distribution network, depending on the coverage requirements.
- Inside each repeater an adaptation function creates a "regionalized TS" that is syntactically correct and where all PSI/SI tables are re-multiplexed along with SHIP and MPE signalling. PSI/SI are however still coherent between all the "regionalized TS" (the SI being the same), therefore a receiver catching local regionalized TS can learn the unique SI, about non-present neighbour or foreign local services.
- This regionalized TS is subsequently modulated.



**Figure 6: "Distribute then adapt" approach**

Another implementation illustrated in figure 7 consists in "adapting before distributing". This approach is better suited for cases where local re-multiplexing can be avoided and where a central head-end can pre-process all signalling:

- The "complete TS" is adapted inside the head-end where all "regionalized TS" individual or complete parts can be pre-computed in the form of individual or group of DVB/SH service(s), further called a 'part'.
- Each part is distributed to the relevant repeaters. Different distributions means are possible. As an example, each part could be carried within a different PID (PID\_1 for "global regionalized TS" part common to all repeaters, PID\_2 for "local regionalized TS" specific part to region 1, PID\_3 for "local regionalized TS" specific part to region 2...). A local repeater in region X will then need to select PID\_1 and PID\_(X+1) to create the complete "regionalized TS". If more transport granularity is required between two regions, more PID can be used to factorize the parts in common between different regions. More details on such a transport implementation is out of scope of the present document.
- Inside each repeater the modulator is in charge of stacking the different parts by appending them for subsequent modulation.
- The head-end can be split into a global and a local head-end where most of the common signalling is being processed at the central head-end and only the local signalling is being processed in the local head-end. More details on this approach is out of scope of the present document.



**Figure 7: "Adapt then distribute" approach**

- Step 3: the regionalized TS are modulated. The modulator located behind the adapter receives canonical TS. Depending on the cell to which they belong, these modulators therefore receive only a fraction of the "complete TS" services inside the "regionalized TS" with a coherent signalling between all the different "regionalized TS". SHIP is used to synchronize the modulators together.

NOTE 1: Regulatory constraints MAY impose all local repeaters to repeat the common services. In addition to these common service, local repeaters MAY also modulate local contents specific to the cell to which they belong.

Each "regionalized TS" is a syntactically correct TS so that a receiver receiving this only TS can process the signal and learn on a service absence and its regionalization. In some circumstances, the terminal can receive several "regionalized TS" from the same "complete TS" (for instance the common and one local ones). If the network configuration and the terminal capacity enable it, the two "regionalized TS" can be combined together to provide more reception quality on the common content.

NOTE 2: This improvement is always optional, a terminal being always able to switch from one "regionalized TS" to another without benefiting from the complementary reception.

Different options are possible for performing service filtering during adaptation: this can be done at SH or DVB service layer:

- At SH services layer, the adapter selects one or several SH services from the "complete TS" as signalled by the SHIP carried inside each SH frames. The downstream repeater will then modulates the only selected SH services and will align them within the SH frame. At the receiver side, these SH services are identified by the EFRAME sequence number. For the common services, the quality MAY be improved by recombining the EFRAMES from both "regionalized TS" in the terminal using code diversity. These principles are more detailed in clause 4.2.1.3.
- At DVB service layer, the adapter selects only the relevant Elementary Streams from the "complete TS". PSI/SI tables are recomputed. At the receiver side it is then not possible to combine the EFRAMES of the common content from the different paths since the individual bits received on satellite and terrestrial paths MAY differ. However, some combination is still possible at MPE and MPE-IFEC section level:
  - For the common services, missing MPE sections on one path COULD be received on the other path.
  - Additionally if MPE-IFEC is used, different MPE-IFEC sections COULD be received via the different paths and combined inside the same decoding matrix by the terminal. This code combining option is FFS.



#### 4.2.1.2 Impact on PSI/SI (normative)

In all cases PSI/SI homogeneity is ensured since the same complete TS identification is used on all regionalized TS (in particular SI are unique). The DVB service granularity is used to provide consistent regionalization information whereby one DVB service MAY belong to, one (e.g. one local content cell), several (e.g. several local cells) or all cells (e.g. common content case). In figure 8, a possible logical DVB object hierarchy is presented:

- One IP encapsulator delivers the complete "complete" TS where all (time-sliced) services are present, usually in individual elementary streams.
- These elementary streams are mapped in DVB services that are logically connected to individual cells: the presence of one DVB service in one cell is signalled via the SDT service\_availability\_descriptor. Therefore a DVB service is a *logical container* for regional distribution.
- If the content regionalization is performed at the SH service layer, the DVB services are in addition mapped on SH services using SHIP signalling so that adapters can perform filtering using SH frames and produce a "regionalized TS" (either local or common) by removing those SH services from the "complete TS" that are not present in the cell, and keeping those that are present. Possible update MAY occur on the local SH services (section header real-time parameters adaptation, PSI reprocessing, SHIP update...).
- If the content regionalization is performed at DVB service layer, the DVB services are simply removed from the "complete TS" at the level of the elementary stream. In addition a number of operations are performed (section header real-time parameters adaptation, PSI/SI reprocessing, SHIP update...) and the common service can be further optimized since no physical combination is requested between the satellite and the terrestrial paths.

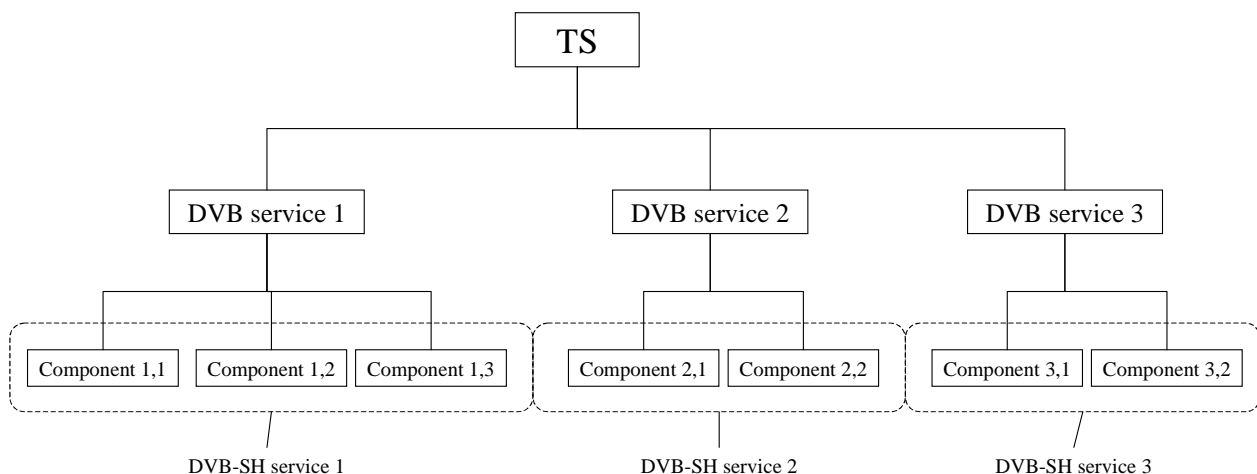


Figure 8: Transport stream with regionalized content and related DVB object hierarchy

#### 4.2.1.3 Filtering at SH service layer (informative)

Due to the specificity of SH service filtering, a special zoom is given on this case. When the filtering is performed at SH service layer, the "complete TS" different layers look like figure 9.

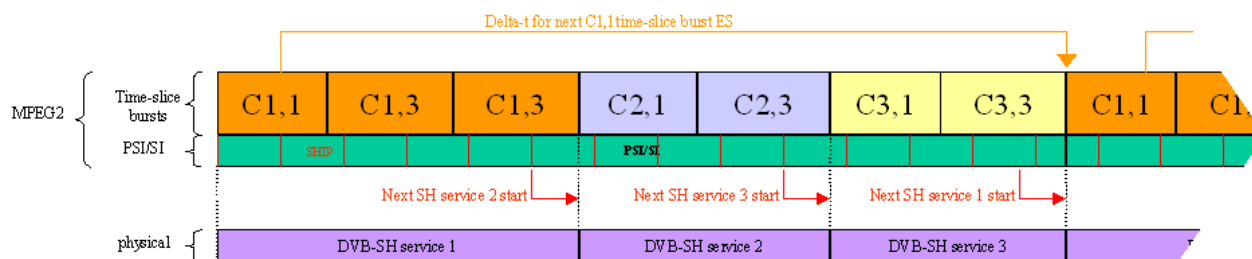


Figure 9: Content regionalization signalling

It can be seen figure 9 that:

- Time-slicing signalling is done at the MPE level using the real-time parameters of the MPE headers. MPE-IFEC sections MAY also be carried.
- MPEG2 TS level signalling is done via the PSI/SI; for instance the PMT, PAT and SDT signal to which DVB services the different elementary streams belong and in which cells the DVB services are located. In the example of figure 9, the elementary streams  $C_{i,j}$  of DVB service "i" share the same colour and are timely grouped together. They will be modulated on the same cells.
- DVB-SH level signalling is done by the SHIP packets inserted in each and every SH frame; the SHIP packets signal what and when the next SH service starts in the next SH frame. When content regionalization is performed, the DVB services MUST match the SH services, id-est a DVB service MUST be completely located inside a SH service.

Based on this signalling, the SH service filtering is performed by the {adapter; distribution} differently depending on the cell where the repeater is located and on the distribution method:

- In all cases, the global {adapter; distribution} keeps only one DVB service (e.g. the service 1) and distribute it to all repeaters.
- In the "transmit and adapt" method, one local adapter keeps the common service by regulatory constraint (service 1) and possibly one or more additional local service(s) (e.g. service 2 or 3) that are transmitted to the modulator so that this latter can transmit both services as exemplified in figure 10.
- In the "adapt and transmit" method, one local adapter keeps the complementary local service(s) (e.g. service 2 or 3) and distributes them in individual parts to the modulator where they are combined with the common part in order to form the "regionalized TS" as exemplified in figure 11.

This is described in more details below.

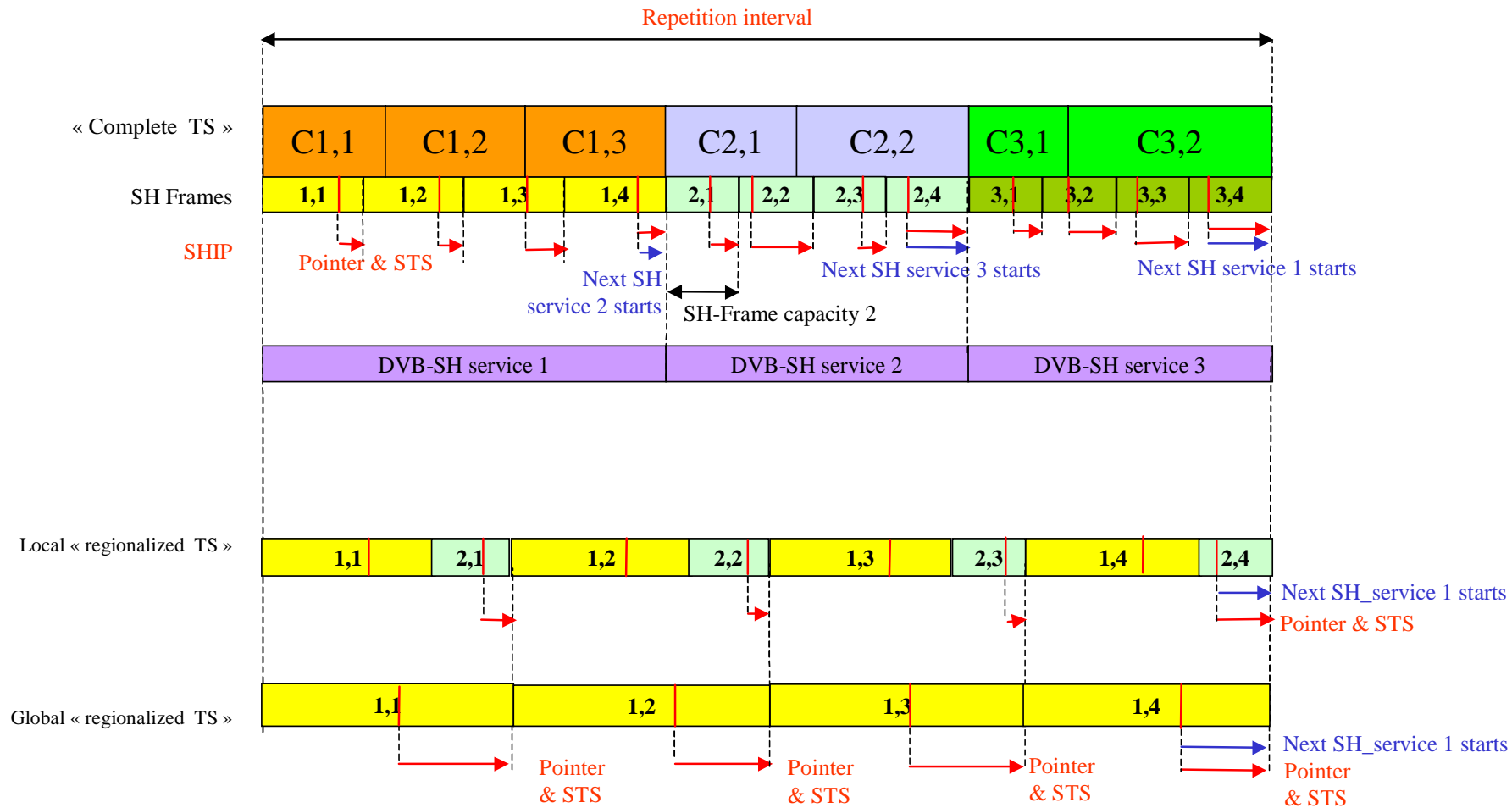


Figure 10: SH service filtering principle using "transmit and adapt" method

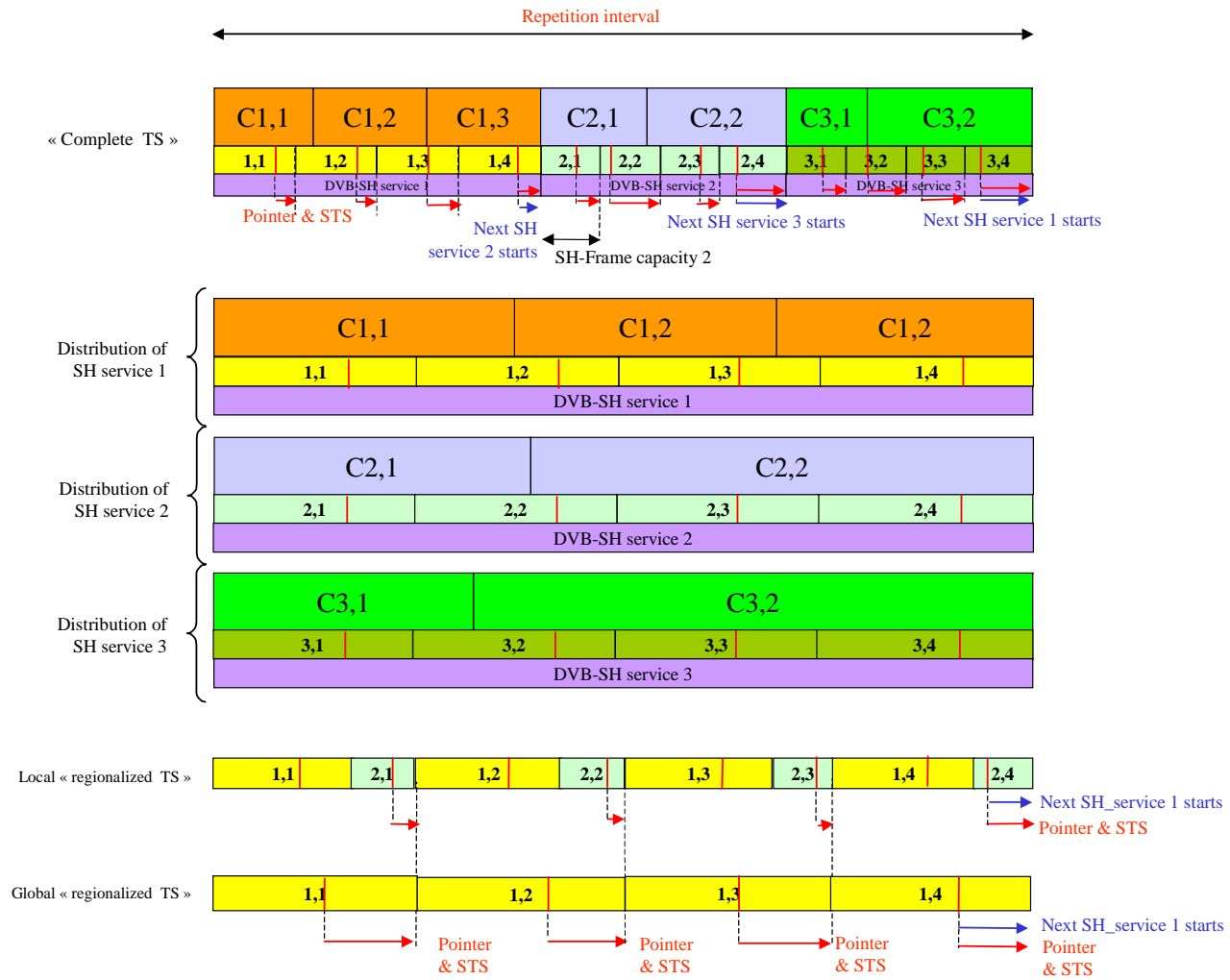


Figure 11: SH service filtering with "adapt and transmit" method

- The IP encapsulator constitutes the "complete TS" with following design criteria:
  - SHIP signals SH services for regionalization purpose, at least one SH service for each region. The SH services are repeated with a specific repetition\_interval. SH services are timely grouped so that all SH services MUST be found during each repetition\_interval.
  - As required for subsequent per-SH frame alignment, SH services MUST be aligned with SH frames following these rules:
    - Beginning of the first SH service of one region MUST match beginning of a SH frame.
    - However if there are more than one SH service in this region, the remaining SH service(s) are not required to match this criteria.
    - As a consequence repetition\_interval is a multiple of the SH-frames duration used in the global "regionalized TS".
  - There is one SHIP per SH-frame whose size depends on the actual modulation parameters:
    - SH frame capacity in the common SH service is based on the global modulation; this capacity is computed from the modulation characteristics (see for instance [6], table 5.11 for OFDM case and [6], table 5.12 for TDM case) and the chosen code rate and is expressed in units of EFRAMES that carries 8 MPEG2 TS.
    - SH frame capacity in the local SH service is a complementary capacity that comes in addition to the global capacity. Therefore SH frame size MAY differ between the common and local SH frame capacities.
  - Note that the above time-slice bursts need not be aligned with this repetition\_interval. However in case power saving is sought with a class 2, time-slice burst MUST be aligned with SH frames as recommended in [7], clause 7.2.3.3.1.
- The {adapter; distribution} create and distribute the "regionalized TS" for subsequent modulation by the modulator:
  - To create the global "regionalized TS", the {adapter; distribution} has to excerpt the common SH service (e.g. service 1). A valid SHIP is already present in every SH frame constituting the SH service that can be used by the global modulator to synchronize the global SH frame with the local ones.
  - To create the local "regionalized TS", the {adapter; distribution} has to excerpt the SH service 1 and the local SH service (e.g. SH service 2) and merge both together. The merging of the global and local SH frames is done in such a way that only one valid SHIP is present in every SH frame, enabling the modulator to synchronize the local SH frame with the global SH frame and with other repeaters of the same terrestrial SFN cell. The merging is therefore achieved at the level of each and every SH frame, each SH frame bearing a common part that can be code-combined between the two "regionalized TS", and a local part that is present only on the local "regionalized TS" (see clause 4.2.1.4 for more information on receiver behaviour).
- The modulator receives a valid SH frame:
  - The resulting SH frame is received at a bit rate equal to the actual radio capacity. Therefore, thanks to the SHIP, the modulator can apply the usual processing for synchronization.
  - Note that the terrestrial modulator will receive two SHIP in each SH-frame, one in the common part and one in the local part, only one (the one in the local part) being valid.
  - This synchronization is important since both SH frames on the two "regionalized TS" need to be aligned by the two modulators before transmission. The procedures for doing such an alignment can be found in clause [7], clause 7.2.3.4.

#### 4.2.1.4 Receiver behaviour with SH service layer filtering (informative):

First at cold start, terminal acquires PSI/SI. In particular, the terminal resolves the global path for the elementary stream of interest. It also resolves availability of the DVB service where the elementary stream is located. Additionally, the terminal MUST acquire via the received SHIP the map of the SH services. The structure of the SH services is repeated regularly in the common part using service\_synchronization\_function (see [6], clauses A.4.9 and 4.2.10.2.5).

We assume that the receiver has acquired non-real time information whereby the receiver has an exact map of SH services and DVB services availability per cell\_id:

- From SHIP cell\_id and service\_localization functions, the receiver can map on which cells local SH services are being transmitted (see clause 4.10.2 for more details). We assume in the following that there is a unique common SH service with an id set to '0'.
- From SDT service\_availability\_descriptor, the receiver has knowledge of the availability of DVB services on each cell (see clause 4.4.3).

In this example, we assume the receiver is interested by a service carried within SH service '0':

- If the receiver can receive both "regionalized TS":
  - On satellite signal, receiver wakes up at time signalled by previously received delta-t whereas on terrestrial signal, receiver wakes up at time signalled by updated delta-t (see clause 4.3).
  - Receiver coarsely aligns each received SH-frame since SH frames are timely aligned (see [6], clause 5.5.2.2).
  - Receiver localizes common SH service '0' on both "regionalized TS". This can be achieved by different means:
    - If the receiver maintains a precise time and frequency clock, it can predict start of the SH frame and SH service (see [7], clause 7.5.3.3).
    - When the first EFRAME has been decoded, the receiver can compare CBCOUNTER\_SH that is related to the SH service number (see [6], clause 5.1.2).
    - When a SHIP is received, it can signal the start of a service in the next SH frame. If the SHIP indicates the start of service '0' in the next SH frame, the receiver can derive immediately the beginning of the common service.
  - Inside the SH service '0', EFRAMES can be compared one to one using CBCCOUNTER\_FB.
  - Receiver decodes current EFRAME with soft bits information coming from both modulation paths as explained in [7], clause 7.2.2.3.
- If the receiver can receive only one "regionalized TS", receiver only decodes EFRAMES individually:
  - Receiver wakes up at time signalled by delta-t. See clause 4.3 for more information.
  - Receiver decodes current EFRAME with soft bits information coming from a unique modulation scheme.

Similar approach (as the reception of a unique "regionalized TS") would be applied for a local SH service.

### 4.2.2 Filtering at SH service level

#### 4.2.2.1 Recommendations (normative)

##### 4.2.2.1.0 Introduction

We give recommendation of the complete TS attributes in clause 4.2.2.1.1, then we describe how filtering is achieved in clause 4.2.2.1.2, then we give the result of the filtering in the form of the regionalized TS attributes in clause 4.2.2.1.3.

#### 4.2.2.1.1 "Complete TS" attributes

##### 4.2.2.1.1.1 Introduction

We describe first the common SH services then the local SH services attributes.

##### 4.2.2.1.1.2 Common SH service attributes

###### 4.2.2.1.1.2.1 Introduction

NOTE: As a consequence of common service repetition in all "regionalized TS", the requirements applying to the common SH service are also valid for common SH services in all regionalized TS (see clause 4.1.2.1.3.1).

###### 4.2.2.1.1.2.2 Mandatory SHIP parameters

Mandatory SHIP parameters are pertinent for the actual regionalized TS where this SHIP is valid. Since SHIP present in the common service MUST have a synchronization\_id set to '1' and be valid for the satellite cell, the SHIP therefore conveys radio parameters corresponding to the satellite cell.

NOTE 1: SHIP having a synchronization\_id set to '0' are valid for the terrestrial cells and therefore convey radio parameters corresponding to the terrestrial cell. They cannot be located in common SH service unless there is no satellite cell at all.

NOTE 2: If different radio parameters are to be used with the same TS (for instance transmitting the TS over different satellite cells while maintaining the same bit rate, e.g. by modifying the FFT in DVB-SHA) only one set of real-time parameters can actually be fixed in the SHIP. However the SHIP in the regionalized global TS can be updated to reflect the updated SHIP values inside each cell.

NOTE 3: Since the complete TS is not made for actual modulation (only the local TS is made for) there is no real consequence on the fact that all radio parameters are not reproduced in the SHIP real time parameters.

###### 4.2.2.1.1.2.3 Optional SHIP parameters

In general, optional functions SHOULD be conveyed in SHIP located in the common SH service. In particular, functions describing content localization such as cell\_id, service\_localization, service\_synchronization MUST be located in the common SH service. Some exceptions are listed in the local service attribute (clause 4.2.2.1.1.3.2).

If an optional function conveyed by the SHIP packet spans several successive SHIP, the function SHOULD be completely described within current common service or, otherwise stated, part of the function SHALL not be distributed in other services than the common one.

If it is not possible to convey the function within the current common service, then the following SHIP conveying the remaining of the function SHALL be located in the next iteration of the common service. Therefore no part of an optional function starting in the common service SHALL be located in the local part.

The procedure for supporting transmission of optional SHIP parameters over several SHIP packets is defined in clause 4.10.2.1.

###### 4.2.2.1.1.2.4 PSI/SI tables

When present, the BAT, TOT, UNT, CAT, TSDT MUST be located in the common SH service only.

The NIT, SDT, TDT SHALL be sent in the common SH service only.

Other tables (EIT, RST, ST) are ignored and SHOULD not be transmitted.

The INT SHALL be sent in the common SH service only.

All tables sent in the common service SHALL be received in all cells.

PAT and PMT must be inserted in the common SH service according to regular repetition frequency. Their content is according to clause 4.2.2.1.2.2:

- The PAT MUST signal all DVB services present in the complete TS.
- All PMT corresponding to DVB services present in the complete TS MUST not be void.

#### 4.2.2.1.1.3 Local SH service attributes

##### 4.2.2.1.1.3.1 Mandatory SHIP parameters

Mandatory SHIP parameters are always pertinent for the actual regionalized TS where this SHIP is valid. Since SHIP present in the local service MUST have a synchronization\_id set to '0' and be valid for the terrestrial cell, the SHIP therefore conveys pertinent radio parameters corresponding to the terrestrial cell.

NOTE 1: SHIP having synchronization\_id set to '1' do not belong to a local SH service but to the global SH service, are not valid in the regionalized TS and are to be ignored with regards to their conveyed mandatory parameters.

NOTE 2: if there are different terrestrial radio parameters but leading to same bit rates (such as FFT size variations), only one set of parameters can be signalled in the mandatory parameters of the local SHIP of the complete TS. Local variations are to be reflected in the local SHIP of the different regionalized TS (see clause 4.2.2.1.2.1).

##### 4.2.2.1.1.3.2 Optional SHIP parameters

Optional functions starting within a local SH service are:

- service\_synchronization\_function:  
the start flag of the service\_synchronization\_function MAY be used in a SHIP external to common SH service.
- Other functions specific to the local transmitters belonging to the cell where the local service is present (transmitter\_\*).

All those functions MUST be transmitted in the current SHIP.

##### 4.2.2.1.1.3.3 PSI/SI tables

SI tables MUST be signalled according to repetition intervals. Their content is according to clause 4.2.2.1.2.2.

#### 4.2.2.1.2 Filtering processing

##### 4.2.2.1.2.1 General procedure

The filtering at SH service layer consists in:

- Selecting those SH services from the "complete TS" that need to be kept in the "localized TS", e.g. based on SHIP signalling (see [6], clause A.4.9)
- Extracting the corresponding MPEG2 TS packets including MPE, MPE-FEC, MPE-IFEC, SHIP, PSI/SI, NULL.
- Updating the MPE / MPE-IFEC headers real time parameters of the selected ES, in particular the delta-t:
  - delta-t for the common services in the global and local "regionalized TS" being based on the repetition interval and global "regionalized TS" bitrate;
  - delta-t for the local services in the local "regionalized TS" being based on the repetition interval and local "regionalized TS" bit rate;
  - see clause 4.3 for more details.



- Creating or updating the SHIP packets inside the common and/or local SH service to signal the new synchronization\_time\_stamp value based on the actual "regionalized TS" (whether global or local) bit rate, and the new service arrangement in the synchronization function.

NOTE: if there are different radio configurations not impacting the bit rate (such as different FFT sizes), the radio parameters of the SHIP need to be aligned in the corresponding areas. For instance in two different terrestrial cellIDs, different FFT MAY be used resulting in different mandatory parameters.

- Creating or updating the PSI such as the PAT and the PMT to reflect the list of local DVB services that are present on the local SH service only (see clauses 4.2.2.1.2.2 and 4.5).

#### 4.2.2.1.2.2 PSI/SI scope

A DVB-SH receiver MUST consider the received SI as valid for all other "regionalized TS" of the same TS.

On the contrary, a DVB-SH receiver MUST consider the PSI of the current "regionalized TS" as only valid for the current TS:

- Even if all PMT of the complete TS services are present, the only PMT of the local (and common) DVB services actually present are valid, the other PMT being void.
- As an exception, the PAT MAY be considered as valid for all "regionalized TS".

A procedure is given to illustrate how PMT MUST be interpreted by the DVB-SH receiver:

- The PMT MUST be monitored during an update period equal to a SH frame duration before being considered as updated.
- During this update period, a DVB-SH terminal receiving a void PMT SHALL NOT conclude that the service is not present but that this DVB service is not globally available.
- All received PMT during the update period MUST be considered. Only when the update period has ended that any conclusion can be drawn.
- Therefore at the end of the update period the following events MAY occur for each DVB service signalled by a PMT:
  - If a non-void PMT for the corresponding DVB service has been received, then the corresponding ES of the DVB service are actually conveyed in the regionalized TS.
  - If only void PMT for the corresponding DVB service have been received, then no ES of the DVB service is actually present in the "regionalized TS".
- The following situation CAN therefore occur:
  - Those DVB-SH receivers receiving only the global "regionalized TS" will get:
    - For common DVB services: complete PMT within the global SH service;
    - For local DVB services: void PMT within the global SH service.

NOTE 1: DVB-SH receivers will therefore have no information on the DVB services that are not present since all corresponding PMT are void.

- Those SH receivers receiving only the local "regionalized TS" will get:
  - For common DVB services: complete PMT within the common SH service;
  - for local DVB services: void PMT within the common SH service;
  - for local DVB services: complete PMT within their corresponding local SH services.

NOTE 2: DVB-SH receivers will consider the local ES as present based on existence of non-void PMT.

PMT SHALL be updated when a change in the receiver situation occurs (change in regionalized TS reception conditions).

### 4.2.2.1.3 "Regionalized TS" attributes

#### 4.2.2.1.3.1 Common SH service attributes

##### 4.2.2.1.3.1.1 Data

For the sake of code combining, all the bits of the common services **MUST** be identical in all regionalized TS.

All adapters **MUST** keep the same number of MPEG2 TS packets from the common SH service.

All adapters **MAY** modify MPEG2 TS packets provided that all adapters of the SH network perform the modification simultaneously and identically.

MPE / MPE-FEC / MPE-IFEC section headers **MUST** be modified as follows: the delta-t must be updated to reflect change in bit rates and service distribution.

##### 4.2.2.1.3.2.1 Signalling

Due to exact correspondence between common SH services in complete and regionalized TS, clause 4.2.2.1.1.2 apply. In addition, the following applies to the regionalized common SH services.

- SHIP packets **MUST** be modified as to be valid for the global repeater:
  - synchronization\_time\_stamp **MUST** be updated to reflect the new emission time of the next SH frame start due to the difference in bit rates between "complete TS" and global "regionalized TS";
  - SH service information **MUST** be modified to align with the service arrangement available on the global "regionalized TS";
  - Pointer **MUST** be kept unmodified so that this information is correct for the global modulator.
  - As a consequence, the SHIP packets **MAY** not be valid for the local repeaters:
    - STS and pointer **MAY** therefore not be correct for the local modulators and these modulators **MUST** ignore them.
    - SH service information **MAY** not be correct after filtering on the local modulators when a SH service following the common one is removed.
    - To signal that SHIP **MUST** be ignored by local modulators but not by global, its synchronization\_id **MUST** be set to "1" (see clause 4.10.1.1 for more details).
- PAT **SHALL** list all programs and therefore all DVB services of the "complete TS":
  - PAT of the "regionalized TS" **SHALL NOT** be modified compared to "complete TS". See for more details clause 4.5.1.
- All PMT present in the "complete TS" **SHALL** be present in common part of the "regionalized TS".
  - All DVB services of the "complete TS" have their PMT present in the "regionalized TS".
  - PMT describing local DVB services **SHALL** be void (no elementary streams are announced in the ES\_info\_loop, ES\_info\_length is set to '0') while keeping the same version\_number. See for more details clause 4.5.2.
- Other PSI/SI tables **MUST** be kept unmodified since they **MUST** be generic for all cells.

##### 4.2.2.1.3.2 Local SH service attributes

##### 4.2.2.1.3.2.1 Data

All modulators belonging to the cell where the SH service is modulated **MUST** keep the same number of MPEG2 TS packets from the local SH service (and discard those SH services that are not present in the cell).

Modulators MAY modify MPEG2 TS packets provided all modulators of the current cell perform this modification identically and simultaneously on a given region.

NOTE : Two sub-regions MAY actually transmit same content but with different radio parameters not modifying the bit rate such as FFT. In such a case it is recommended to formally distinguish the two regions on the infrastructure side, each having its own set of radio parameters.

MPE/MPE-FEC/MPE-IFEC section headers MUST be modified as follows: the delta-t must be updated to reflect the change in bit rates and service arrangement. See for more details clause 4.3.

#### 4.2.2.1.3.2.2 Signalling

SHIP packets from the local SH service are relevant but MUST be updated as follows:

- synchronization\_time\_stamp MUST be modified to reflect the emission time of the next SH frame due to the difference of bit rates between the "complete TS" and local "regionalized TS";
- service\_synchronization function MUST be updated to signal the start of the common SH service in the next SH frame;
- service\_synchronization\_function MAY list services present in the local TS. If this function does this listing, only the common and current local service(s) are listed in their sending order, all services being not transmitted in this local TS MUST not be listed (see clause 4.10.2.5);
- pointer MUST not be updated;
- synchronization\_id MUST be set to '0' to indicate that this SHIP can be used for synchronization by the local modulator (see clause 4.10.1.1).

NOTE 1: SHIP packets in the common SH service are irrelevant for terrestrial repeaters (synchronization\_id is set to '1').

PAT SHALL not be repeated and therefore SHALL be discarded if present in the local SH service.

NOTE 2: PAT of the common SH service can be used by the receiver.

PMT of common services and non-present local services are not repeated and MUST be discarded from the local SH service. Therefore only the PMT of the DVB services present in the local SH service SHALL be present.

NOTE 3: PMT of the other DVB services (common and other local) can be found in the common SH service.

Other PSI/SI tables MUST NOT be modified.

#### 4.2.2.2 Example (informative)

Please refer to figure 10.

At the global modulator, only the common DVB/SH service MUST be kept:

- The time-slicing information MUST be always correct and MAY be used by the receiver for power saving purposes.
- Only SHIP with synchronization\_id set to '1' MUST be used:
  - SH service 'next start' MUST be valid (signalling service '1' start);
  - synchronization\_time\_stamp MUST be valid and can be used by the modulators for synchronization purpose;
  - The SHIP pointer MUST be valid.
- The PSI/SI MUST be valid.

At a given local modulator, the common DVB-SH service **MUST** be kept along with one or several local DVB-SH services:

- delta-t information signalled by MPE **MUST** be always correct (with some adjustment for the common services, see clause 4.3).
- Only SHIP packets with synchronization\_id set to '0' **MUST** be used:
  - The SH service 'next start' **MUST** be valid.
  - The synchronizatoin\_time\_stamp **MUST** be valid.
  - The pointer **MUST** be valid.
- SHIP with synchronization\_id set to '1' **MUST** be ignored; therefore there is only one valid SHIP per SH frame.
- The PSI/SI are always correct.

While receiving a global "regionalized TS" or a local "regionalized TS", the receiver will rely on the only delta-t signalled by the MPE headers to perform power saving (see clause 4.3 for more details).

### 4.2.3 Filtering at TS layer

TS layer filtering **MAY** or **MAY** not be performed using underlying SH service structure. Therefore only reference to DVB services **SHALL** be done in the following although SH services **MAY** also be used.

#### 4.2.3.1 Recommendations (normative)

##### 4.2.3.1.1 "Complete TS" attributes

EIT, RST, ST are ignored and **SHOULD** not be transmitted.

##### 4.2.3.1.2 Filtering processing

The filtering at TS layer consists in:

- Selecting the TS packets belonging to the target DVB service(s).
- Updating the MPE / MPE-IFEC headers real time parameters of the selected ES, in particular the delta-t.
- Updating the SHIP packets to signal the new DVB-SH service sequence (if present) and the new synchronization\_time\_stamp/pointer values.
- Updating the PAT and PMT tables to reflect the ES actual presence.

To perform rate matching, NULL MPEG2 TS packets **MAY** be inserted.

##### 4.2.3.1.3 "Regionalized TS" attributes / local SH service attribues

MPEG2 TS packets carrying elementary streams belonging to filtered-out DVB services are discarded.

MPEG2 TS packets carrying elementary streams belonging to filtered-in DVB services are kept.

MPEG2 TS packets carrying elementary streams belonging to filtered-in DVB services **MAY** be modified provided this update is done identically and simultaneously on all modulators of the cell.

MPE/MPE-FEC/MPE-IFEC sections headers are updated as follows: delta-t must be updated to reflect the change in bit rates and service arrangement.

SHIP is modified as follows:

- service\_synchronization function: service\_index is updated to reflect new service arrangement (if present);
- mandatory parameters: synchronization\_time\_stamp and pointer are updated to reflect the change in bit rates and service arrangement.

One SHIP is inserted in each SH-frame whose capacity is computed from the actual modulation and encoding parameters.

PMT are constituted as follows:

- Only the PMT corresponding to the DVB services present in the "regionalized TS" SHALL be present.
- The regionalized PMT SHALL list all elementary streams present in this DVB service.

The PAT lists PMT that are present in the "regionalized TS" only.

The INT MUST not be updated.

The other PSI/SI tables are not modified.

#### 4.2.3.2 Example (informative)

The examples are strictly the same as at the SH service layer with the following improvements:

- the SHIP "next service" indication is always correct (if SH service is used).
- the PAT and PMT tables are not any more generic in the common part and no PMT SHALL be void.

### 4.3 Multiprotocol Encapsulation (normative)

Clauses 4.3 and 5.2 of [8] apply without any exclusion. In addition, the following applies when paTS is used.

#### 4.3.1 SH SERVICE FILTERING

##### 4.3.1.1 Common DVB-SH service

In the common DVB service, if SH service filtering is used, the delta-t inserted in the real-time parameters is computed with a repetition interval equal to the actual common DVB service repetition interval and a bit rate equal to the bit rate used for global "regionalized TS" modulation. This computation is unique for all modulators, including the local ones. The DVB-SH receiver receiving the common DVB-SH service on the global "regionalized TS" MUST apply the signalled delta-t without any modification.

When the global and local "regionalized TS" do not have same bit rates, assuming stretch\_factor to be the ratio between local and global "regionalized TS" bitrates ( $\text{stretch\_factor} \geq 1$ ), the DVB-SH receiver receiving the common DVB-SH service on the local frequency MUST update the signalled delta-t using one of the two following methods:

- Assuming the receivers knows the position of the MPE section within the current SH frame as equal to  $t(\text{start\_current\_frame}_{\text{local\_TS}}; \text{current\_sect}_{\text{local\_TS}})$ , we can derive:
  - A, the position of the MPE section within global TS:  
 $A = t(\text{start\_current\_frame}_{\text{local\_TS}}; \text{cur\_sect}_{\text{local\_TS}}) * \text{stretch\_factor}$ .
  - B, the position of the next burst within global TS:  $B = A + \text{delta\_t}$ .
  - C, the position of next burst within local TS:  $C = \text{frame\_duration} * \text{floor}(B / \text{frame\_duration}; 0) + [B - \text{frame\_duration} * \text{floor}(B / \text{frame\_duration}; 0)] / \text{stretch\_factor}$ .
  - D, the updated delta\_t:  $D = C - A$ .

- Assuming the receiver does not know the position of the MPE section within the current SH frame, the actual delta-t cannot be known precisely and we need subtract the highest possible correction from the signalled delta-t value to avoid the receiver to wake up too late. This highest possible correction happens when the MPE section is at the beginning of the current SH frame (so both sections arrive at the same time on global and local) and the burst starts at the end of the target SH frame. In that case the delta-t is too long by  $SH\_frame\_duration * (1 - 1/strech\_factor)$ . In the absence of MPE position knowledge within the SH frame, the delta-t needs then to be lowered by  $SH\_frame\_duration * (1 - 1/strech\_factor)$ :

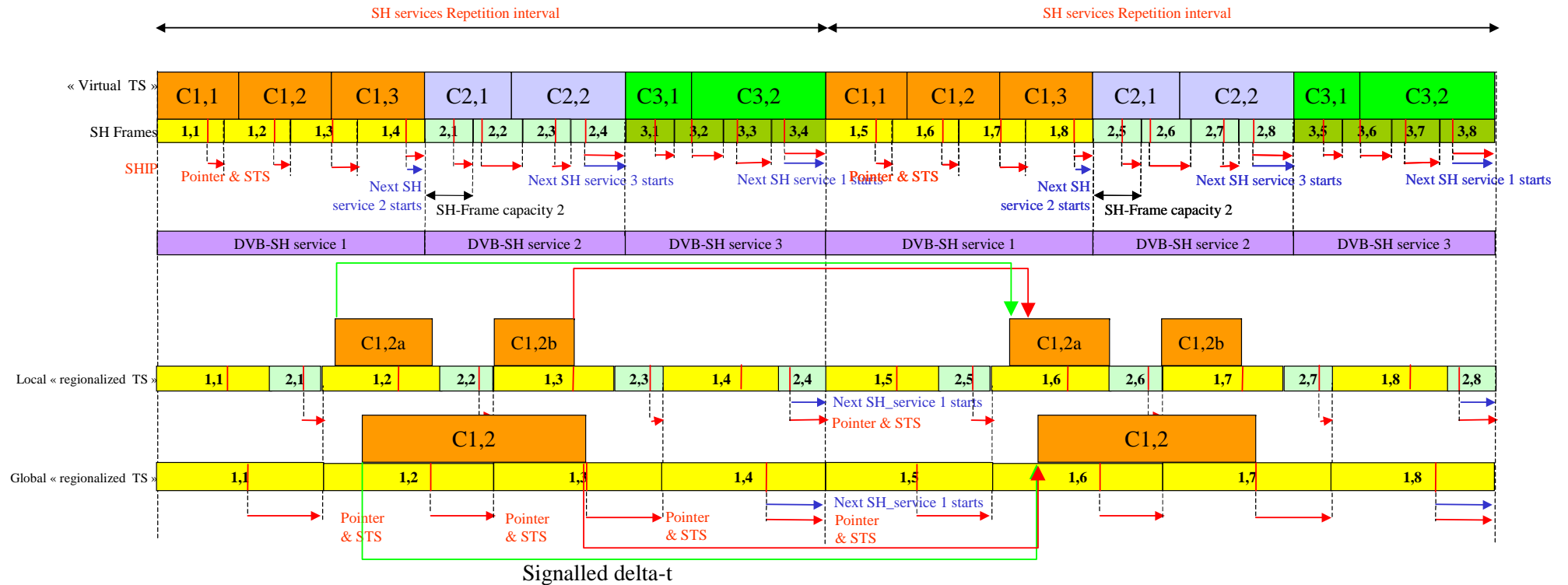
$$\Delta t' = \Delta t - \text{ceil} \left[ SH\_service\_duration * \left( 1 - \frac{1}{stretch\_factor} \right) \right]_{10ms}$$

where  $\text{ceil}(x)_{10ms}$  gives the highest and nearest duration expressed in units of 10 ms.

#### 4.3.1.2 Local DVB-SH service

The DVB-SH receiver receiving the local DVB-SH service on the local frequency MUST apply the signalled delta-t without any modification.

In the following, we give one example that illustrates the need to update the delta-t on the "local regionalized TS".



**Figure 12: Example of MPE delta-t updating**

- The green delta-t signalled by first section of burst C1,2 can be used as it is since the durations between, respectively, SH frame start and MPE section, and SH frame start and next burst start, are identical.
- The red delta-t signalled by last section of burst C1,2 need to be updated before being used in the "regionalized TS" since, in that case, the durations between SH frame start and MPE section, and SH frame start and next burst start, are different. If not updated, the red delta-t would lead to a too-late wake up time.

## 4.3.2 TS LAYER FILTERING

In TS layer filtering is used, the delta-t is computed on the actual "regionalized TS" with repetition interval being equal to the actual DVB service repetition interval and bit rate equal to the actual "regionalized TS" bit rate so that the DVB-SH receiver can process the delta-t signalling for all received services as usual.

## 4.4 Descriptors (normative)

The complete list of the descriptors, their use in different tables, and descriptor tags may be found in EN 300 468 [1] and EN 301 192 [2]. The list given in [8], clause 4.6 is fully applicable with the exceptions given hereunder.

### 4.4.1 SH\_delivery\_system\_descriptor

SH\_delivery\_system\_descriptor can be found in [1].

The descriptor MUST be found in the NIT in the TS loop, where there is at most 1 descriptor for each TS. Its purpose is to precise, for a given TS, the main physical (modulation, code rate, interleaver...) parameters. In addition to the physical parameters, it also delivers basic information on diversity options, including MPE-IFEC if relevant. One should note that it lacks frequency information since the latter can be found in other descriptors inside the NIT. It differs significantly from previous terrestrial and satellite delivery system descriptors in the sense that it has been designed to accommodate a large variety of system configurations. Therefore its size varies depending on the chosen configuration.

#### 4.4.1.1 Diversity mode

The descriptor starts with a diversity\_mode that indicates principle diversity options selected for this TS:

When paTS is not activated, there is no difference of content (in terms of hard bits) between the TS modulated on (possibly) different frequencies. The principle learning is that same bit rates are used for transmission on all frequencies listed in the cell\_frequency\_link\_descriptor (see clause 4.4.5) and same 'hard bits' (including PSI/SI) are being modulated on all these cells. This does not however mean that there is no diversity supported:

- In SFN configuration, diversity can be supported on the unique frequency at the receiver side at radio layer (e.g. using multiple radio combining).
- In non-SFN configuration, diversity can be supported at physical layer with complementary code rates. To detect that complementary modes are used, the modulation loop has to be checked.

When paTS is activated, this means that there is different content being transmitted over the different frequencies (in terms of hard bits), including PSI/SI that MAY differ between the different cells where the TS is being transmitted. Diversity\_mode details how these different contents can be used for diversity purpose. 3 main combinations are possible:

- "FEC at physical layer": this case corresponds to the combination of soft bits for specific SH services (the common one) using the "code combining" technique described in [7], clauses 7.2.2.3.3 and 7.4. In addition to the case where same code rates are being used (similar to the non-paTS non-SFN case described previously), it MAY be possible to use different complementary code rates.
- "FEC at link layer": this case corresponds to the possibility to provide diversity at the link layer, using MPE and MPE-IFEC sections (this latter case is FFS). In this case SH services MAY not be used, however SH usage even in this case is recommended in order to provide an homogeneous synchronization scheme.
- Both previous cases together.



All different diversity options are presented in figure 13.

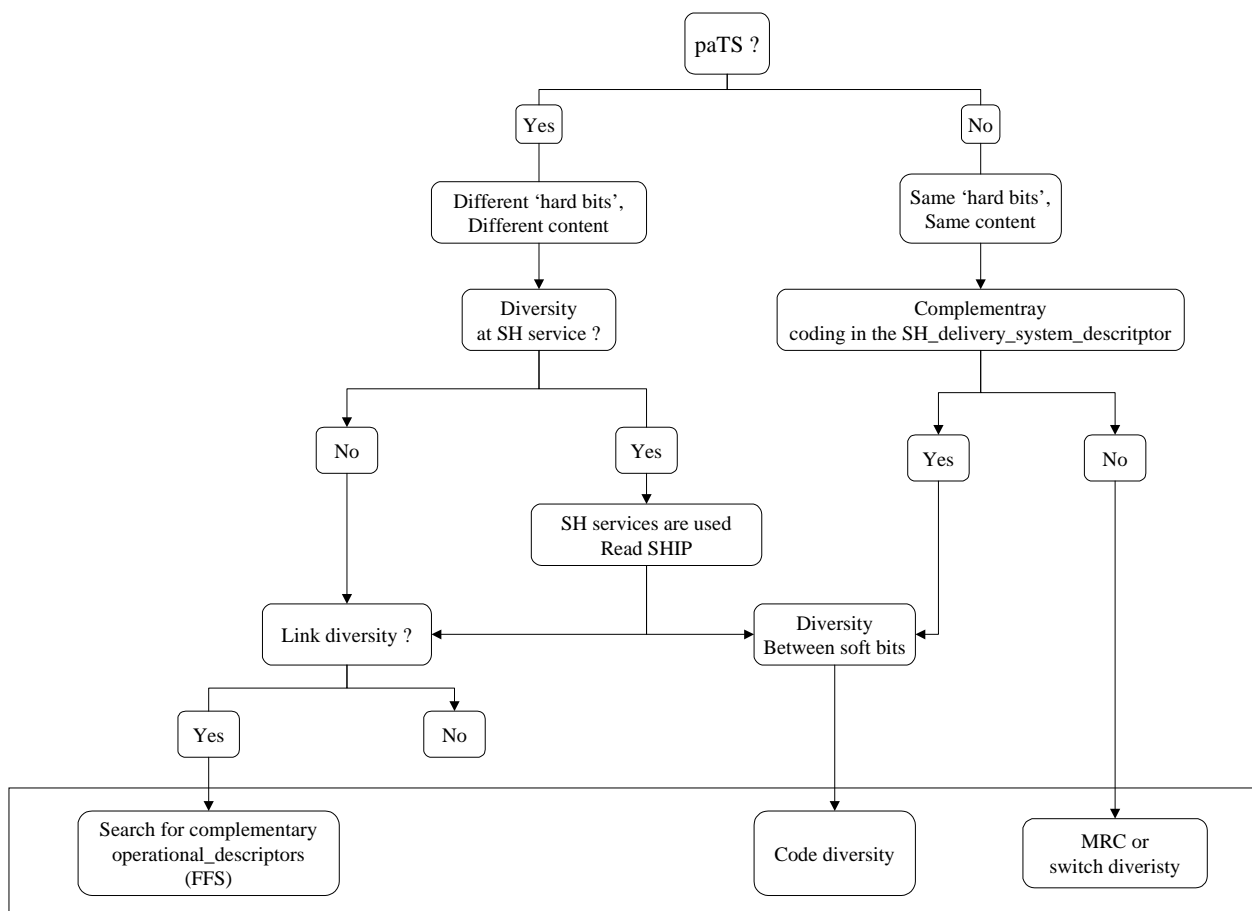


Figure 13: Diversity options

#### 4.4.1.2 Modulation loop

Then there is a loop on the modulation schemes. The number of iterations depends on the system configuration. In the simplest case, the SFN on one unique frequency, there is only one iteration describing an OFDM modulation. When additional diversity and/or frequencies are added, the number of iterations increases. Some examples are given in the table hereunder.

Table 1: Examples of modulation iterations within SH\_delivery\_descriptor

Case	Description	OFDM modulation	TDM modulation
1	SH-A SFN with 1 satellite	1	0
2	SH-A SFN with satellite diversity	2	0
3	SH-B with 1 satellite and same terrestrial scheme	1	1
4	SH-B with 2 satellite and same terrestrial scheme	1	2
5	SH-B with 1 satellite and different terrestrial schemes	As many terrestrial cells	1

Among all these case, the 5 needs special explanations given below through the modulation ordering loop design rules and their usage with the NIT context.

Since the frequency is not included in the SH\_delivery\_system\_descriptor, special care needs to be given to the modulation ordering according to the following rules:

- Satellite modulations:
  - Satellites modulation are always the first, terrestrial are the last.
  - When several satellite modulations exist, they are all positioned at the beginning of the list.
- Terrestrial modulations:
  - When terrestrial modulations are the same on all frequencies, one unique iteration MUST be done.
  - When different modulation parameters exist in the cells that transmit the TS, then all modulation schemes of all cells MUST be listed, even if some of them are redundant.
- Transition between satellite and terrestrial modulations in the loop:
  - When TDM is used for the satellite modulation, the transition is clearly defined by the change in the modulation scheme since TDM can only be used for a satellite transmission.
  - When OFDM is used for the satellite modulation, there is an ambiguity in the transition since OFDM is also used for terrestrial modulation. Therefore the transition MUST be defined via another mechanism which is the common\_frequency\_flag:
    - if OFDM modulation is used for satellite (SH-A mode), common\_frequency flag SHALL be set to '1' for the relevant modulation scheme.
    - if OFDM modulation is used for terrestrial (all cases), common\_frequency flag SHALL be set to '0'.

The usage of this ordering in conjunction with cell\_frequency\_link\_descriptor is explained in the NIT section (clause 4.6.2).

Each element in the loop has a size that depends on the actual individual physical parameters, essentially if TDM or OFDM modulation scheme is used, and if, and how the interleaver is configured. The design has been made the most compact possible when several modulation schemes are present, using the following rules:

- When the interleaver is the same, it SHALL not be repeated after the first definition (interleaver\_presence set to '1' for the first iteration, and '0' for the following).
- More generally, when an interleaver\_presence is set to '0', this means that the latest previously described interleaver MUST be used. This can be useful not only between the satellite and terrestrial modulation (previous case) but also between terrestrial modulations when different parameters other than the modulation are changed.
- When the interleaver is of class 1, the short form SHOULD be used instead of the long form reserved for class 2.

#### 4.4.1.3 Usage restrictions

Some combinations MAY correspond to non-canonical SH configurations: for instance it is possible to configure a SH\_delivery\_system\_descriptor with a unique TDM modulation. Due to this independence of the TDM configuration with regards to the OFDM, some care MUST be taken when OFDM and TDM are configured in the same descriptor: OFDM and TDM parameters MUST be harmonized according to SH specifications given in [6], in particular the symbol rate.

When code combining is used in non-SFN conditions, then several modulations are present in the loop (at least 2) and complementary code rates MUST be announced. For instance in SH-B configuration with complementary codes, the following SH\_delivery\_system is used (see table 2).

**Table 2: SH\_delivery\_system descriptor in SH-B with complementary code**

Syntax	Nof bits	elements	Multi	
SH_delivery_system_descriptor(){				
descriptor_tag	8	1	8	
descriptor_extension_tag	8	1	8	
descriptor_length	8	1	8	
diversity_mode	4	1	4	
reserved	4	1	4	
tdm_modulation_descriptor	24	1	24	
interleaver_descriptor_complete	32	0	0	
ofdm_modulation_descriptor	24	1	24	
interleaver_descriptor_partial	8	2	16	
}				
total in bits			96	bits
Total in bytes			12	bytes
signaled in bytes			10	bytes

DVB-SH_tdm_descriptor		
modulation_descriptor_type	1	set to "0"
interleaver_descriptor_flag	1	set to "1"
interleaver_type	1	set to "0"
reserved	5	
polarization	2	
roll off	2	
modulation_type	2	
code_rate	4	set to '1000 CR= 1/2 standard
symbol_rate	6	
	24	

DVB-SH_ofdm_descriptor		
modulation_descriptor_type	1	set to "1"
interleaver_descriptor_flag	1	set to "1"
interleaver_type	1	set to "1"
reserved	5	
bandwidth	3	
priority	1	
constellation_and_hierarchy	3	
code_rate	4	set to '1001 CR= 1/2 complementar
guard_interval	2	
transmission_mode	2	
satellite_frequency	1	
	24	

#### 4.4.2 time\_slice\_fec\_identifier\_descriptor

This descriptor identifies whether time-slicing and/or MPE-FEC and/or MPE-IFEC are used on an elementary stream. This descriptor is used to announce each time-sliced Elementary Stream. The descriptor is defined in [2], clause 9.5.

When located in the first descriptor loop of NIT, the descriptor applies to all Elementary Streams within all Transport Streams within the DVB network. If located in the second descriptor loop of NIT, the descriptor applies to all Elementary Streams within the referred Transport Stream, overriding any time-slicing or FEC information from the first descriptor loop.

If located in the platform descriptor loop of an INT, the descriptor applies to all Elementary Streams referenced within the table, overriding any time-slicing or FEC information from the NIT. If located in the target descriptor loop, the descriptor applies to all Elementary Streams referenced within the current iteration of the target descriptor loop following the appearance of the descriptor, overriding any time-slicing or FEC information from the platform descriptor loop and in the NIT.

Note that the descriptor applies to Elementary Streams with stream\_type 0x90. Other stream\_type values may be specified later.

The descriptor may appear more than once, in which case each new occurrence overrides previous occurrence(s).

### 4.4.3 Service Availability Descriptor

This clause specifies the construction rules of the `service_availability_descriptor`, for the actual or a neighbouring partially available Transport Stream. We assume 1 TS having at least 1 `SH_delivery__system_descriptor` with a `paTS` in at least 1 network:

- Step 1: the NIT `sub_tables` in scope SHALL be all the NIT `sub_tables` announcing this Transport Streams on networks where the `SH_delivery__system_descriptor` signals a `paTS`.
- Step 2: the total set of cells in scope SHALL be all the cell entries of `cell_frequency_link_descriptors` assigned to this TS in the NIT `sub_tables` in scope.
- Step 3: in the SDT `sub_table` of the Transport Stream, for each service entry of the `services_loop`:
  - Step 3.1: within the total set of cells, identify the subset of filtering cells (i.e. the cells on which the service is not available).
  - Step 3.2: in case two cell entries or more share the same `cell_id`, while providing opposite availability information for the service (whether the cell descriptions of these cell entries are identical or not), the common `cell_id` value SHALL be added to the subset of filtering cells.
  - Step 3.3: if the subset of filtering cells is empty, continue to next service entry.
  - Step 3.4: otherwise, include the `service_availability_descriptor`, as follows:
    - either set `availability_flag` to 0, and list in the descriptor the `cell_id(s)` of the subset of filtering cells;
    - or set `availability_flag` to 1, and list in the descriptor the `cell_id(s)` of the total set of cells that are not present in the subset of filtering cells.

NOTE: Value of `availability_flag` could change for each inclusion of the `service_availability_descriptor`, in order for instance to produce the shortest list of `cell_id(s)` as possible in the descriptor.

### 4.4.4 cell\_list\_descriptor

#### 4.4.4.0 Introduction

This descriptor lists all the cells of the DVB network together with their `cell_id`.

#### 4.4.4.1 General requirements

The descriptor appears in the first descriptor loop of a NIT `sub_table` describing an IPDC DVB-SH Network and the cell list MUST be complete.

The following applies:

- Due to the definition regarding the sign of latitudes and longitudes the south-western corner of the rectangle is specified.
- In case of large list of cells exceeding the capacity of the `cell_list_descriptor` (a maximum of 25 cells can be listed in a `cell_list_descriptor`) and/or the capacity of the NIT `sub-table` section (of a maximum size of 1 024 bytes), the descriptor MAY appear several times inside the NIT table.
- The splitting rules as defined in [i.1], clause 4.1.11.2 apply in that case.

#### 4.4.4.2 Special case of satellite cells

Cells corresponding to a satellite transmission are called beams.

Their `cell_id` is taken in the range [0;255] so that  $\text{AND}(\text{cell\_id};0\text{xFF00}) = 0\text{x0000}$ .

The descriptor also lists the locations and the extension of the listed cells. While the location of a satellite cell does not bring any complexity, the extension of an overflow current maximum values:

- `cell_extent_of_latitude` is coded on 12 bits but with steps of  $90 / 2^{15}$ ; maximum value is therefore  $11,25^\circ$ . While `cell_extent_of_latitude` maximum values MAY be suitable for a pan-European satellite ( $\pm 11^\circ$ ), these values fall short for a North American coverage ( $\pm 12^\circ$ ).
- `cell_extent_of_longitude` is coded on 12 bits but with steps of  $180 / 2^{15}$ ; maximum value is therefore  $22,5^\circ$ . While `cell_extent_of_longitude` maximum value MAY be suitable for a pan-European satellite ( $\pm 20^\circ$ ), value for beam covering North America ( $\pm 30^\circ$ ) or Middle East ( $\pm 50^\circ$ ) are much more demanding.

In order to signal values beyond the maximum, it is recommended to use the value '0'. Extension '0' therefore means that cell is of extension greater than the maximum allowable value.

#### 4.4.4.3 Special case of terrestrial cells

Cells corresponding to a terrestrial transmission MUST have a `cell_id` of value greater than 255. Therefore  $\text{AND}(\text{cell\_id};0\text{xFF00})$  must differ from  $0\text{x0000}$ .

### 4.4.5 `cell_frequency_link_descriptor`

#### 4.4.5.1 General requirements

This descriptor lists all the frequencies used in transmission of a multiplex within the DVB network. It gives a complete list of cells and identifies the frequencies that are in use in these cells for the multiplex described.

The following applies:

- It can appear more than once in each iteration for which there is a `SH_delivery_system_descriptor` when the list of cells exceed the capacity of the descriptor (a maximum of 36 links can be listed in a `cell_frequency_list_descriptor`) and/or the capacity of the NIT sub-table section (of a maximum size of 1 024 bytes), or when there are different groups of cells to be attached to different modulation schemes (see clause 4.6.2.1.5).
- The splitting rules as defined in [i.1], clause 4.1.11.2 apply in that case.
- The list of frequencies is complete.

#### 4.4.5.2 Special case of frequency diversity:

When diversity of frequency is used in non-SFN configurations, the following ordering rules apply:

- Satellite cells are listed first, terrestrial cells are listed last.

## 4.5 PSI tables (normative)

### 4.5.1 Program Association Table (PAT)

#### 4.5.1.1 Introduction (informative)

Program Association Table (PAT) provides the correspondence between a `program_number` and the PID value of the Transport Stream packets that carry the DVB service definition. The `program_number` is the numeric label associated with a DVB service. The overall table is contained in one or more sections. It may be segmented to occupy multiple sections.

A DVB network transmits the PAT on every Transport Stream. The PAT contains no descriptors. The program loop within PAT contains information about each DVB service within the actual Transport Stream:

- If the program\_number 0x0000 is announced, the corresponding network\_PID field is set to 0x10.
- The program\_number of each DVB service available within the Transport Stream is announced. The corresponding program\_map\_PID indicates the PID of the PMT sub\_table for the DVB service. A PMT sub\_table is carried within an Elementary Stream with PID value between 0x0020 ... 0x1FFE.
- The PAT table does not contain multiple iterations of the program loop with the same value of the program\_number field (i.e. each program\_number is announced only once).

#### 4.5.1.2 Requirements (normative)

The following requirements apply to all cases:

- PAT is always delivered in the Elementary Stream with the PID 0x0000.
- For bit rate optimisation reasons, all Elementary Streams used to carry IP streams of a particular IP platform SHOULD be carried by a single DVB service unless paTS is used.
- DVB-SH Network SHALL transmit PAT on each Transport Stream of the DVB network. The repetition period of all PAT sections is RECOMMENDED to be SH\_frame\_duration ms or lower.
- If a DVB-SH Receiver is receiving an IP stream, the following applies:
  - Receiver SHALL detect changes in the PAT table (version number field).
  - In connection with receiving a burst, Receiver SHALL check for a new version of the PAT during on-time of the time-sliced Elementary Stream. Receiver MAY ignore PAT filtering during the off-period of the time-sliced Elementary Stream.

The following requirements apply to cases where the TS is of paTS nature at SH service layer:

- The PAT SHALL list all DVB services. This applies to the common DVB service but also to all local DVB services, including those that are not present in the cell.
- The PAT SHALL be present in the common SH service and SHALL not be present in the local SH services.
- A PAT table section shall not span two successive SH services. One PAT table section SHALL end before the end of the current SH service.

The following requirements apply to cases where the TS is of paTS nature at TS layer

- The PAT SHALL list only those DVB services that are actually being sent on the paTS, keeping program\_map PIDs that have been filtered-in, removing those that have been filtered out. The filtered-in program\_numbers as well as the program\_map\_PID SHALL not be modified.

## 4.5.2 Program Map Table (PMT)

### 4.5.1.1 Introduction (informative)

The Program Map Table (PMT) provides mappings between program numbers and the program elements that comprise them. A PMT sub\_table announces the mapping for a single DVB service. Within a Transport Stream, a PMT sub\_table is identified by the program\_number. A PMT sub\_table is also referred to as a "program definition". The PMT is the complete collection of all program definitions (i.e. all PMT sub\_tables) for a Transport Stream.

The program\_number of each DVB program should be unique within the network. The PMT sub\_table for a particular DVB service is transmitted on the same Transport Stream as the referred DVB service, except for the partially available case where (void) PMT sub tables referring local DVB services MAY be found in the global regionalized TS.

Descriptors in the PMT important for use in IPDC DVB-SH Systems are:

- data\_broadcast\_id\_descriptor: For each component containing INT sub\_table(s), this descriptor with data\_broadcast\_id set to 0x000B (IP/MAC Notification Info Structure) is located in the ES\_info loop. Each INT sub\_table within the Elementary Stream is announced.
- stream\_identifier\_descriptor: for each component carrying IP streams, this descriptor is located in the ES\_info loop. The component\_tag announced within the descriptor is unique for each component within the DVB service.

#### 4.5.1.2 Requirements (normative)

The following requirements apply to all cases.

- Generic requirements
  - DVB-SH Receiver SHALL support usage of multiple PMT sub\_tables on a Transport Stream for a single IP platform.
  - DVB-SH Network SHALL transmit all PMT sub-tables on each Transport Stream of the DVB network.
  - The repetition period of all PMT sections is RECOMMENDED to be SH\_frame\_duration or lower.
  - A PMT sub-table SHALL be carried by a unique section of maximum size 1 024 bytes, including header and CRC, where the section\_number field is set to 0.
  - Each PMT sub\_table is delivered in an Elementary Stream on the PID announced in the PAT. Different PMT sub\_tables may be delivered on different Elementary Streams, in which case they are differentiated by the PID. However different PMT sub-tables MAY be delivered on the same Elementary Stream, in which case sub-tables are differentiated by the program\_number.
  - The PCR\_PID field MAY be set to 0x1FFF, indicating that no PCR is associated with the program.
  - DVB-SH Receiver MAY ignore PCR even if available.
- The following descriptor types are important in DVB-SH System and may appear in a PMT sub\_table:
  - stream\_identifier\_descriptor;
  - data\_broadcast\_id\_descriptor.
- DVB-SH Receiver MAY ignore all other descriptors, when present.
- DVB-SH Receiver SHOULD follow changes in PMT sub\_table while accessing components of the DVB service. Id est while receiving an INT sub\_table or an IP stream carried within the components of a DVB service, a Receiver SHOULD also filter for newer versions of the PMT sub\_table of that DVB service.

The following requirements apply to A/V services:

- These requirements apply for components carrying IP stream.
- For each component carrying IP stream(s), the stream\_type SHALL be set to value of 0x90.
- The ES\_info\_loop associated with an Elementary Stream carrying IP stream(s) SHALL contain a stream\_identifier\_descriptor announcing the component\_tag of the Elementary Stream. This component\_tag SHALL be unique within the DVB service. The announced component\_tag SHALL have the same value as in the corresponding data\_broadcast\_descriptor in the SDT (if any).

- If a DVB-SH Receiver is receiving an IP stream, the following applies:
  - The Receiver SHALL detect changes in an INT sub\_table within the same Transport Stream announcing the received IP stream by detecting changes in PMT sub\_table announcing the Elementary Stream where INT sub\_table is carried.
  - In connection with receiving a burst, Receiver SHALL check for a new version of the corresponding PMT sub\_table during on-time of the time-sliced Elementary Stream. Receiver MAY ignore filtering of the particular PMT sub\_table during the off-period of the time-sliced Elementary Stream.

The following requirements apply to notification services:

- These requirements apply for components carrying INT sub-tables.
- In case there is only one IP platform, component(s) carrying INT sub\_table(s) SHOULD be announced as the first component(s) within the PMT sub\_table of the DVB service. In case of several IP platforms, all components ) carrying INT sub\_table(s) MAY be found in the same PMT sub\_table.
- For each component carrying INT sub\_table(s), the stream\_type SHOULD be set to value of 0x05.
- Each INT sub\_table within an Elementary Stream SHALL be announced using a data\_broadcast\_id\_descriptor in the corresponding PMT sub\_table. The descriptor SHALL be located in ES\_info\_loop associated with the component. The descriptor SHALL appear exactly once for each INT sub\_table carried within the Elementary Stream. In the data\_broadcast\_id\_descriptor, the data\_broadcast\_id SHALL be set to value of 0x000B, indicating that the descriptor contains IP/MAC Notification Info Structure (see clause 4.9).

The following requirements apply to cases where the TS is of paTS nature at SH service layer:

- During global "regionalized TS" transmission of the common SH services, all PMT of the "complete TS" are repeated. Those PMT listing local DVB services MUST be void (ES\_info\_length set to '0').
- During local "regionalized TS" transmission of the local SH services, only those PMT of the "complete TS" listing DVB services that are present MUST be present and MUST NOT be void. In case several local SH services are present, each PMT MUST be located in the SH service carrying the DVB service signalled by this PMT.
- The PMT sub-tables corresponding to the different DVB local services SHOULD be transmitted on the same Elementary Stream with the same PID. Section packing SHALL be used to lower transmission overhead, especially when a high number of local services is present.
- A PMT sub-table section SHALL not span two successive SH services: one PMT sub-table section SHALL end before the end of the current SH service.

The following requirements apply to cases where the TS is of paTS nature at TS layer:

- During global "regionalized TS" transmission, only the PMT of the common DVB services are transmitted. Those PMT listing local DVB services MUST not be present.
- During local "regionalized TS" transmission, only the PMT of the common and those local DVB services actually present are transmitted. Those PMT listing local DVB services not present MUST not be transmitted.

### 4.5.3 Conditional Access Table (CAT)

Same content as [8], clauses 5.4.3 and 4.4.3.

### 4.5.4 Transport Stream Description Table (TSDDT)

Same content as [8], clauses 5.4.4 and 4.4.4.



## 4.6 SI Tables (normative)

### 4.6.1 Bit rates and repetition intervals

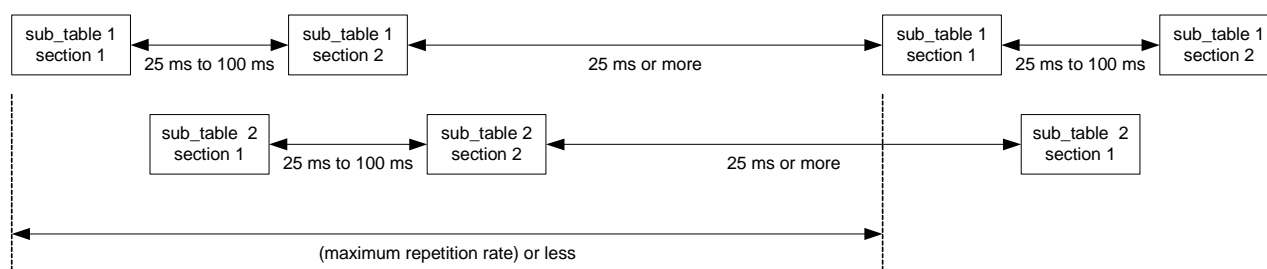
#### 4.6.1.1 SH modes excluding diversity at SH service level

In all SH modes excluding diversity at SH service level, the following applies to all SI tables transmitted over the TS exiting the IP encapsulator:

- The time between transmitting sequential sections of a sub\_table SHOULD NOT exceed 100 ms, and the time between the last byte of the preceding section and the first byte of the next section SHALL not be less than 25 ms.
- The bandwidth used by an Elementary Stream transmitting sections of any sub\_table SHOULD NOT exceed 1 Mbps calculated over any period of half a second.

TS 102 470-1 [8] illustrates the requirements for times between sections of a sub\_table. The maximum time of 100 ms is between sequential sections of a sub\_table. The minimum time of 25 ms is between the last section of a sub\_table to the first section of the next occurrence of the sub\_table. The maximum repetition rate of a table defines the maximum time within which all sections of every sub\_table of the table shall be transmitted once.

Note that different sub\_tables of a particular table may be transmitted simultaneously.



**Figure 14: Times between sections of sub\_tables (general case)**

#### 4.6.1.2 SH modes supporting diversity at SH service level

In modes supporting diversity at SH service level, these rules at the output of the IP encapsulator are modified as follows:

- In the common DVB service, the preceding rules MUST be respected with the corresponding global "regionalized TS" bit rate and during the common service duration.
- In the local DVB services, the rules MUST be respected for each service with the corresponding local "regionalized TS" bitrate and during the local service duration.
- The stretch factor being defined as the ratio between the local and the global "regionalized TS" bitrates ( $\text{stretch\_factor} \geq 1$ ), due to the repetition of the common service on the local network:
  - The repetition intervals within the common service will be higher and the 25 ms time between two succeeding sections of the same sub table must not be lower than  $\text{stretch\_factor} * 25$ .
  - The bandwidth used by an Elementary Stream transmitting sections of any sub\_table calculated over any period of half a second will be higher.

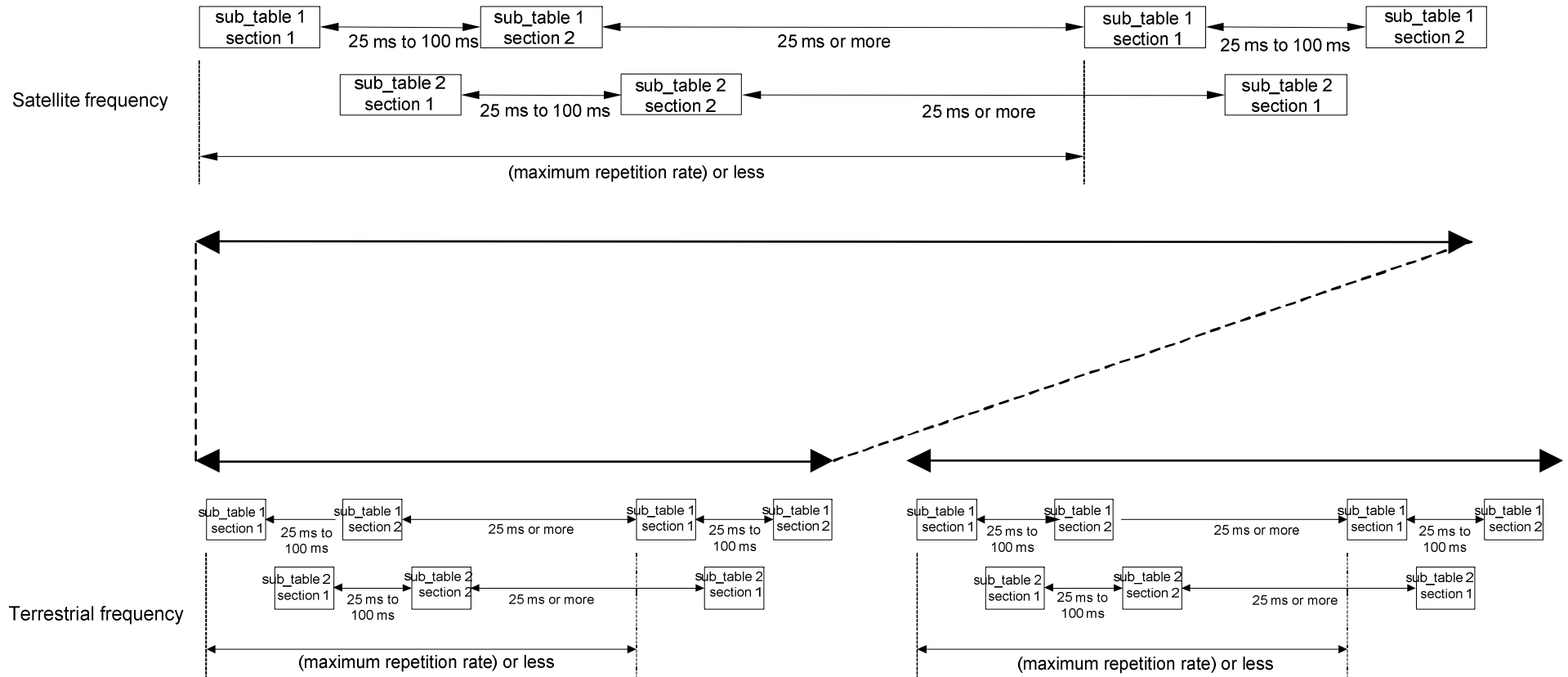


Figure 15: Times between sections of sub\_tables (code diversity case)

Therefore the rules are the following in case diversity at SH service level is used:

- The time between transmitting sequential sections of a sub\_table SHOULD NOT exceed 100 ms as computed with a bit rate equal to the global "regionalized TS" one for the common service and the local "regionalized TS" one for the local service.
- In the common service, the time between the last byte of the preceding section and the first byte of the next section SHALL not be less than 25 ms multiplied by the stretch\_factor and as computed with a bit rate equal to the global "regionalized TS" one.
- In the local service, the time between the last byte of the preceding section and the first byte of the next section SHALL not be less than 25 ms as computed with a bit rate equal to the local one.
- In the common service, the bandwidth used by an Elementary Stream transmitting sections of any sub\_table SHOULD NOT exceed 1 Mbps / stretch\_factor calculated over any period of half a second with the global bit rate.
- In the local service, the bandwidth used by an Elementary Stream transmitting sections of any sub\_table SHOULD NOT exceed 1 Mbps calculated over any period of half a second and with the local "regionalized TS" bit rate.

## 4.6.2 Network Information Table (NIT)

### 4.6.2.1 NIT\_actual

#### 4.6.2.1.1 Introduction (informative)

In general clause 4.5.1 of [8] applies unless contradicted by the requirements below.

#### 4.6.2.1.2 Generalities

A DVB-SH Network SHALL transmit the NIT\_actual on each Transport Stream of the DVB network. The NIT\_actual SHALL contain exactly one SH\_delivery\_system\_descriptor for each of Transport Streams of the actual delivery system and provide valid information about the Transport Stream.

A cell MAY contain multiple Transport Streams where IP streams are carried over DVB-SH sent on different frequencies. When hierarchical modulation is used, there MAY be up to two TS sent in the same frequency AND cell.

The following descriptors are important in DVB-SH System and SHALL appear in a NIT\_actual sub\_table:

- network\_name\_descriptor;
- linkage\_descriptor with a linkage type of 0x0B or 0x0C;
- SH\_delivery\_system\_descriptor;
- cell\_list\_descriptor;
- cell\_frequency\_link\_descriptor.

The following descriptor MAY appear in a NIT\_actual sub\_table:

- time\_slice\_fec\_identifier\_descriptor.

DVB-SH Receiver MAY ignore other descriptors, when present.

DVB-SH Receiver MAY assume the content of NIT\_actual being static (i.e. not changing) during the time it is attached to a DVB network. Therefore a receiver may read the content of NIT\_actual only when it attaches to the DVB network. A DVB-SH Receiver SHOULD read the content of NIT\_actual every time it is attaching a DVB network (either when powered on, or when changing from a DVB network to another). The NIT does not depend on the location of the receiver and is the same under satellite and terrestrial coverage.

Due to the potentially large size of a NIT, it MAY be possible that the NIT exceeds the admissible size of a sub-table. In that case, the segmentation rules found in [i.1], clause 4.1.11.2 apply.

#### 4.6.2.1.3 Linkage descriptors

The following applies to each Transport Stream carrying one or more INT sub\_tables:

- The NIT\_actual SHALL contain at least one linkage\_descriptor with a linkage\_type of 0x0B or 0x0C.
- If the NIT\_actual carries linkage\_descriptor(s) with a linkage\_type of 0x0B, the following applies:
  - The descriptor(s) SHALL announce each DVB service carrying INT sub\_table(s) within the actual DVB network.
  - Each of the descriptor(s) SHALL carry exactly one IP/MAC Notification Service Structure announcing one or more IP/MAC Notification Services.
  - The list of IP/MAC Notification Services announced SHALL be complete. The list is complete if all INT sub\_tables within the DVB network are referred to by at least one linkage\_descriptor with a linkage\_type of 0x0B.

The following applies to each Transport Stream not carrying any IP flows:

The Transport Stream SHOULD carry a linkage\_descriptor with a linkage\_type of 0x0C within its NIT\_actual, announcing at least one NIT\_actual within the DVB network containing a linkage\_descriptor with a linkage\_type of 0x0B.

#### 4.6.2.1.4 Network\_name\_descriptors

The following applies to the network\_name\_descriptor:

The descriptor SHALL appear exactly once in the first descriptor loop. The descriptor SHOULD contain the name of the DVB network (i.e. SHOULD NOT contain an empty string).

#### 4.6.2.1.5 SH\_delivery\_system\_descriptor, cell\_list\_descriptor, cell\_frequency\_link\_descriptor

The following applies to the SH\_delivery\_system\_descriptor:

- The descriptor SHALL appear at most once in each iteration of the transport\_stream\_loop (i.e. for each announced Transport Stream). Traditionally the descriptor is assumed to appear once in each iteration. However when several iterations make use of exactly the same descriptor, it can be omitted in replacement of the latest previously listed.
- There is no frequency given in the SH\_delivery\_system\_descriptor, these are signalled by the cell\_frequency\_link\_descriptor.

The following applies to the cell\_list\_descriptor:

- The descriptor SHALL be present in the first descriptor loop.
- The descriptor MAY appear more than once within the descriptor loop.
- Descriptor syntax MUST follow rules defined in clause 4.4.4, in particular:
  - The cell and subcell list SHALL be complete.
  - Cell\_id range depends on cell type (satellite, terrestrial).

The following applies to the cell\_frequency\_link\_descriptor:

- This descriptor SHALL appear in the transport\_stream\_loop to list all the frequencies where the Transport Stream is available within the DVB network.

- Descriptor syntax SHALL follow rules defined in clause 4.4.5, in particular:
  - The list of announced frequencies SHALL be complete.
  - Cell list order depends on cell type (satellite, terrestrial).

The way SH\_delivery\_system\_descriptor, cell\_list\_descriptor and cell\_frequency\_link\_descriptor and combined is the following:

- Inside the main loop, the cell\_list\_descriptor describes all cells present in the network, their cell\_id and latitude/longitude extension MUST follow the specific syntax given in clause 4.4.4.
- For each TS in the TS loop, one SH\_delivery\_system\_descriptor is given that follows the syntax of clause 4.4.1 and gives as many modulation loop as needed.
- For each TS in the TS loop, one (logical-wise since actually several descriptors MAY be used depending on the size of the list and the topology of the groups) cell\_frequency\_link\_descriptor follows that specifies on which cells and what frequencies the TS is being repeated. The cells are grouped in two categories depending on their cell\_id, the satellite and the terrestrial.
- Cells belonging to different categories (satellite and terrestrial) MAY be found in the same descriptor provided that the order (satellite first, terrestrial second) is respected, but this is not mandatory. A different descriptor MAY be used to list the terrestrial cells.
- Inside each category, the following rules apply individually:
  - If there are as many cell entries in the cell\_frequency\_link\_descriptor as there are modulation entries in the SH\_delivery\_system\_descriptor, then the modulation entries are one to one allocated to the different cells: first modulation entry to first cell, second modulation entry to second cell, etc.
  - If there are more than one entry in the cell\_frequency\_link\_descriptor but only one modulation entry in the SH\_delivery\_system\_descriptor, then this unique modulation entry MUST be allocated to all cells listed in the cell\_frequency\_link\_descriptor.

EXAMPLE: We assume in table 3 a SH-B system where a unique TS is being distributed over a unique satellite cell and 10 local cells.

Table 3: Example of SH-B NIT (1 TS, 1 satellite cell, 10 terrestrial cells)

Syntax	Nof bits	elements	Multi
network_information_section(){			
table_id	8	1	8
section_syntax_indicator	1	1	1
reserved_for_future_use	1	1	1
reserved	2	1	2
section_length	12	1	12
network_id	16	1	16
reserved	2	1	2
version_number	5	1	5
current_next_indicator	1	1	1
section_number	8	1	8
last_section_number	8	1	8
reserved_for_future_use	4	1	4
<b>network_descriptor_length</b>	12	1	12
network_name_descriptor	96	1	96
cell_list_descriptor	816	1	816
linkage_descriptor	72	1	72
reserved_for_future_use	4	1	4
<b>transport_stream_loop_length</b>	12	1	12
transport_stream_id	16	1	16
original_network_id	16	1	16
reserved_for_future_use	4	1	4
transport_descriptors_length	12	1	12
SH_system_delivery_descriptor	96	1	96
cell_frequency_link_descriptor	552	1	552
CRC32	32	1	32
}			

} satellite TS loop

cell_list_descriptor			
descriptor_tag		8	
descriptor_length		8	
All_cells		792	
cell_id	16		
cell_latitude	16		
cell_longitude	16		
cell_extent_of_latitude	12		
cell_extent_of_longitude	12		
subcell_info_loop_length		8	
		816	

} 1 sat + 10 ter cells

} unitary size  
72 bytes

cell_frequency_link_descriptor			
descriptor_tag		8	
descriptor_length		8	
All_cells		528	
cell_id	16		
frequency	32		
subcell_info_loop_length		8	
		552	

} 1 sat + 10 ter cells

} unitary size  
48 bytes

NOTE 1: It can be seen that the number of listed satellite and terrestrial cells in the cell\_list\_descriptor is 1 and 10 respectively. In the TS loop, there is only one TS being listed, the satellite one. The SH\_delivery\_system\_descriptor has 2 entries, 1 for TDM and 1 for OFDM whereas the cell\_frequency\_link\_descriptor lists 11 entries, the first being the satellite cell (cell\_id < 256) and the others being terrestrial cells (cell\_id > 255). Therefore the unique satellite cell is related to the unique satellite TDM modulation entry whereas the terrestrial cells are all related to the also unique OFDM modulation entry.

- If there are larger entries in the cell\_frequency\_link\_descriptor than in the SH\_delivery\_system\_descriptor and there are several modulation entries, then each modulation entry MUST be allocated to a distinct group of cells according to the following rules:
  - Each modulation entry corresponds to a group of cells. Therefore there are as many groups of cells as there are modulation entries.
  - Cells (and their corresponding frequencies) belonging to a group of cell (and for which a specific modulation entry apply) are listed by a cell\_frequency\_link\_descriptor or a set of consecutive cell\_frequency\_link\_descriptors when the size of one descriptor reaches the capacity of an individual descriptor and/or the capacity of an individual NIT sub-table. In the latter cases plitting rules described in [i.1], clause 4.1.11.2 apply.
  - When the list of {cells; frequencies} belonging to this group is complete and a new group has to be listed, a void cell\_frequency\_link\_descriptor MUST be inserted between the two groups to delineate the separation between two consecutive groups and avoid ambiguity about which modulation entry MUST be used.

EXAMPLE: We assume in table 4 a SH-A system where a unique TS is being distributed over a unique satellite cell and two groups made of 10 cells each. The two groups have different modulation parameters differing only by the used FFT.

Table 4: Example of SH-B with two groups of terrestrial cells having different FFT

Syntax	Nof bits	elements	Multi
network_information_section()			
table_id	8	1	8
section_syntax_indicator	1	1	1
reserved_for_future_use	1	1	1
reserved	2	1	2
section_length	12	1	12
network_id	16	1	16
reserved	2	1	2
version_number	5	1	5
current_next_indicator	1	1	1
section_number	8	1	8
last_section_number	8	1	8
reserved_for_future_use	4	1	4
network_descriptor_length	12	1	12
network_name_descriptor	96	1	96
cell_list_descriptor part 1	16	0	0
cell_list_descriptor part 2	896	1	896
linkage_descriptor	72	2	144
reserved_for_future_use	4	1	4
transport_stream_loop_length	12	1	12
transport_stream_id	16	1	16
original_network_id	16	1	16
reserved_for_future_use	4	1	4
transport_descriptors_length	12	1	12
SH_system_delivery_descriptor	120	1	120
cell_frequency_link_descriptor	680	1	680
CRC32	32	1	32

Syntax	Nof bits	elements
SH_delivery_system_descriptor()		
descriptor_tag	8	1
descriptor_extension_tag	8	1
descriptor_length	8	1
diversity_mode	4	1
reserved	4	1
tdm_modulation_descriptor	24	1
interleaver_descriptor_complete	32	0
ofdm_modulation_descriptor	24	2
interleaver_descriptor_partial	8	2

$$72 + 2 * 296 + 16 = 680$$

1 X:	<table border="1"> <tr><td>cell_frequency_link_descriptor_satellite</td><td></td><td></td><td></td></tr> <tr><td>descriptor_tag</td><td></td><td>8</td><td></td></tr> <tr><td>descriptor_length</td><td></td><td>8</td><td></td></tr> <tr><td>All_cells</td><td></td><td></td><td>56</td></tr> <tr><td>cell_id</td><td>16</td><td></td><td></td></tr> <tr><td>frequency</td><td>32</td><td></td><td></td></tr> <tr><td>subcell_info_loop_length</td><td>8</td><td></td><td></td></tr> <tr><td></td><td></td><td></td><td>72</td></tr> </table>	cell_frequency_link_descriptor_satellite				descriptor_tag		8		descriptor_length		8		All_cells			56	cell_id	16			frequency	32			subcell_info_loop_length	8						72	TDM links
cell_frequency_link_descriptor_satellite																																		
descriptor_tag		8																																
descriptor_length		8																																
All_cells			56																															
cell_id	16																																	
frequency	32																																	
subcell_info_loop_length	8																																	
			72																															
2 X:	<table border="1"> <tr><td>cell_frequency_link_descriptor_terrestrial</td><td></td><td></td><td></td></tr> <tr><td>descriptor_tag</td><td></td><td>8</td><td></td></tr> <tr><td>descriptor_length</td><td></td><td>8</td><td></td></tr> <tr><td>All_cells</td><td></td><td></td><td>280</td></tr> <tr><td>cell_id</td><td>16</td><td></td><td></td></tr> <tr><td>frequency</td><td>32</td><td></td><td></td></tr> <tr><td>subcell_info_loop_length</td><td>8</td><td></td><td></td></tr> <tr><td></td><td></td><td></td><td>296</td></tr> </table>	cell_frequency_link_descriptor_terrestrial				descriptor_tag		8		descriptor_length		8		All_cells			280	cell_id	16			frequency	32			subcell_info_loop_length	8						296	OFDM links
cell_frequency_link_descriptor_terrestrial																																		
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descriptor_length		8																																
All_cells			280																															
cell_id	16																																	
frequency	32																																	
subcell_info_loop_length	8																																	
			296																															
1 X:	<table border="1"> <tr><td>cell_frequency_link_descriptor_terrestrial</td><td></td><td></td><td></td></tr> <tr><td>descriptor_tag</td><td></td><td>8</td><td></td></tr> <tr><td>descriptor_length</td><td></td><td>8</td><td></td></tr> <tr><td>All_cells</td><td></td><td></td><td>0</td></tr> <tr><td>cell_id</td><td>16</td><td></td><td></td></tr> <tr><td>frequency</td><td>32</td><td></td><td></td></tr> <tr><td>subcell_info_loop_length</td><td>8</td><td></td><td></td></tr> <tr><td></td><td></td><td></td><td>16</td></tr> </table>	cell_frequency_link_descriptor_terrestrial				descriptor_tag		8		descriptor_length		8		All_cells			0	cell_id	16			frequency	32			subcell_info_loop_length	8						16	Transition between 2 OFDM groups
cell_frequency_link_descriptor_terrestrial																																		
descriptor_tag		8																																
descriptor_length		8																																
All_cells			0																															
cell_id	16																																	
frequency	32																																	
subcell_info_loop_length	8																																	
			16																															

NOTE 2: It can be seen that the number of listed satellite and terrestrial cells in the cell\_list\_descriptor is 1 and 10 respectively. In the TS loop, there is only one TS being listed, the satellite one. The SH\_delivery\_system\_descriptor has 3 entries, 1 for TDM and 2 for OFDM (one with FFT 1, the other with FFT 2) whereas the cell\_frequency\_link\_descriptor lists 11 entries in 3 separate descriptors: the first descriptor list the unique satellite cell and frequency (cell\_id < 256), the second list the 5 cells and frequencies using the first OFDM modulation and the last list the 5 cells and frequencies related to the second OFDM modulation.

NOTE 3: It would have been possible to list the satellite and the first 5 cells of the first group in the same cell\_frequency\_link\_descriptor since their cell\_id can identify them unambiguously. For clarity purpose we have separated them in 2 descriptors in the example given.

#### 4.6.2.1.6 time\_slice\_fec\_identifier\_descriptor

The following applies to the time\_slice\_fec\_identifier\_descriptor:

- When located in the first descriptor loop, the descriptor applies to all elementary streams with stream\_type 0x90 within all transport streams announced within the sub-table.
- When located in the second descriptor loop, the descriptor applies to all elementary streams with stream\_type 0x90 within the specific transport stream. This descriptor overwrites any descriptors in the first descriptor loop.



## 4.6.2.2 NIT\_other

### 4.6.2.2.1 Specific requirements

A DVB-SH Network MAY transmit NIT\_other on one or more Transport Streams of the DVB network. NIT\_other has to be valid and only announce an existing network. In case other network is delivered using SH modulation, NIT\_other SHALL contain exactly one SH\_delivery\_system\_descriptor for each of the Transport Streams of the actual delivery system and provide valid information about the Transport Stream. Otherwise, NIT\_other follows specification of [8], clause 5.5.1.2

### 4.6.2.2.2 Generic requirements

Other requirements applicable for NIT\_actual are also application for NIT\_other.

## 4.6.3 Bouquet Association Table (BAT)

Same as [8], clauses 5.5.2 and 4.5.2.

## 4.6.4 Service Description Table (SDT)

### 4.6.4.1 Introduction

In DVB-SH networks with paTS, different types of SDT tables can be used, contrarily to DVB-H networks where only SDT\_actual are used:

- SDT\_actual (table\_id = 0x42) describes the services present in actual TS.
- SDT\_other (table\_id = 0x46) describes the services present in other TS, be they in the current or other networks.

The two types of table are defined in [1], clause 5.2.3.

### 4.6.4.2 SDT\_actual

A DVB-SH Network SHALL transmit SDT\_actual sub\_table (table\_id 0x42) for the actual Transport Stream. All transmitted sections of the SDT\_actual for the actual multiplex SHALL be transmitted at least every 2 s.

The services\_loop of the SDT\_actual sub-table SHALL contain information about all DVB services composing the Transport Stream (id-est before filtering when this is a paTS). Each DVB service SHOULD NOT be announced more than once within an SDT\_actual sub\_table.

In a DVB-SH System, the following descriptor types SHALL appear in the SDT\_actual of a Transport Stream where one or more MPE section streams are available:

- service\_descriptor;
- data\_broadcast\_descriptor.

In a DVB-SH System, the following descriptor types MAY appear in the SDT-actual of a Transport Stream where one or more MPE section streams are available:

- service\_availability\_descriptor.

DVB-SH Receiver MAY ignore other descriptors, when present.

The following applies to the SDT\_actual when announcing a DVB service carrying INT sub\_table or IP streams:

- The EIT\_schedule\_flag SHOULD be set to value of 0x00, indicating that the EIT schedule information for the DVB service is not present in the Transport Stream. DVB-SH Receiver MAY ignore schedule information if present.
- DVB-SH Receiver MAY ignore present/following information if present.

- The `running_status` SHOULD be set to value of 0x04, indicating that the DVB service is currently running.
- The following applies to the `service_descriptor`:
  - The descriptor SHALL be present.
  - DVB-SH Receiver SHALL NOT assume any particular value for the `service_type`.
  - The `service_provider_name` MAY contain the service provider name. DVB-SH Receiver MAY ignore service provider name.
  - The `service_name` MAY contain the DVB service name. DVB-SH Receiver MAY ignore service name.
- The following applies to the `data_broadcast_descriptor`:
  - The descriptor SHALL be present for each component carrying one or more MPE section streams within the DVB service.
  - It MAY occur more than once. DVB-SH Receiver MAY ignore them all but one, for which the following applies:
    - The `data_broadcast_id` field SHALL be set to value 0x0005.
    - The `component_tag` field SHALL be set to the value of the component announced within the PMT sub\_table of the DVB service.
    - The descriptor SHALL contain Multiprotocol Encapsulation Info Structure. For the structure, the following applies:
      - `MAC_address_range` SHALL be set to value of 0x01, indicating that only `MAC_address_6` in the header of MPE sections carried within the referred component contains valid MAC-address information;
      - `MAC_IP_mapping_flag` SHOULD be set to '1', indicating that it uses the IP to MAC mapping as described in RFC 1112 [3] for IPv4 multicast addresses, and RFC 2464 [4] for IPv6 multicast addresses;
      - `alignment_indicator` SHALL be set to '0', indicating that alignment of 8 bits is used;
      - `max_sections_per_datagram` SHALL be set to value of 0x01, indicating that each IP datagram is carried in exactly one MPE section.
    - DVB-SH Receiver MAY ignore the text description of the data component, if present.
- The following applies to the `service_availability_descriptor`:
  - The inclusion as well as the generation of this descriptor SHALL follow clause 5.3.3 of the present document.

Note that a DVB-SH Receiver does not use MAC address for filtering MPE section streams.

A DVB-SH Receiver SHALL NOT ignore `SDT_actual`, when it describes a paTS as signalled by `SH_delivery_system_descriptor`, as it may signal some restrictions on the service availability of the described Transport Stream.

#### 4.6.4.3 SDT\_other

A DVB-SH Network SHALL transmit `SDT_other` sub\_table (table\_id 0x46) for each non-actual Transport Stream fulfilling the three following conditions:

- The Transport Stream is a paTS as announced by `SH_delivery_system_descriptor` *diversity\_mode*.
- The Transport Stream is a neighbouring Transport Stream, i.e. transmitted in geographically co-located, adjacent or intersecting cells, whether belonging to the actual and/or other network(s).
- The Transport Stream is actually filtered in one of the neighbouring cells.

All transmitted sections of the SDT\_other for the actual multiplex SHALL be transmitted at least every 10 s.

Remaining requirements are similar to SDT\_actual and recalled for memory.

The services\_loop of the SDT\_other sub-table SHALL contain information about all DVB services composing the Transport Stream (id-est before filtering when this is a paTS). Each DVB service SHOULD NOT be announced more than once within an SDT\_other sub\_table.

In a DVB-SH System, the following descriptor types SHALL appear in the SDT\_other of a Transport Stream where one or more MPE section streams are available:

- service\_descriptor;
- data\_broadcast\_descriptor.

In a DVB-SH System, the following descriptor types MAY appear in the SDT\_other of a Transport Stream where one or more MPE section streams are available:

- service\_availability\_descriptor.

DVB-SH Receiver MAY ignore other descriptors, when present.

The following applies to the SDT\_other when announcing a DVB service carrying INT sub\_table or IP streams:

- The EIT\_schedule\_flag SHOULD be set to value of 0x00, indicating that the EIT schedule information for the DVB service is not present in the Transport Stream. DVB-SH Receiver MAY ignore schedule information if present.
- DVB-SH Receiver MAY ignore present/following information if present.
- The running\_status SHOULD be set to value of 0x04, indicating that the DVB service is currently running.
- The following applies to the service\_descriptor:
  - The descriptor SHALL be present.
  - DVB-SH Receiver SHALL NOT assume any particular value for the service\_type.
  - The service\_provider\_name MAY contain the service provider name. DVB-SH Receiver MAY ignore service provider name.
  - The service\_name MAY contain the DVB service name. DVB-SH Receiver MAY ignore service name.
- The following applies to the data\_broadcast\_descriptor:
  - The descriptor SHALL be present for each component carrying one or more MPE section streams within the DVB service.
  - It MAY occur more than once. DVB-SH Receiver MAY ignore them all but one, for which the following applies:
    - The data\_broadcast\_id field SHALL be set to value 0x0005.
    - The component\_tag field SHALL be set to the value of the component announced within the PMT sub\_table of the DVB service of the other TS.

- The descriptor SHALL contain Multiprotocol Encapsulation Info Structure. For the structure, the following applies:
  - MAC\_address\_range SHALL be set to value of 0x01, indicating that only MAC\_address\_6 in the header of MPE sections carried within the referred component contains valid MAC-address information;
  - MAC\_IP\_mapping\_flag SHOULD be set to '1', indicating that it uses the IP to MAC mapping as described in RFC 1112 [3] for IPv4 multicast addresses, and RFC 2464 [4] for IPv6 multicast addresses;
  - alignment\_indicator SHALL be set to '0', indicating that alignment of 8 bits is used;
  - max\_sections\_per\_datagram SHALL be set to value of 0x01, indicating that each IP datagram is carried in exactly one MPE section.
- DVB-SH Receiver MAY ignore the text description of the data component, if present.

The following applies to the service\_availability\_descriptor:

- The inclusion as well as the generation of this descriptor SHALL follow clause 5.3.3 of the present document.

Note that a DVB-SH Receiver does not use MAC address for filtering MPE section streams.

A DVB-SH Receiver SHALL NOT ignore SDT\_other, when it describes a paTS as signalled by SH\_delivery\_system\_descriptor, as it may signal some restrictions on the service availability of the described Transport Stream.

#### 4.6.4.4 Determining service availability

##### 4.6.4.4.1 Service availability of the actual TS on the current cell

This clause specifies how an IPDC DVB-SH Receiver can determine the service availability of the actual Transport Stream on the current cell.

In this procedure, the following prerequisites are known to the IPDC DVB-SH Receiver:

- Identity of the actual Transport Stream (original\_network\_id, transport\_stream\_id).
- If one service only is of interest, identity of the service (service\_id).
- Identity of the current cell (cell\_id).

The IPDC DVB-SH Receiver SHOULD conclude to the availability of all the services of the actual Transport Stream on the current cell:

- if the delivery\_system\_descriptor given for the Transport Stream implicitly or explicitly declares to not support or apply service filtering; or else
- if the SDT\_actual sub\_table is (unexpectedly) not found.

Otherwise, the IPDC DVB-SH Receiver SHOULD determine the availability of [one specific service | each service] of the actual transport Stream as follows: for [the service entry | for each service entry] in the services\_loop of SDT\_actual sub\_table, the service is available on current cell:

- if the service\_availability\_descriptor is absent; or else
- if the availability\_flag is unset and actual\_cell\_id is not listed in the descriptor; or else
- if the availability\_flag is set and actual\_cell\_id is listed in the descriptor;
- otherwise the service is not available on the current cell.

#### 4.6.4.4.2 Service availability of a TS on the cells of a given network

This clause specifies how an IPDC DVB-SH Receiver can determine the service availability of a Transport Stream in a given network. More specifically the purpose of this procedure is to determine, within the cells listed by the `cell_frequency_link_descriptor` given for the Transport Stream in this network, on which cell(s) each service is actually available.

In this procedure, the following prerequisites are known to the IPDC DVB-SH Receiver:

- Identity of the Transport Stream (`original_network_id`, `transport_stream_id`).
- If one service only is of interest, identity of the service (`service_id`).
- Identity of the network (`network_id`).

The IPDC DVB-SH Receiver performs the following initialization steps (should one of these steps fails, the procedure is aborted):

- If not already done, retrieve the NIT sub\_table identified by `network_id`.
- If not already done, check the presence of the Transport Stream in the TS loop of the NIT sub\_table.
- Retrieve the `cell_frequency_link_descriptor` as well as the `delivery_system_descriptor` given for the Transport Stream in the TS loop iteration.

The IPDC DVB-SH Receiver SHOULD conclude to the availability of all the services of the Transport Stream on all the cells listed by the `cell_frequency_link_descriptor`:

- if the `delivery_system_descriptor` implicitly or explicitly declares to not support or apply service filtering, or else;
- if the SDT (actual or other) sub\_table associated to this Transport Stream is not found.

Otherwise, the IPDC DVB-SH Receiver SHOULD determine the availability of [one specific service | each service] of the actual transport Stream as follows: for [the service entry | for each service entry] in the `services_loop` of SDT sub\_table :

- if the `service_availability_descriptor` is absent, the service is available on all the cells listed by the `cell_frequency_link_descriptor`, or else;
- if the `availability_flag` is unset, the service is only available on the cells of the `cell_frequency_link_descriptor` which are not listed in the `service_availability_descriptor`, or else;
- if the `availability_flag` is set, the service is only available on the cells listed by the `cell_frequency_link_descriptor` which are besides listed in the `service_availability_descriptor`.

#### 4.6.5 Event Information Table (EIT)

Same as clauses 5.5.4 and 4.5.4 in [8].

#### 4.6.6 Running Status Table (RST)

Same as clauses 5.5.5 and 4.5.5 in [8].

#### 4.6.7 Time and Date Table (TDT)

Same as clauses 5.5.6 and 4.5.6 in [8].

#### 4.6.8 Time Offset Table (TOT)

Same as clauses 5.5.7 and 4.5.7 in [8].

## 4.6.9 Stuffing Table (ST)

Same as clauses 5.5.8 and 4.5.8 in [8].

## 4.6.10 IP/MAC Notification Table (INT)

This clause gives precisions on the way INT MUST be used in a DVB-SH context. It is divided into two parts: the first is valid for all SH configurations whereas the second specific to cases when the TS is partially available.

### 4.6.10.1 Common specifications

#### 4.6.10.1.0 Introduction

This clause is applicable to all SH configurations.

#### 4.6.10.1.1 Generalities

An IP platform MAY have IP streams on multiple Transport Streams within a DVB network. An IP platform MAY have IP streams on multiple DVB networks.

Two Transport Streams carrying IP streams of a particular IP platform MAY carry the same, partially different, or entirely different set of IP flows of the IP platform.

Two IP flows carried on a single Elementary Stream on a particular Transport Stream MAY be carried on different Elementary Streams on another Transport Streams as well.

If one or more IP streams of an IP platform are carried within a Transport Stream, the Transport Stream SHALL carry the INT sub\_table describing the IP platform.

An IP stream MAY be announced on INT sub\_tables of two or more IP platforms (i.e. one IP stream MAY belong to multiple IP platforms).

The INT sub\_table of a particular IP platform SHALL NOT be carried in multiple Elementary Streams (i.e. only one copy allowed) on a particular Transport Stream.

DVB-SH network MAY use IPv4 and/or IPv6. Within one IP platform, and therefore INT, only one IP version SHOULD be used.

The INT is referenced by a data\_broadcast\_id\_descriptor with a data broadcast id of 0x000B, in the ES\_info loop of the PMT (see clause 4.9 for more information on ways to signal the INT).

An INT table may consist of one or more INT sub\_tables. INT sub\_tables are differentiated by platform\_id and action\_type:

- The platform\_id is used to identify the IP platform. Within the actual transport stream, a DVB-SH Network SHALL transmit one INT sub\_table for each IP platform delivering IP streams within the Transport Stream. It is generally recommended to use one IP platform per service provider.
- The action\_type indicates the action to be performed. Currently the only action type supported is 0x01, which means that location of IP streams in DVB networks is announced. The processing\_order field of an INT sub\_table with action\_type 0x01 SHALL be set to value of 0xFF or 0x00, indicating that no ordering is implied.

All transmitted sections of the INT SHALL be transmitted at least once in every 30 s.

The INT is structured in two loops inside which different descriptors are used:

- the platform\_descriptor\_loop;
- the target and operational descriptor loops.

INT sub\_table SHALL announce each IP stream of the IP platform available on the actual Transport Stream (i.e. target-loop SHALL contain a descriptor announcing the IP address of the corresponding IP flow, and the corresponding operational-loop SHALL contain a descriptor announcing the location of the IP stream within the actual Transport Stream).

INT sub\_table SHOULD announce each IP stream of the IP platform available on the neighbouring Transport Streams. Neighbouring Transport Streams are Transport Streams, which are transmitted in geographically co-located, adjacent or intersecting cells. In the specific case of a satellite cell (called a beam, cell\_id < 255) the cell is neighbour of all terrestrial cells within the coverage of the satellite cell. Although the number of IP streams MAY be quite large, in particular if there are local TS transmitted in the terrestrial cells, a different platform\_id for signalling IP streams available only on the local TS SHALL be avoided.

#### 4.6.10.1.2 Platform\_descriptor\_loop

The following descriptors MAY appear in platform\_descriptor\_loop:

- IP/MAC\_platform\_name\_descriptor: Platform\_loop MAY contain this descriptor, containing the name of the IP platform in one or more languages. The descriptor MAY occur more than once. Each occurrence of the platform\_name SHOULD be identical with the platform\_name announced using the same language code in NIT containing IP/MAC Notification Service Structure.
- time\_slice\_fec\_identifier\_descriptor: If this descriptor is present in platform\_loop, it indicates that all Elementary Streams referred within this INT sub\_table are time-sliced with parameters announced in this descriptor.

DVB-SH Receiver MAY ignore all other descriptors in platform-loop.

#### 4.6.10.1.3 Target\_descriptor\_loop

Following descriptors MAY appear in target-loop:

- target\_IP\_address\_descriptor;
- target\_IP\_slash\_descriptor;
- target\_IP\_source\_slash\_descriptor;
- target\_IPv6\_address\_descriptor;
- target\_IPv6\_slash\_descriptor;
- target\_IPv6\_source\_slash\_descriptor.

Each iteration of 2<sup>nd</sup> loop of INT table SHALL contain at least one of the above listed target-descriptors in target-loop.

Descriptor\_length field of any descriptor in this loop SHALL NOT be set to "0" (i.e. the descriptor SHALL signal at least one IP flow).

An IP flow SHALL NOT be announced in more than one iteration of 2<sup>nd</sup> loop of INT table.

IP streams carried within an Elementary Stream SHALL use the same version of IP protocol. I.e. mixing IPv4 and IPv6 datagrams within a single Elementary Stream is not allowed.

Following applies to each target\_IP\_address\_descriptor within the 2<sup>nd</sup> loop of INT table:

- The use of target\_IP\_slash\_descriptor or target\_IP\_source\_slash\_descriptor instead is RECOMMENDED.
- Note that this descriptor can contain maximum of 62 IPv4\_addr fields.
- IPv4\_addr\_mask field indicates the bits significant in each IP address announced in the following IPv4\_addr fields within the descriptor.
- This descriptor refers to every IP flow with any source address and any of the announced destination address.

Following applies to each target\_IP\_slash\_descriptor within the 2<sup>nd</sup> loop of INT table:

- Note that this descriptor can contain maximum of 51 IPv4\_addr fields.
- IPv4\_slash\_mask indicates the number of significant bits in the corresponding IPv4\_addr, starting from the msb.
- This descriptor refers to every IP flow with any source address and any of the announced destination address.

Following applies to each target\_IP\_source\_slash\_descriptor within the 2<sup>nd</sup> loop of INT table:

- Note that this descriptor can contain maximum of 25 IPv4\_addr fields.
- IPv4\_source\_slash\_mask indicates the number of significant bits in the corresponding IPv4\_source\_addr, starting from the msb.
- IPv4\_dest\_slash\_mask indicates the number of significant bits in the corresponding IPv4\_dest\_addr, starting from the msb.
- This descriptor refers to every IP flow with any of the announced source address and any of the announced destination address.

Following applies to each target\_IPv6\_address\_descriptor within the 2<sup>nd</sup> loop of INT table:

- The use of target\_IPv6\_slash\_descriptor or target\_IPv6\_source\_slash\_descriptor instead is RECOMMENDED.
- Note that this descriptor can contain maximum of 14 IPv6\_addr fields.
- IPv6\_addr\_mask field indicates the bits significant in each IPv6 address announced in the following IPv6\_addr fields within the descriptor. IPv6\_addr\_mask value ffff:ffff:ffff:ffff:ffff:ffff:ffff:ff00 would indicate that the 8 lsb of the IPv6\_addr value are to be ignored.
- This descriptor refers to every IP flow with any source address and any of the announced destination address.

Following applies to each target\_IPv6\_slash\_descriptor within the 2<sup>nd</sup> loop of INT table:

- Note that this descriptor can contain maximum of 15 IPv6\_addr fields.
- IPv6\_slash\_mask indicates the number of significant bits in the corresponding IPv6\_addr, starting from the msb. IPv6\_slash\_mask\_value 120 would indicate that the 8 lsb of the IPv6\_addr value are to be ignored.
- This descriptor refers to every IP flow with any source address and any of the announced destination address.

Following applies to each target\_IPv6\_source\_slash\_descriptor within the 2<sup>nd</sup> loop of INT table:

- Note that this descriptor can contain maximum of seven (7) IPv6\_addr fields.
- IPv6\_source\_slash\_mask indicates the number of significant bits in the corresponding IPv6\_source\_addr, starting from the msb.
- IPv6\_dest\_slash\_mask indicates the number of significant bits in the corresponding IPv6\_dest\_addr, starting from the msb.
- This descriptor refers to every IP flow with any of the announced source address and any of the announced destination address.
- If the IP/MAC\_stream\_location\_descriptors associated with the first descriptor announce different locations than the IP/MAC\_stream\_location\_descriptors associated with the second descriptor (i.e. located in different iteration of 2<sup>nd</sup> loop of INT table), DVB-SH Receiver would need to know which of the locations to use. For such cases, following applies:
  - If within an INT sub\_table an IP flow is announced multiple times using different masks, Receiver SHALL use the one with more precise mask (i.e. the mask with more bits set). If several announcements are available it is to the implementation to decide which one to use, not to a DVB standard to specify this.



#### 4.6.10.1.4 Operational\_descriptor\_loop:

NOTE: This clause is identical to clause 5.5.9 of [8] dealing with operational\_descriptor\_loop and recalled for consistency.

Following descriptors MAY appear in operational-loop:

- IP/MAC\_stream\_location\_descriptor: Each iteration of 2<sup>nd</sup> loop of INT table SHALL contain at least one IP/MAC\_stream\_location\_descriptor in operational-loop, providing the location of IP streams. Given location SHALL NOT occur more than once within each iteration of 2<sup>nd</sup> loop of INT table.
- time\_slice\_fec\_identifier\_descriptor: If this descriptor is present in target\_loop, it indicates that all Elementary Streams referred within this loop after this descriptor are time-sliced with parameters announced in this descriptor. Descriptor applies from the next IP/MAC\_stream\_location\_descriptor (if any) to the end of the current iteration of the loop or to the next time\_slice\_fec\_identifier\_descriptor, which ever comes first.

The IP/MAC\_stream\_location\_descriptor SHOULD have different content within each iteration of 2<sup>nd</sup> loop of INT table (i.e. SHOULD announce different location).

DVB-SH Receiver MAY ignore all other descriptors in operational-loop.

#### 4.6.10.2 Specificities in the case of a partially available TS

##### 4.6.10.2.1 Unicity and availability of the INT

Each sub-table SHALL be part of the common services in case the TS is partially available so that the complete INT is available anywhere in the DVB-SH network. There MAY be a number of IP streams that are not available on the common service but only on the local service. Therefore the number of IP streams to be announced in the INT sent in the common service MAY be quite large. However due to the 30 seconds repetition interval, the bit rate increase is expected to remain limited.

##### 4.6.10.2.2 Multiplicity of IP/MAC\_stream\_location\_descriptors within operational\_loop:

With a partially available TS, it MAY be possible that multiple IP/MACstream\_location\_descriptor entries exist for same target\_IP\_descriptor, whereby the same IP flow MAY be instantiated by different IP streams found in different DVB services. In such case, appearance order of the different IP/MAC\_stream\_location\_descriptors within the operational\_loop is of importance and MUST follow the rules :

- if the IP flow is present in a common DVB service, the position of the corresponding IP/MAC\_stream\_location\_descriptor SHALL be first;
- if the IP flow is present on several local DVB services.

The procedure for the receiver to choose the correct IP stream and corresponding DVB service is the following:

- 1) the terminal should:
  - scan the INT table and the operational\_loop;
  - select an IP address ;
  - find a matching {target\_descriptor\_loop(); operational\_descriptor\_loop()} in the loop following the platform\_descriptor\_loop;
  - in the operational\_descriptor\_loop() more than one IP/MACstream\_location\_descriptor will be found for the actual TS;
  - the first IP/MACstream\_location\_descriptor of the list should be the one associated with the satellite DVB service, other being associated to the local DVB services.
- 2) According to this order, a procedure can be followed as described under:
  - Step 1: list all services that contain the target IP address;
  - Step 2: check availability of the service in the SDT table, the latter being cached in the memory;
  - Step 3: if only one service is available, use its service\_id to trigger the IP flow;
  - Step 4: if two services are available, use the service\_id that is not in the first position of the list to trigger the IP flow.

## 4.7 Transmission Parameters Signalling (TPS)

The Transmission Parameters Signalling (TPS) bits are used to signal parameters related to the OFDM transmission scheme, i.e. to channel coding, modulation and interleaver. They are specified in [6], clause 5.7.4.3.

The Signalling Field is used to signal parameters related to the TDM transmission scheme, id est interleaver and channel coding (the modulation is supposed to have been resolved beforehand). The signalling field is specified in [6], clause 5.5.2.2.

## 4.8 Update Notification Table (normative)

Same as clauses 5.7 and 4.10 in [8].

## 4.9 Announcing INT (normative)

This clause summarizes how the INT SHALL be announced. The description starts from the ES that carries the INT and follows signalling backwards.

### 4.9.1 IP/MAC Notification Service

An elementary stream that carries an INT is called IP/MAC Notification service. This Elementary Stream is then called a IP/MAC Notification Service. An IP/MAC Notification Service MAY carry multiple INT sub\_tables. An IP/MAC Notification Service SHOULD NOT carry any other data but INT sub\_tables. DVB-SH Receiver MAY ignore any other data on an Elementary Stream carrying one or more INT sub\_tables.

The notification service MUST be announced in the PMT describing the elementary stream where the INT is carried. The IP/MAC Notification Info Structure announces each INT sub\_table carried within the announced component (see clause 4.9.2 for more details).

The DVB service described by this PMT is itself announced by an IP/MAC Notification Service Structure. The latter is located within a linkage\_descriptor that MAY be found in the NIT\_actual of each Transport Stream containing one or more IP/MAC Notification Services (see clause 4.9.3 for more details), or in BAT carried on at least one of the Transport Streams of the network (see clause 4.9.4 for more details).

## 4.9.2 IP/MAC Notification Info structure

As defined in clause 8.3.1 of [2], the structure is located in the ES\_info loop of the PMT, precisely in the selector field of data\_broadcast\_id\_descriptor, with the data\_broadcast\_id field set to 0x000B. There is exactly one structure per data\_broadcast\_id\_descriptor but there MAY be several data\_broadcast\_id\_descriptors within the ES\_loop.

Following applies to each IP/MAC Notification Info Structure found in the PMT:

- At least one INT sub\_table SHALL be announced.
- More than one INT sub\_tables SHOULD NOT be announced.
- If more than one INT sub\_tables are announced within a single structure, each SHALL have a different platform\_id.
- If more than one platform\_id are present, the list of platform\_ids shall be complete.
- For each announced platform\_id, action\_type 0x01 (location of IP/MAC streams in DVB networks) SHOULD be announced exactly once.
- INT\_versioning\_flag fields SHALL be set to '1', indicating that the INT\_version field reflects the changes of the announced INT sub\_table.

NOTE: If INT\_versioning\_flag is set to 1, a Receiver needs to filter only the PMT sub\_table to detect changes in PMT and INT sub\_tables. If the flag is set to 0, the Receiver needs to filter both PMT and INT sub\_table, therefore requiring one extra filter.

## 4.9.3 IP/MAC Notification NIT

As defined in [1], the IP/MAC Notification Service Structure is carried within exactly one linkage\_descriptor, located in the first descriptor loop of a NIT. There is exactly one structure per linkage\_descriptor but there MAY be several linkage\_descriptors in the NIT main loop.

The following applies to each NIT containing IP/MAC Notification Service Structure:

- Each notification service within the DVB-SH network is announced in the NIT.
- If there are several IP platforms and therefore several INT sub\_tables, these are announced in the same IP/MAC Notification Service Structure.
- In that case, the list of announced IP platforms SHALL be complete, so that each INT sub\_table within the entire DVB network is referred to by at least one linkage\_descriptor containing an IP/MAC Notification Service Structure.
- A platform\_name SHALL be given for each announced IP platform. The platform\_name MAY be announced just once within each NIT containing IP/MAC Notification Service Structures.

To get the names of each available IP platform within a DVB network, a DVB-SH Receiver would read the NIT containing linkage\_descriptors with linkage\_type 0x0B. Within such NIT, names of each available IP platform are announced.

## 4.9.4 IP/MAC Notification BAT

If an IP/MAC Notification BAT is used, the following applies:

- The BAT sub\_table should be announced within the NIT sub\_tables describing the actual delivery system.
- To announce a BAT sub\_table, a NIT carries a linkage\_descriptor with the linkage\_type set to 0x0C.

As defined in [1], the IP/MAC Notification Service Structure is carried within exactly one linkage\_descriptor, located in the first descriptor loop of a specifically identified BAT sub\_table. There is exactly one structure per linkage\_descriptor but there MAY be several linkage\_descriptors in the BAT main loop.

Each IP/MAC Notification BAT announces each IP/MAC Notification Service within the DVB network. For each such DVB service, each IP platform for which INT sub\_tables are carried in components of the service, is announced.

The following applies to each BAT containing IP/MAC Notification Service Structure:

- Each IP/MAC Notification Service within the DVB network is announced in the BAT.
- If there are several IP platforms and therefore several INT sub\_tables, these are announced in the same IP/MAC notification service structure.
- In that case, the list of announced IP platforms SHALL be complete, so that each INT sub\_table within the entire DVB network is referred to by at least one linkage\_descriptor containing an IP/MAC Notification Service Structure.
- A platform\_name SHALL be given for each announced IP platform. The platform\_name MAY be announced just once within each BAT containing IP/MAC Notification Service Structures.

To get the names of each available IP platform within a DVB network, a DVB-SH Receiver would read the BAT containing linkage\_descriptors with linkage\_type 0x0B. Within such BAT, names of each available IP platform are announced.

## 4.10 SH frame initialization packet (normative)

SHIP is defined in [6], annex A. Its usage is refined in this clause.

### 4.10.1 Mandatory SHIP parameters

Mandatory parameters are set according to specified rules except for the following parameters:

- synchronization\_id;
- individual\_addressing\_length.

#### 4.10.1.1 Synchronization\_id:

When SH\_delivery\_system\_descriptor signals a diversity\_mode where FEC diversity is used at SH service layer (diversity\_mode XNOR '1110' = '1111'), the synchronization\_id can be set to two different values:

- SHIP located in common services MUST have their synchronization\_id set to 0x01;
- SHIP located in local services MUST have their synchronization\_id set to 0x00.

Therefore, transmitters located in terrestrial cells (cell\_id > 255) MUST behave as usual, synchronizing on SHIP with a synchronization\_id set to 0x00, and avoid using SHIP with a synchronization\_id set to 0x01 that are reserved to transmitters located in satellite cell. Transmitters located in satellite cells (cell\_id < 256) MUST use the unique SHIP with a synchronization\_id set to 0x01.

#### 4.10.1.2 Individual\_addressing\_length

In unicast configuration ('0x00' < individual\_addressing\_length < '0xFF') individual\_addressing\_length informs how many tx\_identifiers entries there are in the SHIP so that multiple tx\_identifiers can be addressed within the same SHIP. Using multicast addressing can be more efficient to address a large number of transmitters and therefore makes individual\_addressing\_length useless. Multicast and unicast addressing are therefore exclusive. When multicast addressing is used (individual\_addressing\_length = 0xFF), this field can no more be used for setting the number of multicast entries. However, the receiver can still derive the number of entries from the section length and the individual function\_loop\_length. It is then still recommended to use several tx\_identifier entries per SHIP even in the multicast case.

Using service\_synchronization function assumes a multicast tx\_identifier addressing scheme is used (length set to '0xFF').

Using service\_localization function assumes a unicast tx\_identifier addressing scheme is used (length set strictly between to '0x00' and '0xFF').

## 4.10.2 Optional SHIP parameters

In this clause, we precise how some of the optional functions useful in a DVB-SH context SHALL be used: after some general requirements, we review cell\_id function, service\_localization function and service\_synchronization function. Other optional SH-related (TDM, group\_membership) or non SH-related functions MAY be used in a SH context but do not require specific guidance.

### 4.10.2.1 General requirements

According to clause 4.1.2.1, in the specific case of diversity used at SH service layer (diversity\_mode XNOR '1110' = '1111'), the SHIP packet SHALL signal the optional parameters in the common service so that any receiver will receive this information.

If the optional function cannot be transmitted in a unique SHIP because of size, then the information SHALL be split into successive SHIP packets because the payload of a SHIP (184 bytes) is not enough for carrying the optional data. This happens in the following cases:

- The list of tx\_identifiers cannot be completed within the current SHIP: at least one tx\_identifier address has been described but more are requested.
- An optional function cannot be ended within current SHIP: there is not enough bytes left in the current payload to complete the function, especially if this function has many iterations:
  - For service\_localization\_function: with a unique multicast address for all cells, we can signal localization of 17 cells with 1 service declared in each cell within 1 SHIP.
  - For service\_synchronization\_function: With a unique multicast address and no cell\_id, we can signal a total number of services of 77.

To detect the multiple SHIP situation, the terminal cannot use section\_length since the latter is limited to 182 bytes, therefore preventing this parameter to be used in multiple SHIP context. Wait\_for\_enable\_flag is used for that purpose: the terminal discovers that there is a multi-SHIP case because the wait\_for\_enable\_flag is set to '0' on the intermediate SHIP and set to '1' on the final SHIP where an enable\_function MUST be located. So the terminal has to monitor successive SHIP to discover the full configuration. Moreover, in all cases, at each iteration, the individual\_addressing length signals the length within current SHIP so that total length is the sum of all successive signalled lengths.

More precisely, the syntax rules are the following:

- A function MAY be split into several parts called hereunder "the parts".
- Each part MUST be correctly signalled and compliant with the SHIP specification:
  - For a given part, function description MUST be complete: fields function\_tag, function\_length, data, wait\_for\_enable\_flag, reserved MUST be present and correctly set.
  - For a given part, function\_loop\_length MUST be set to the length of the part of the function located within current SHIP.
  - Wait\_for\_enable\_flag MUST be set to '1' up to the reception of enable\_function with the corresponding enable\_function\_tag.
  - Function MUST be enabled with reception of the function last part, or the following one if no room is available on the last part.

- The complete function CAN be built from individual parts to constitute a compliant function:
  - The complete function description MUST be complete: fields function\_tag, function\_length, data, wait\_for\_enable\_flag, reserved MUST be present.
  - The complete function\_loop\_length MUST be set to the sum of lengths of all individual parts and MUST be limited to 255 bytes.
  - Wait\_for\_enable\_flag MUST be set to '1' up to the reception of enable\_function with the corresponding enable\_function\_tag.

Additional following rules are mandated:

- If signalling for a given tx\_identifier MUST be split over several SHIP, the same tx\_identifier SHOULD be used in all successive SHIP (the signalling MUST not change the addressing before completing the current one). This applies to both unicast and multicast addressing schemes.
- This rule MAY not be respected with content regionalization cases where different SHIP are generated for the global and local regionalized TS. However this rule MUST be respected for the sequence of individual SH service present and valid in the same cell.
- The SHIP sequence SHALL be repeated regularly so that any transmitter or receiver performing a cold start SHALL be able to retrieve the complete sequence within a small delay and so that a missed intermediate SHIP MAY be recovered quickly.

#### 4.10.2.2 Tx\_identifier

Tx\_identifier syntax depends on individual\_addressing\_length. See the later for more information.

#### 4.10.2.3 Cell\_id\_function

This cell\_id SHALL be present when service\_localization function is used to give binding information between cell\_id and SH service (refer to service\_localization\_function for more information on this binding).

#### 4.10.2.4 Service\_localization\_function:

##### 4.10.2.4.0 Introduction

This service\_localization\_function enables to discover what SH services are actually on which region. This function is therefore useful for both transmitters and receivers since both need to discover the SH regionalization information.

The service\_localization\_function by itself only lists the SH services. In order to provide binding information between the region and the SH services, the tx\_identifiers and the cell\_ids need to be detailed according to the following rules.

##### 4.10.2.4.1 tx\_identifier

For providing binding information between the service\_localization\_function and the transmitters, the following rules on tx\_identifier are recommended:

- For signalling a common SH service alone: an individual tx\_identifier (individual\_addressing\_length strictly between 0x00 and 0xFF) MUST be used unless the TS is being modulated over several satellite modulators.
- For signalling a local SH service: a multicast addressing scheme (individual\_addressing\_scheme equal to 0xFF) SHOULD be used since in the general case several modulators are located in a terrestrial cell; multicast addressing is therefore convenient for informing all the transmitters at once.
- For signalling a common SH service among other local services: a multicast addressing scheme (individual\_addressing\_scheme equal to 0xFF) SHOULD be used in order to address in the same SHIP the different transmitters.

#### 4.10.2.4.2 Cell\_id

For providing binding information between the service\_localization\_function and the receivers, the cell\_id function MUST be used in the same SHIP as the service\_localization\_function. Therefore, the receiver can immediately derive on which cell\_id the signalled SH service is being transmitted.

EXAMPLE: SHIP detailed in table 5 gives the regionalization information for a case where we have 2 common SH service (id = 0 and id = 1) sent on a unique cell (cell\_id = 0), and 2 additional local SH service sent on 10 local cells (cell\_id from 256 to 265). The signalling is done using 11 different multicast groups (1 to 11) for the 11 different regions (1 for the global region, 10 for the local regions). Therefore the individual\_addressing\_scheme is set to multicast mode.

**Table 5: Example of SHIP with SH\_service\_localization function**

SH frame initialization_packet	individual	iteration	bits	bytes	value(dec)	value	remarks
transport_packet_header	32	1	32	4			
synchronization_id	8	1	8	1			
section_length	8	1	8	1	178	0xB2	Size is 178 bytes, enabling to determine the number of iterations in tx_loop when multicast addressing is used
Pointer	16	1	16	2			
periodic_flag	1	1	1	0,125			
future_use	14	1	14	1,75			
SH_use	1	1	1	0,125			
synchronization_time_stamp	24	1	24	3			
maximum_delay	24	1	24	3			
tps_ship	32	1	32	4			
individual_addressing_length	8	1	8	1	255	0xFF	multicast addressing is used
<i>Global tx_loop</i>							
tx_identifier	16	1	16	2	1	0x0001	multicast address equals 1 for 1 global region
function_loop_length	8	1	8	1	10	0x0A	10 < max value 255 / 0xFF bytes
cell_id	40	1	40	5	0	0x00	cell_id 0 for 1 global region
service_localization_function	40	1	40	5	0	0x00	2 global SH services are signaled SH_service_id varies from 0 to 1
<i>Local tx_loop</i>							
tx_identifier	16	10	160	20	2	0x0002	multicast address from 2 to 11 for the 10 local regions
function_loop_length	8	10	80	10	120	0x78	120 < max value 255 / 0xFF bytes
cell_id	40	10	400	50	256	0x0100	cell_id 256 to 265 for the 10 local regions
service_localization_function	56	10	560	70	2	0x02	2 global service(s) and 2 local service(s) are signalled at each iteration Global: 2 ids from 0 to 1 Local: 2 ids from (2+ k*2) to (3+ k*2) where k is selected in [0;9],
crc_32	32	1	32	4			
stuffing_byte	8	0	0	0			
			1504	188			

In this example, there are 11 tx\_identifier iterations, one for each multicast group / cell:

- Multicast\_id 1 / cell\_id 0:
    - This group refers to the satellite cell (cell\_id 0) where multicast group 1 configures the unique satellite transmitter.
- NOTE: Individual addressing is not possible when there are other multicast groups being signalled for local repeaters.
- 2 SH\_services (SH\_services 0 and 1) are signalled on this cell, no local SH service is signalled.
  - Not only the transmitter is configured but also the receiver, since the receiver can now attach SH\_services 0 and 1 to cell\_id 0.
- Multicast\_id 2 to 11 / cell\_ids 256 to 265:
    - These groups refer to the 10 local cells (id 256 to 265).
    - Different multicast groups are used to signal this information (from address 2 to 11).
    - Inside every terrestrial cell, the 2 common SH\_services (id 0 to 1) are signalled so that every local transmitter repeat the 2 common SH\_services, in addition to a unique local SH\_service selected among the 10 possible.

In the simple case of 1 common SH service and 1 local SH service per region, the maximum number of regions that enable to send all signalling in 1 DVB packet of payload size 184 bytes is around 10. If more regions are needed, the repeaters can be grouped in different multicast groups, or signalling can be split in successive SHIP packets according to rules described in clause 4.10.2.1.

#### 4.10.2.5 Service\_synchronization\_function

##### 4.10.2.5.0 Introduction

The service\_synchronization\_function MUST be present in the following cases:

- Case 1: When diversity is used at SH service layer (diversity\_mode XNOR '1110' = '1111') to signal SH services delineation to both transmitters and receivers.
- Case 2: When class 2 physical interleaver is used to signal SH service delineation to transmitters and receivers for power saving and memory reduction (see [7], clause 7.2.3.3.1).
- Case 3: The service\_synchronization\_function MAY be present when the number of SH frames per superframe is lower than 1 since other means can be used to synchronize transmitters (see [7], clause 7.5.1.2.2).

Depending on each case, the following requirements are put on service\_synchronization.

**Table 6: service\_synchronization\_function requirements**

Constraint/Case	Number of SH services	Individual SH service	Sum of SH services	Example
1 (diversity at SH layer)	At least equal to the sum of global and local regions	In each region, one SH service MUST start a SH frame and end an SH frame	The SH services have a repetition_interval which is a multiple of SH_frame duration	See clause 4.2.1.3
2: long PHY interleaver with time slicing)	Inferior or equal to the number of time-slice services	Non specific	The SH services have a repetition interval equal to the repetition period of the physical interleaver, itself being a multiple of SH frames	See [7], clause 7.2.3.3.1
3: transmitter synchronization	At least 1	Non specific	The cumulated length of all SH services MUST be higher or equal in size to the number of EFRAMES per Superframe	See [6], clause A.4.9

This service\_synchronization\_function enables to discover how SH services are actually organized at the level of EFRAMES in the TS. This function is therefore useful for both transmitters and receivers since both need to discover the SH services distribution. How the service\_localization\_function is signalled depends on the case:

- In case of content regionalization (case 1 of table 6):
  - If the synchronization\_function is located on the common part, the service\_synchronization\_function MUST be complete and MUST list all SH services present in the complete TS in their sending order.
  - If the synchronization\_function is located on the local part, the service\_synchronization\_function MUST list only the common and current local service(s) in their sending order, all services being not transmitted in this local TS MUST not be listed.
- In case 2, in addition to the previous rule, the individual time-slices services MUST also be listed in their sending order.
- In case 3, no specific rule is required.

##### 4.10.2.5.1 tx\_identifier

Same rules as clause 4.10.2.4.1 apply.



#### 4.10.2.5.2 Cell\_id

Cell\_id is not mandatorily required since the information is TS dependent (if the receiver catches the service\_synchronization\_function, this means it can receive the signalled services, except for the common part for which the service\_localization\_function MUST be used). However for simplification purposes, the same SHIP can also provide binding information between the service\_synchronization\_function and the receivers, the cell\_id function MUST be used in the same SHIP as the service\_localization\_function. Therefore, the receiver can immediately derive on which cell\_id the signalled SH service is being transmitted.

**EXAMPLE:** For instance the SHIP detailed in table 7 gives the service description information on a SHIP located on the common part for a case where we have the maximum possible number of SH service sent on a unique cell (cell\_id = 0). As can be seen, up to 75 services MAY be signalled in a unique SHIP.

**Table 7: Example of SHIP with a service\_synchronization\_function**

SH frame initialization packet	individual	iteration	bits	bytes	value(dec)	value	remarks
transport_packet_header	32	1	32	4			
synchronization_id	8	1	8	1			
section_length	8	1	8	1	178	0xB2	Size is 178 bytes, enabling to determine the number of iterations in tx_loop when multicast addressing is used
Pointer	16	1	16	2			
periodic_flag	1	1	1	0,125			
future_use	14	1	14	1,75			
SH_use	1	1	1	0,125			
synchronization_time_stamp	24	1	24	3			
maximum_delay	24	1	24	3			
tps_ship	32	1	32	4			
individual_addressing_length	8	1	8	1	255	0xFF	multicast addressing is used
<i>Global tx_loop</i>							
tx_identifier	16	1	16	2	1	0x0001	multicast address equals 1 for 1 global region
function_loop_length	8	1	8	1	160	0xA0	160 < max value 255 / 0xFF bytes
cell_id	40	1	40	5	0	0x00	cell_id 0 for 1 global region
service_synchronization_function	1240	1	1240	155	0	0x00	75 global SH services are signaled
crc_32	32	1	32	4			
stuffing_byte	8	0	0	0			
			1504	188			

## 4.11 Signalling field

Signalling field is defined in [6], clause 5.5.5.2. Its usage is refined in this clause.

The signalling field MUST be used to signal the cell\_id via the field transport\_stream\_identifier. The 8-bit field enables to signal a value between 0 and 255 which are the allowable values for satellite cell\_id.

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## Annex A (informative): Bibliography

ISO/IEC 13818-1: "Information technology - Generic coding of moving pictures and associated audio information: Systems".

ETSI ETR 162: "Digital Video Broadcasting (DVB); Allocation of Service Information (SI) codes for DVB systems".

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## History

<b>Document history</b>		
V1.1.1	December 2009	Publication