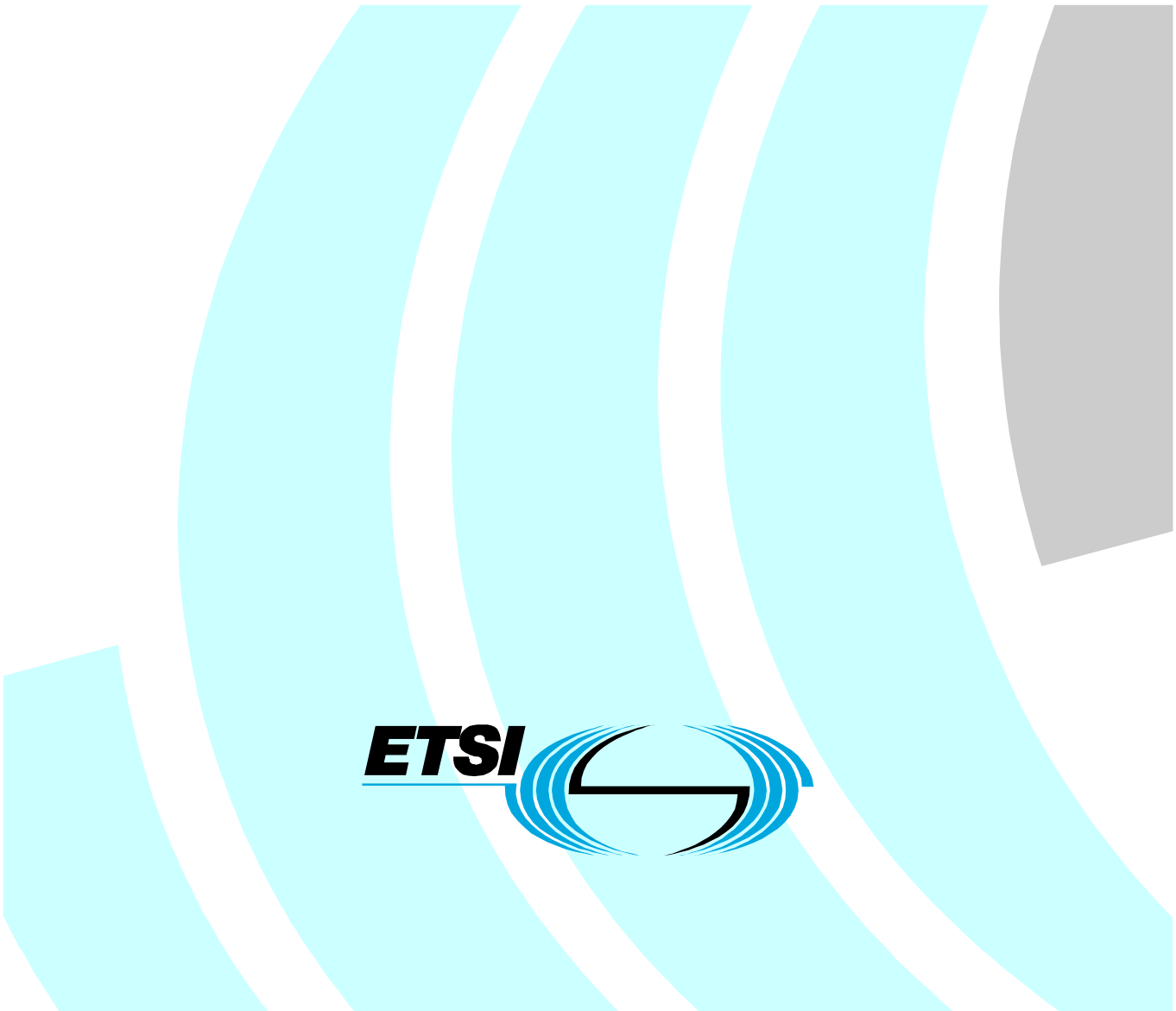
# ETSI TR 101 309 V1.1.1 (2002-04)

*Technical Report*

## Satellite Earth Stations and Systems (SES); Autonomous Satellite Signalling Channel (ASSC); General specifications and guidelines



Reference
DTR/SES-00068

Keywords
satellite, signalling, terminal

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Association à but non lucratif enregistrée à la
Sous-Préfecture de Grasse (06) N° 7803/88

# Contents

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# Foreword

This Technical Report (TR) has been produced by ETSI Technical Committee Satellite Earth Stations and Systems (SES).

# Introduction

The present document defines in clause 4, the common characteristics of ASSCs, and provide in clause 5, a guideline for the content of each Technical Specifications (TS) of a series of TSs applicable to each system implementing ASSC.

# 1 Scope

The present document applies to the physical layer and associated signalling of the air interface of Autonomous Satellite Signalling Channels (ASSCs) between user Satellite Terminals (STs) and Gateways (GWs), or between STs, for satellite access systems where inbound and outbound channels are independent from each other.

In these systems, the inbound channels of a Satellite Terminal are those channels carrying data, and transmitted from the Satellite Terminal to Gateways or to other Satellite Terminals. The outbound channels of a Satellite Terminal are those channels carrying data, and received by the Satellite Terminal from the Gateways or other Satellite Terminals. The inbound and outbound channels may be of any type.

These satellite access systems are designed to provide end-users with multi-services such as data transfer, telephony and associated services, data gathering, etc.

These systems are designed to offer two way links for traffic between end-user Satellite Terminals and service providers connected to Gateways, or between end-user Satellite Terminals.

In these systems, the inbound channels from Satellite Terminals and the signalling to and from the Satellite Terminals are transmitted through the same satellite.

In these systems, the inbound channels from Satellite Terminals and the outbound channels towards Satellite Terminals may be transmitted through the same satellite or via different satellites, and to and from the same gateway or different gateways.

These satellite access systems are operated through geostationary satellites, in the Fixed Satellite Service frequency bands.

In these systems, the STs are designed usually for unattended operation.

The interfaces of GWs with the terrestrial networks and the interfaces of STs with the user terminals or local networks are outside the scope of the present document.

# 2 References

For the purposes of this Technical Report (TR) the following references apply:

[1] ETSI EN 301 428 (V1.2.1): "Satellite Earth Stations and Systems (SES); Harmonized EN for Very Small Aperture Terminal (VSAT); Transmit-only, transmit/receive or receive-only satellite earth stations operating in the 11/12/14 GHz frequency bands covering essential requirements under article 3.2 of the R&TTE directive".

[2] ETSI EN 301 443 (V1.2.1): "Satellite Earth Stations and Systems (SES); Harmonized EN for Very Small Aperture Terminal (VSAT); Transmit-only, transmit-and-receive, receive-only satellite earth stations operating in the 4 GHz and 6 GHz frequency bands covering essential requirements under article 3.2 of the R&TTE Directive".

[3] ETSI EN 300 673 (V1.2.1): "Electromagnetic compatibility and Radio spectrum Matters (ERM); ElectroMagnetic Compatibility (EMC) standard for Very Small Aperture Terminal (VSAT), Satellite News Gathering (SNG), Satellite Interactive Terminals (SIT) and Satellite User Terminals (SUT) Earth Stations operated in the frequency ranges between 4 GHz and 30 GHz in the Fixed Satellite Service (FSS)".

[4] ETSI EN 301 360 (V1.1.3): "Satellite Earth Stations and Systems (SES); Harmonized EN for Satellite Interactive Terminals (SIT) and Satellite User Terminals (SUT) transmitting towards geostationary satellites in the 27,5 GHz to 29,5 GHz frequency bands covering essential requirements under article 3.2 of the R&TTE Directive".

[5] ETSI EN 301 489-1 (V1.3.1): "Electromagnetic compatibility and Radio spectrum Matters (ERM); ElectroMagnetic Compatibility (EMC) standard for radio equipment and services; Part 1: Common technical requirements".

[6] ETSI EN 301 489-12 (V1.1.1): "Electromagnetic compatibility and Radio spectrum Matters (ERM); ElectroMagnetic Compatibility (EMC) standard for radio equipment and services; Part 12: Specific conditions for Very Small Aperture Terminal, Satellite Interactive Earth Stations operated in the frequency ranges between 4 GHz and 30 GHz in the Fixed Satellite Service (FSS)".

[7] ETSI EN 301 430 (V1.1.1): "Satellite Earth Stations and Systems (SES);Harmonized EN for Satellite News Gathering Transportable Earth Stations (SNG TES) operating in the 11-12/13-14 GHz frequency bands covering essential requirements under article 3.2 of the R&TTE directive".

# 3 Definitions and abbreviations

## 3.1 Definitions

For the purposes of the present document, the following terms and definitions apply:

**Channel layer:** layer in charge of multiplexing and demultiplexing data, including signalling, into and from data containers

**Inbound channel:** channel carrying data and transmitted from a ST to a GW or to another ST

**Inbound Gateway:** gateway receiving the Inbound Traffic Channel

**Inbound Traffic Channel:** channel carrying traffic data and transmitted from a ST to a GW or to another ST

**Initialization Centre:** centre in charge of the STs logins

**Initialization Signalling Channel:** channel carrying signalling between the Initialization Centre and the STs

**Management Centre:** centre in charge of the system management

**Management Signalling Channel:** channel carrying signalling between the Management Centre and the STs

**Outbound channel:** channel carrying data and received by STs from a GW or another ST

**Outbound Gateway:** gateway transmitting the Outbound Traffic Channel

**Outbound Traffic Channel:** channel carrying traffic data and received by STs from a GW or another ST

**Physical layer:** layer in charge of the physical transmission of all the bits transmitted through a channel

**Processing layer:** layer in charge of processing the data received via the satellite and the terrestrial interfaces (e.g. routing, signalling, etc.)

## 3.2 Abbreviations

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

| | |
|---|---|
| AP | Access Provider |
| ASSC | Autonomous Satellite Signalling Channel |
| CDMA | Code Division Multiple Access |
| Chl | Channel |
| Ctr | Centre |
| Ctrlr | Controller |
| DAMA | Demand Assignment Multiple Access |
| EIRP | Equivalent Isotropically Radiated Power |
| EN | European Standard |
| ES | Earth Station |
| FDMA | Frequency Division Multiple Access |
| FEC | Forward Error Correcting code |
| FSS | Fixed Satellite Service |

| | |
|---|---|
| GPS | Global Positioning System |
| GW | Gateway |
| IB-GW | InBound GateWay |
| IOB-GW | Inbound and OutBound GateWay |
| LAN | Local Area Network |
| ISP | Internet Service Provider |
| NAP | Network Access Provider |
| OB | On board |
| OB-GW | Outbound Gateway |
| PABX | Private Automatic Branch eXchange |
| PC | Personal Computer |
| PSPDN | Public Switched Packed Data Network |
| PSTN | Public Switched Telephone Network |
| R&TTE | Radio and Telecommunication Terminal Equipment (directive) |
| SIT | Satellite Interactive Terminals |
| SNG TES | Satellite News Gathering Transportable Earth Stations |
| SP | Service Provider |
| ST | Satellite Terminal |
| SUT | Satellite User Terminals |
| TDMA | Time Division Multiple Access |
| TR | Technical Report |
| TS | Technical Specifications |
| VSAT | Very Small Aperture Terminal |

# 4 Section I - General characteristics

## 4.1 System Architecture

A satellite system with ASSC may consist of one or more satellite networks with ASSC which may use common parts (e.g. channels, stations, functional centre).

Two types of networks are considered: star networks and meshed networks, as presented in figure 1 (Channels of a ST in a star network) and figure 2 (Channels of a ST in a mesh network).

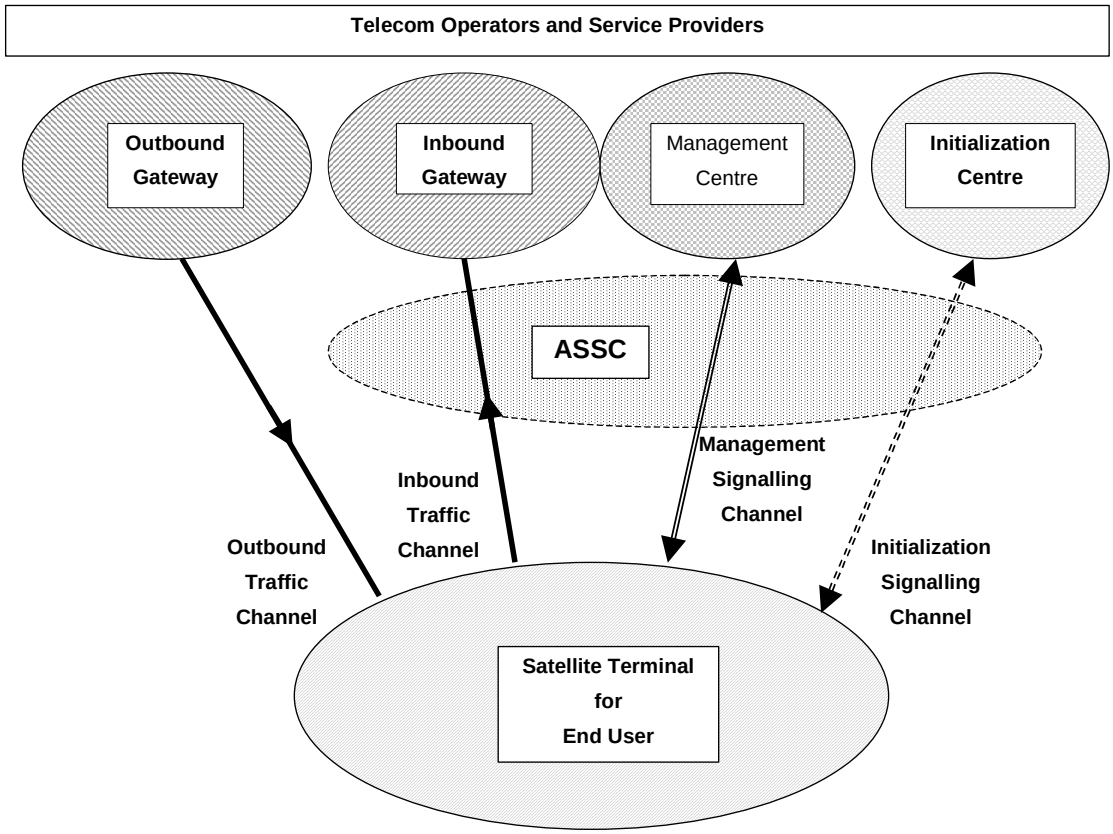


**Figure 1: Channels of a ST in a star network**

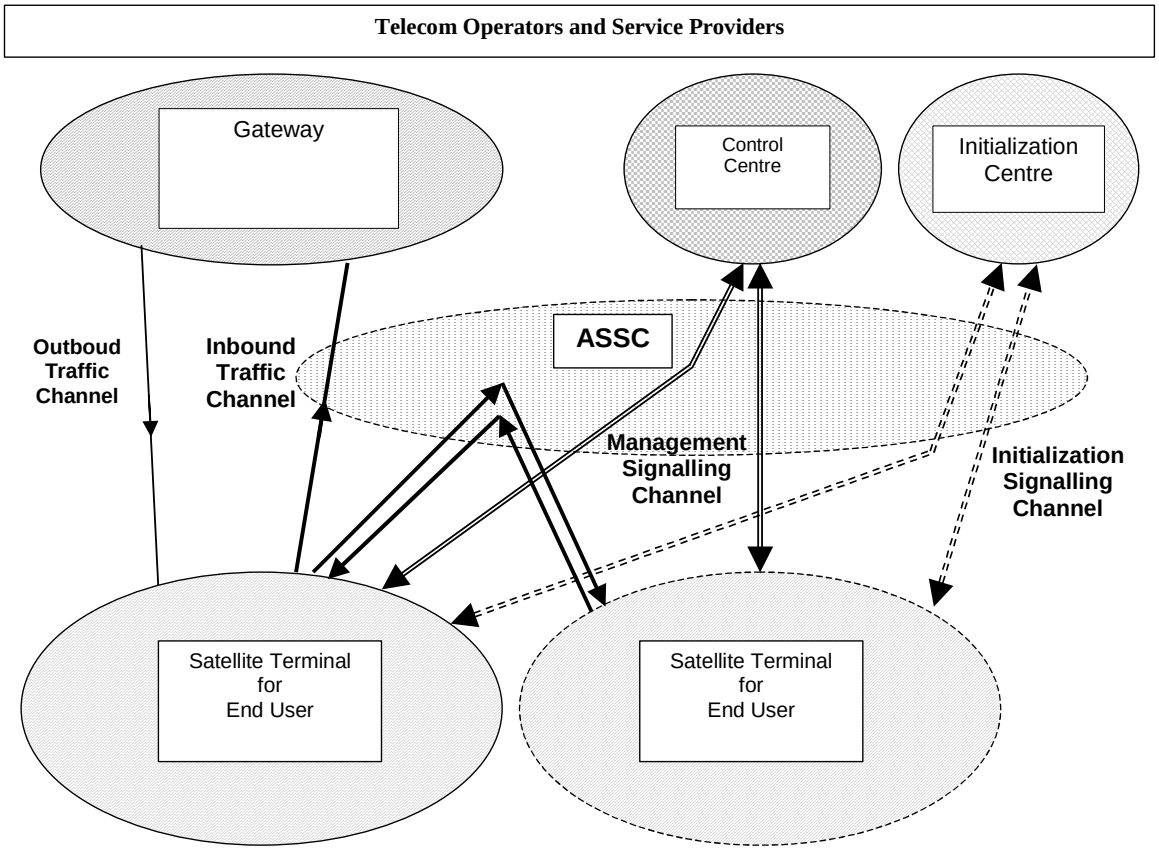


**Figure 2: Channels of a ST in a mesh network**

### 4.1.1 Network elements

A satellite network with ASSC consists of the following elements:

- Satellite Terminals (STs),
- a unique Initialization Centre which manages each ST entering the network,
- one or more Control Centre which dynamically assigns satellite capacity,
- one or more Outbound Gateways which transmits traffic data to the STs,
- one or more Inbound Gateways which receives traffic data from the STs.

NOTE: These last four elements may be in separated or collocated earth stations.

### 4.1.2 Channels

The STs transmit and receive the following satellite channels:

- **Outbound Traffic Channels:** channels received by STs from Outbound Gateways or from other STs.
- **Inbound Traffic Channels:** channels transmitted by STs to Inbound Gateways or to other STs.
- **Management Signalling Channels:** bi-directional channels between the Control Centres and STs.
- **Initialization Signalling Channel:** bi-directional channel between a ST and the Initialization Centre.

### 4.1.3 System general characteristics

The inbound and signalling channels are transmitted through the same satellite in order to provide easy ST synchronization, whatever is the access technique used (FDMA, TDMA, CDMA).

The outbound channel or channels may be transmitted via the same or other satellites.

A ST is under the control of only one Control Centre, at a time, either permanently or dynamically assigned.

A ST may have to receive one or several outbound signals, at a time, i.e. modulated carriers carrying data or signalling.

The outbound signals to be received by a ST are either dynamically assigned by the Control Centre or permanently assigned.

A ST may have to transmit one or several inbound signals, at a time.

The inbound signals to be transmitted by a ST are either dynamically assigned by the Control Centre or permanently assigned.

The Inbound and Outbound Gateways (GWs) may be connected either to a public environment (e.g. a PSTN, PSPDN, data platforms, ISP, etc), or a private environment (e.g. PABX, LAN, leased lines through another network).

The Satellite Terminals may be locally connected either to private environments (PABX or LAN, or leased lines through another network), or to consumer environments (phone, fax, PC connection) or, in some locations, used for an extension of a public network (e.g. a PSTN).

The present document does not contain any requirement on the type of service which could be provided with such systems with ASSC.

### 4.1.4 ST satellite links

For a ST, the following satellite single hop links should be used:

- between the ST and the Initialization Centre, both ways, for signalling,
- from the ST to the assigned Inbound Gateway, for traffic data,
- between the ST and the assigned Control Centre, both ways for signalling,
- between the ST and other STs in a mesh network for traffic data.

### 4.1.5 Other system links

For the management of the system elements other than the STs, there may be additional signalling links either terrestrial or via satellite such as:

- between the Initialization Centre and the Control Centre(s) (e.g. for network configuration, capacity allocation, etc.),
- between the Initialization Centre and the Inbound Gateway(s) (e.g. for monitoring and control information),
- between the Initialization Centre and the Outbound Gateway(s) (e.g. for monitoring and control information),
- between the Control Centre(s) and the Inbound Gateway(s) (e.g. for the capacity management and monitoring and control),
- between the Control Centre(s) and the Outbound Gateway(s). (e.g. for the capacity management and monitoring and control).

## 4.2 Services

### 4.2.1 Duplex circuit mode

Duplex circuits could be established between Satellite Terminals and Gateways or between Satellite Terminals, for data, telephone or facsimile.

### 4.2.2 Data transfer

Data transfer could be possible in a symmetric or dissymmetric mode, or in a Packet mode.

## 4.3 Reference models

### 4.3.1 Communication layers

For the specification of ASSC systems, the communication layers (physical layer, channel layer and processing layer) defined in clause 3.1 apply.

## 4.4 Business Model

The following business model shows the typical relationship between actors.

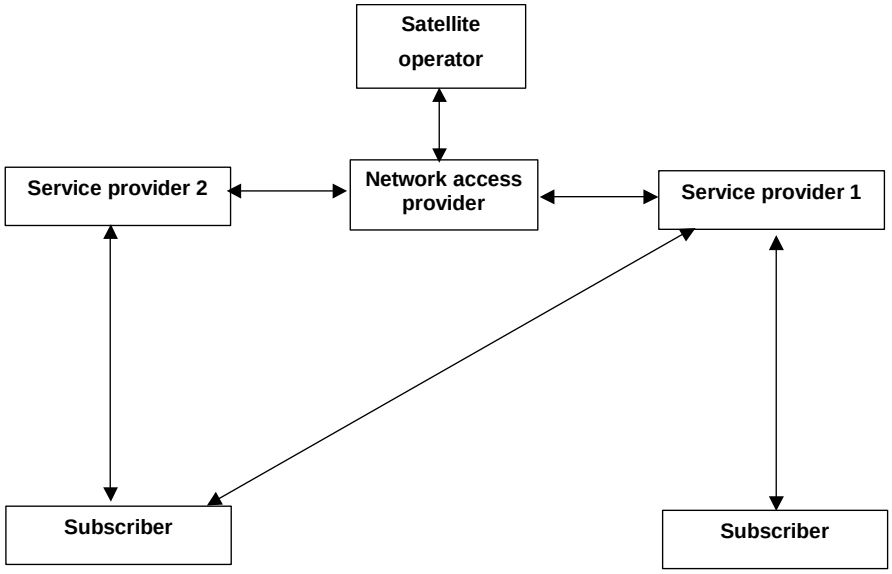


**Figure 3: Typical business model**

In this business model:

- the Network Access Provider (NAP) operates the Initialization Centre, one or several Control Centres, and Inbound and Outbound Gateways,
- the Service Providers are connected to Inbound and Outbound Gateways,
- the Service Providers to be connected to may be selected by the ST user,
- according to the type of service (e.g. telephony), several subscribers may share a ST.

## 4.5 Outbound Channel

### 4.5.1 Outbound Channel in a star network

For a star network, an outbound channel is a channel arriving to the Satellite Terminal, and coming from an Outbound Gateway as shown in figure 4.

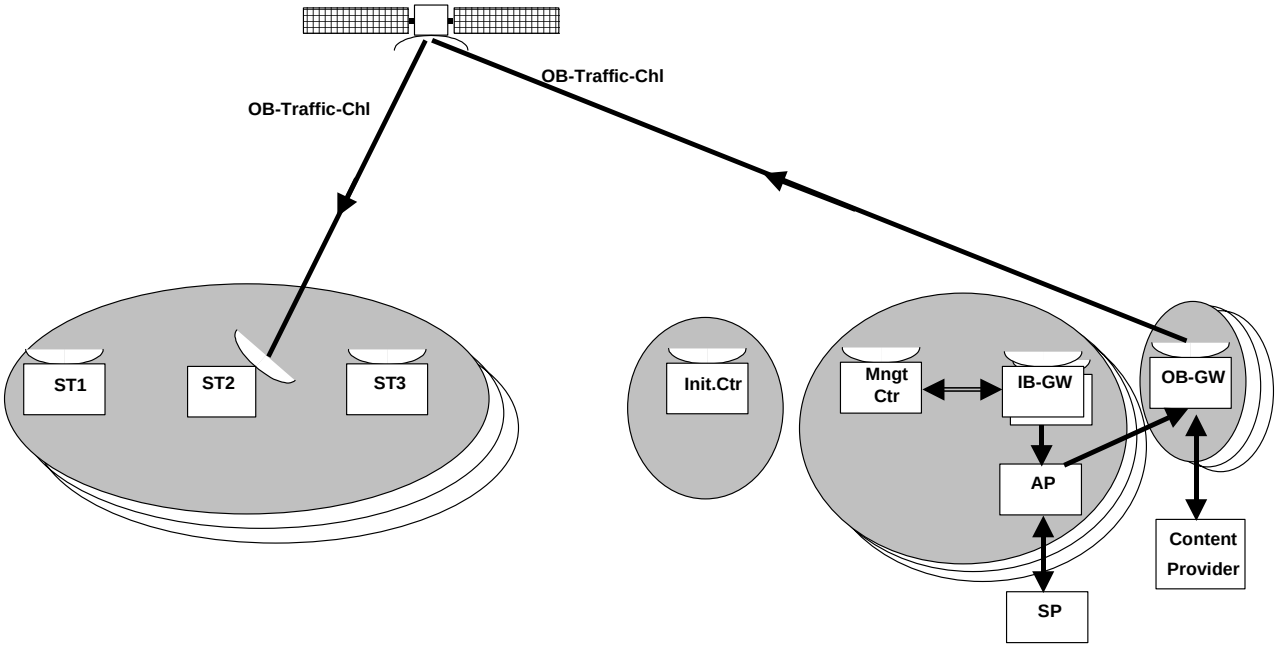


**Figure 4: Outbound Channel in a star network**

### 4.5.2 Outbound Channel in a mesh network

For a mesh network, an outbound channel is a channel arriving to a Satellite Terminal, and coming from another Satellite Terminal as shown in figure 5.

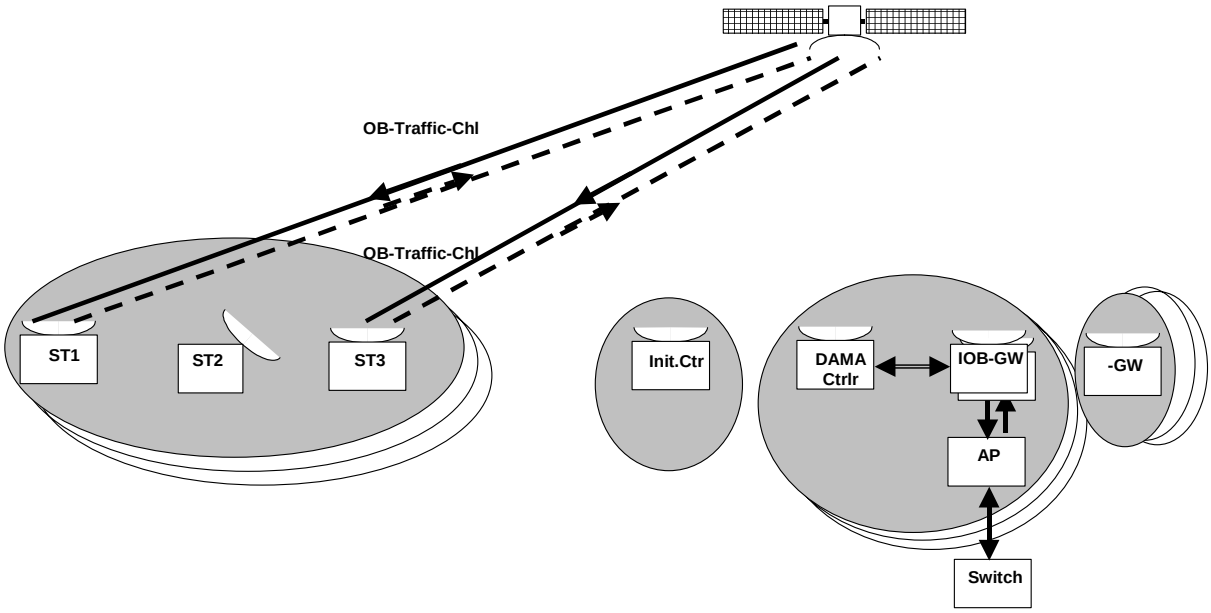


**Figure 5: Outbound Channel for a mesh network**

# 4.6 Inbound Channel

## 4.6.1 Inbound Channel in a star network

For a star network, an inbound channel is a channel arriving to the inbound Gateway, and coming from a Satellite Terminal as shown in figure 6.

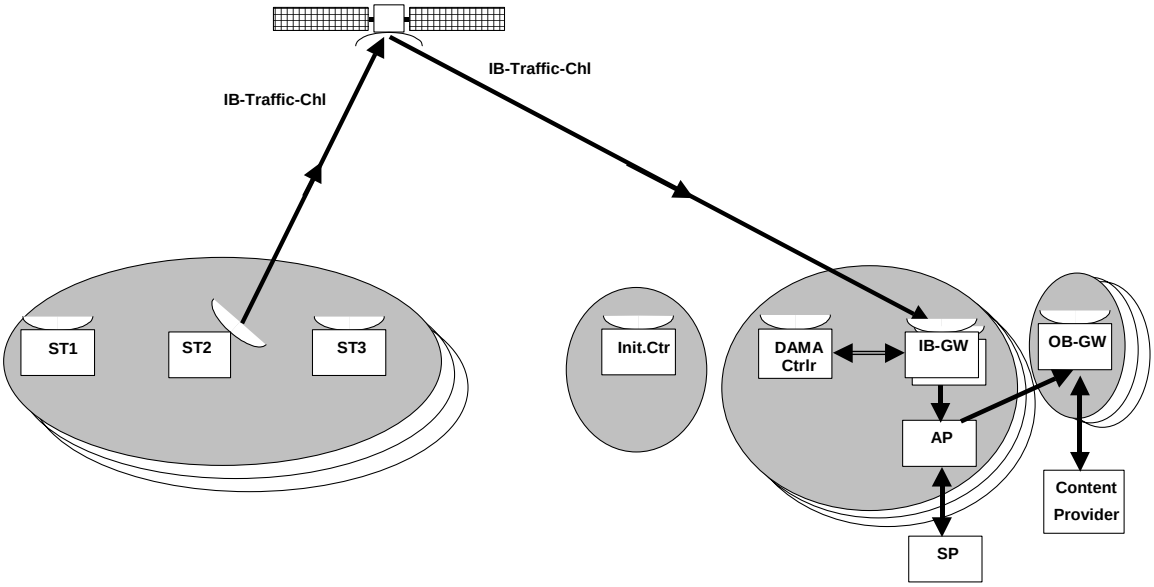


**Figure 6: Inbound Channel in a star network**

## 4.6.2 Inbound Channel in a mesh network

For a mesh network, an inbound channel is a channel arriving to a Satellite Terminal, and coming from another Satellite Terminal as shown in figure 7.

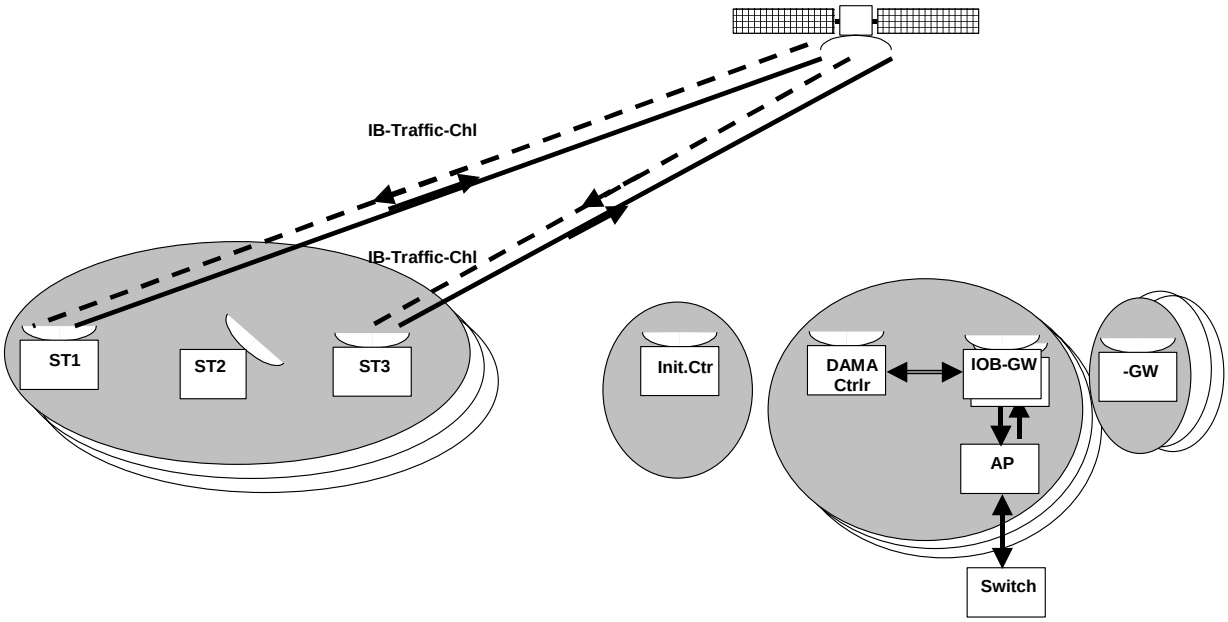


**Figure 7: Inbound Channel in a mesh network**

# 5 Section II - Guidelines for technical specifications

## 5.1 Foreword

This clause is a guideline on the technical characteristics of the air interface of a system with ASSC which have to be specified either as mandatory or as optional requirements in an ETSI Technical Specification.

## 5.2 Network architecture overview

A TS on ASSC system should define the applicable network architectures related to the air interface with the identification of the functional elements and the channels between them. Such network architectures may be star, mesh or both.

### 5.2.1 Star network

An example of a star network architecture is given in figure 8.

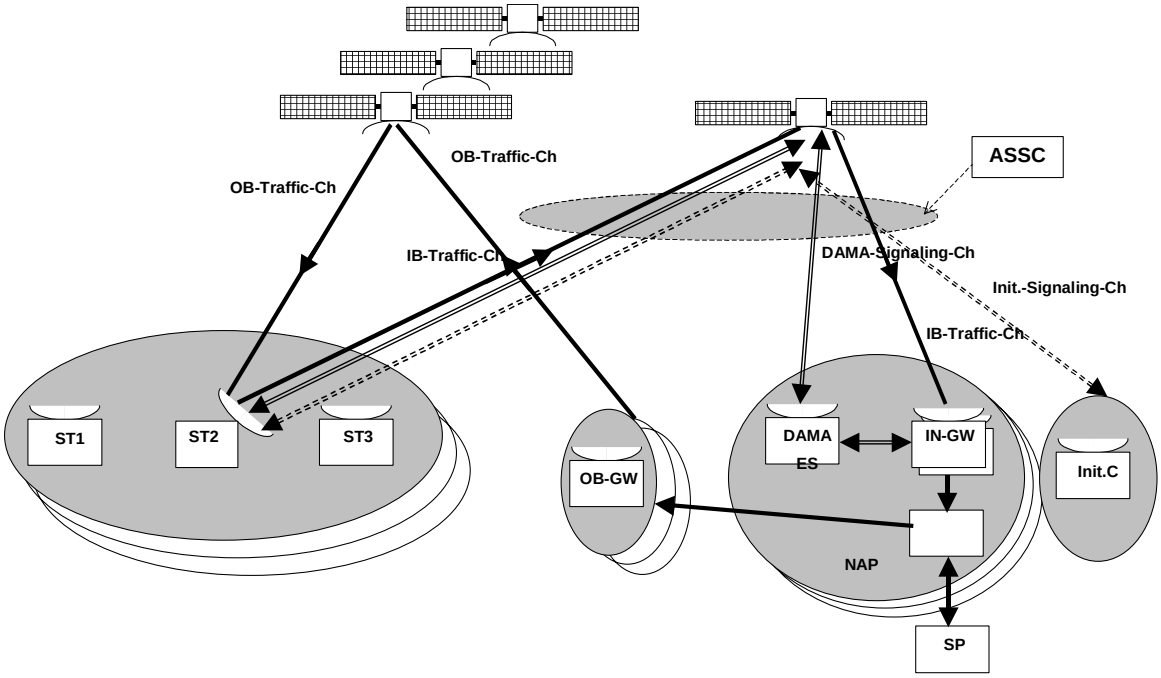


**Figure 8: Example of star network architecture**

The TS should specify whether or not:

- the Inbound GW and the Outbound GW are collocated or separated,
- more than one Inbound GW and Outbound GW are operated in the same network,
- the Inbound Traffic Channel and the Outbound Traffic Channel use the same or different satellites.

### 5.2.2 Mesh network

An example of a mesh network architecture is given in figure 9.

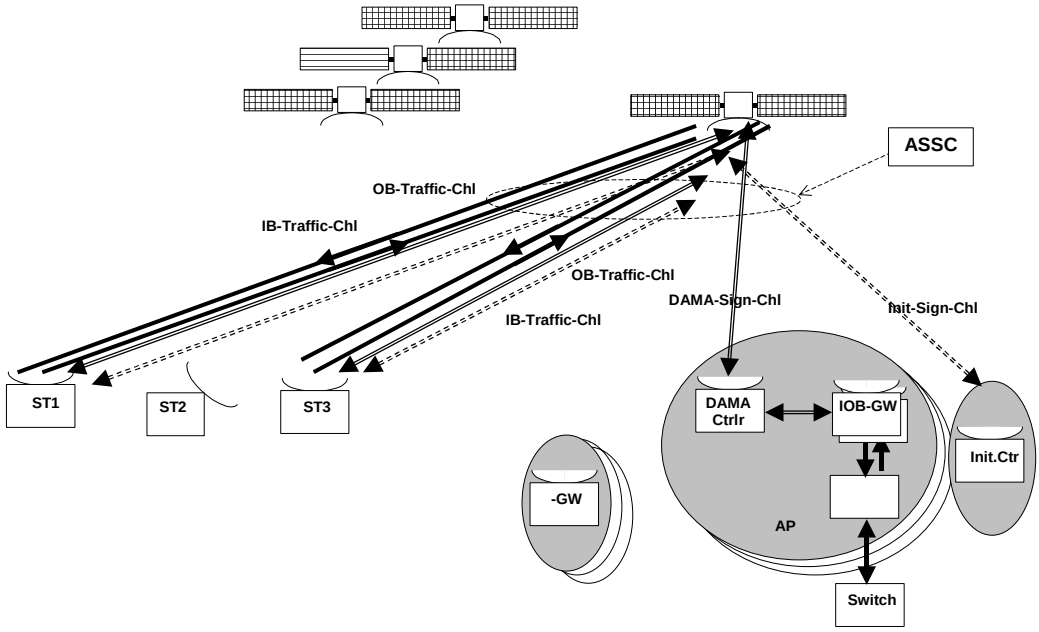


**Figure 9: Example of mesh network architecture**

In this type of network, the Inbound Traffic Channel and an Outbound Traffic Channel are transmitted between STs and consequently the inbound and outbound channels have similar structures.

## 5.3 Air interface overview

The TS should contain the following parts:

- the physical layer specification,
- the synchronization principles and specification,
- the signalling for the control and monitoring of STs,
- the signalling for the Air Interface management when applicable.

## 5.4 Air interface physical layer

The TS should specify any transmission parameter necessary for the STs to access the network, covering but not limited to the following areas:

- the radio frequency bands,
- the access method or methods: FDMA, TDMA or CDMA, etc.,
- the modulation, the coding,
- the framing according to the access method,
- the data encapsulation,
- the mechanism for rain fade compensation (e.g. uplink power control, adaptive transmission scheme, etc.^) when implemented,
- etc.

## 5.5 Synchronization

The TS should describe the synchronization principles (time, frequency, etc.) and should specify:

- the signals and information provided to the ST or to be received by the ST (e.g. GPS, etc.) for synchronization purpose, with the associated expected performances,
- the signals and information to be transmitted by the ST for synchronization purpose with the required performances.

## 5.6 Air interface signalling

### 5.6.1 General

The TS should specify:

- the signalling for the control and monitoring of STs,
- the signalling for the Air Interface management (Medium Access Control) when applicable, e.g.:
  - carriers, time slots, CDMA codes, bit rate allocation,
  - EIRP, FEC, modulation.

For system with DAMA, the TS should specify the signalling request and assignment messages.

### 5.6.2 Signalling messages

The TS should contain the list of the messages, the description of the general format of the messages and should specify each message. The exact message formats may be dependent on the network configuration.

### 5.6.3 Control and monitoring of the ST

The TS should specify:

- the state diagram of the ST. This state diagram should be consistent with the applicable harmonized standards referring article 3.2 of the R&TTE,
- the events (e.g. messages, signals, etc.) that may occur and to consider, and the required consequent action.

Where applicable, the TS should specify for:

- Terminal login: the set of messages used to identify the terminal and to verify the hardware and software configurations,
- Terminal start-stop: the messages used to start and stop either a specific terminal or a set of terminals,
- Terminal alarms: the messages used to inform about the operational parameters, equipment states and faults,
- Terminal steady state: the messages transmitted during the steady state of the ST,
- Terminal software loading: the terminal software loading process and messages,
- Terminal line-up: the messages for line-up and maintenance,

These specifications may be defined either mandatory requirements or additional optional requirements for compliance with the TS or the TS with the selected options.

### 5.6.4 Air interface management

The air interface resource management description and messages are only needed for DAMA purpose, if such a facility is offered by the system.

For systems with DAMA, the TS should specify the messages used for the air interface management (e.g. request, assignment, release).

# History

| Document history | | |
|---|---|---|
| V1.1.1 | April 2002 | Publication |
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