ETSI TECHNICAL COMMITTEE REFERENCE TECHNICAL REPORT

TCR-TR 025

July 1995

Source: ETSI TC-SES

Reference: DTR/SES-02017

ICS: 33.100

Key words: satellite links, telecommunications networks

Satellite Earth Stations and Systems (SES); Consideration of satellite links in telecommunications networks within ETSI standards

ETSI

European Telecommunications Standards Institute

ETSI Secretariat

Postal address: F-06921 Sophia Antipolis CEDEX - FRANCE
Office address: 650 Route des Lucioles - Sophia Antipolis - Valbonne - FRANCE
X.400: c=fr, a=atlas, p=etsi, s=secretariat - **Internet:** secretariat@etsi.fr

Tel.: +33 92 94 42 00 - Fax: +33 93 65 47 16

Contents

Blank page

Foreword

This Technical Committee Reference Technical Report (TCR-TR) has been produced by the Satellite Earth Stations and Systems (SES) Technical Committee of the European Telecommunications Standards Institute (ETSI). It was given the classification TCR-TR by the 19th TC Chairmens' Co-ordination (TCC) meeting, and approval by the 21st Technical Assembly (TA).

A TCR-TR is a deliverable for use inside ETSI which records output results of ETSI Technical Committee or Sub-Technical Committee studies which are not appropriate for European Telecommunications Standards (ETS), Interim European Telecommunications Standards (I-ETS) or ETSI Technical Report (ETR) status. They can be used for guidelines, status reports, co-ordination documents, etc. They are used to manage studies inside ETSI and shall be mandatorially applied amongst the concerned TCs. They shall also be utilised by the TC with overall responsibility for a study area for co-ordination documents (e.g. models, reference diagrams, principles, structures of standards, framework and guideline documents) which constitute the agreed basis for several, if not all, TCs and STCs to pursue detailed standards.

Introduction

Satellite, fibre optic, copper pair, coaxial cable and radio relay links are all transmission media. The ETSI standards should therefore take into account the use of all transmission media. The use of these media should be considered to maintain flexibility within the network.

When the Integrated Services Digital Network (ISDN) standards were developed, the propagation delay of satellite links was not always correctly taken into account. This led to inefficient use of the satellite capacity and occasional exclusion of the use of satellites. This development was neither deliberate, nor caused by service requirements and has led to complications when satellite links are inserted within the network. Efforts have been made to modify the ISDN standards to enable efficient use of satellite links. However, modifying published ETSs can be a very time consuming process which should be avoided if possible.

The information included in this report is intended to help in the maintenance of existing ETSI standards and in the development of future ETSI standards, and should be used as a check list before the approval of those ETSs.

Blank page

1 Scope

This TCR-TR describes issues related to the use of satellite links in telecommunications networks which should be taken into account during development and maintenance of the ETSI standards.

2 References

This TCR-TR incorporates by dated and undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this TCR-TR only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies.

[1] ITU-T Recommendation G.114 (1994): "One-way transmission time".

[2] ITU-T Recommendation G.821 (1989): "Error performance of an international digital connection forming part of an ISDN".

[3] ITU-T Recommendation G.826 (1993): "Error performance parameters and objectives for international constant bit rate digital paths at or above the primary rate".

[4] ITU-R Recommendation 614-3: "Allowable error performance for a hypothetical digital path in the fixed-satellite service operating below 15 GHz when forming part of an international connection in an integrated services digital network".

[5] ITU-R Recommendation 1062: "Allowable error performance for a hypothetical reference digital path operating at or above the primary rate".

3 Abbreviations

For the purposes of this TCR-TR, the following abbreviations apply:

B-ISDN	Broadband ISDN
BER	Bit Error Ratio
GSM	Global System for Mobile Communications
GHz	Gigahertz
IN	Intelligent Network
ISDN	Integrated Services Digital Network
ms	milliseconds
N-ISDN	Narrowband ISDN
OSI	Open Systems Interconnection
PSPDN	Packet Switched Public Data Network
PSTN	Public Switched Telephone Network
VSAT	Very Small Aperture Terminal

4 Satellites in the network

Satellite links are present in many types of networks, e.g. Public Switched Telephone Network (PSTN), Packet Switched Public Data Network (PSPDN) and ISDN.

Generally, they can be used either as mere physical links between network nodes (see figure 1) or as complete networks (see figure 2). Examples of the figure 1 are point-to-point links used in today's telecommunication networks. Figure 2 can be exemplified by point-to-multipoint systems (also used in the telecommunications network) or private Very Small Aperture Terminal (VSAT) networks.

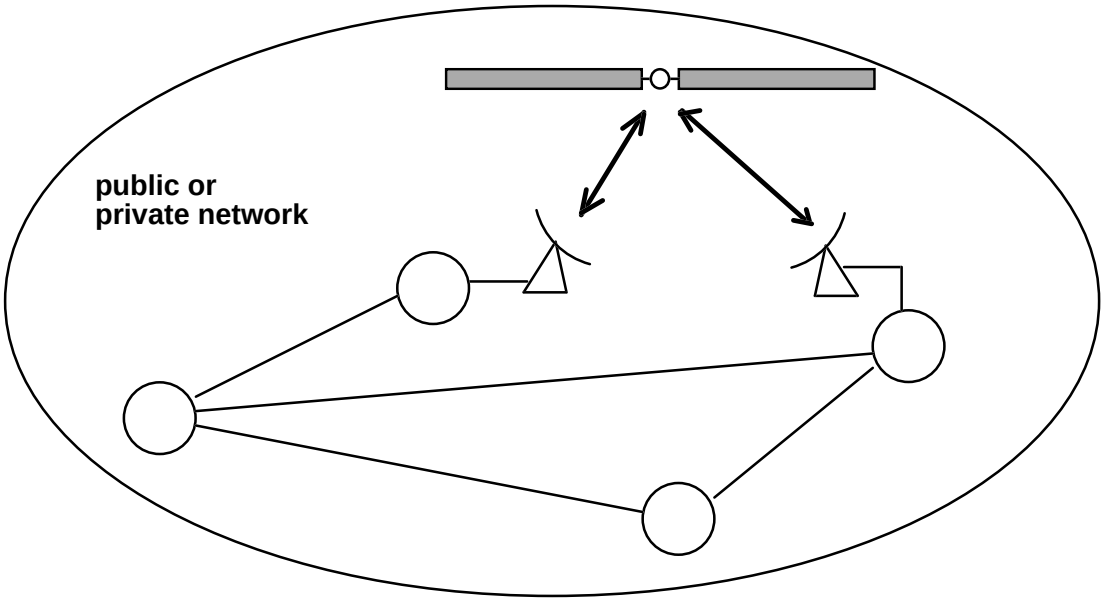

Figure 1: Satellite link used as a physical link in a network

Satellite links are commonly used for international connections, because of their ability to interconnect sites within a large geographical area independently of the actual distance between transmitter and receiver (see figure 3).

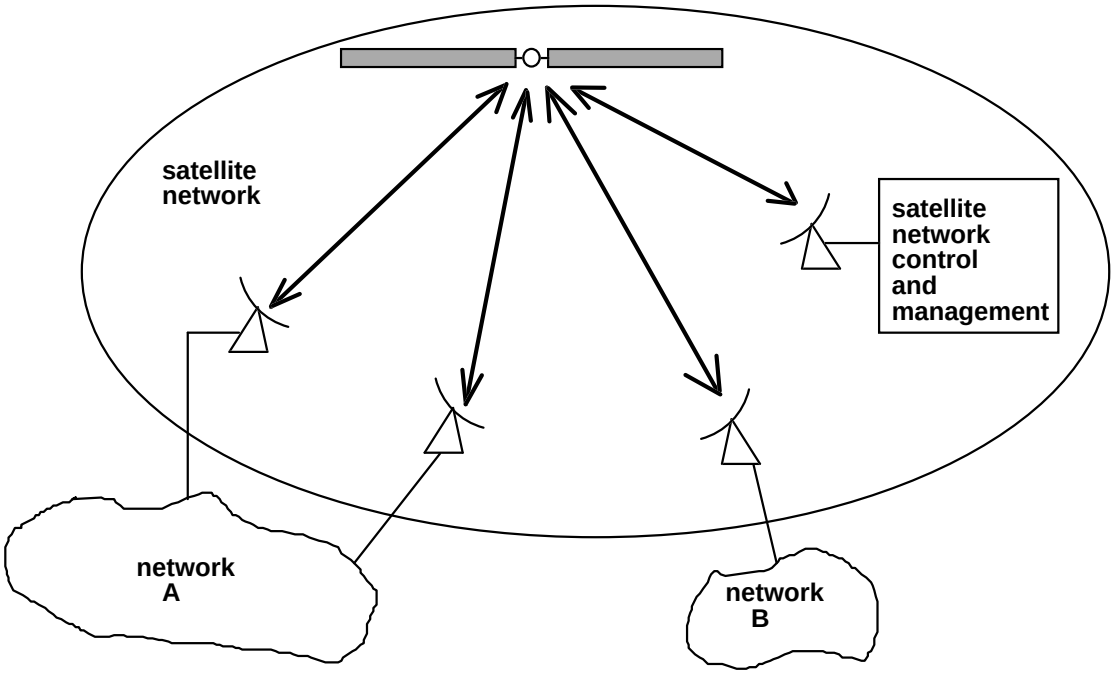

Figure 2: Satellite links used between networks

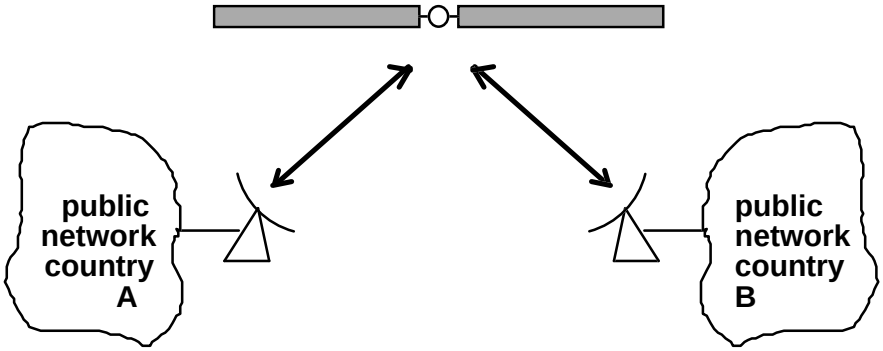

Figure 3: Satellite links used in the international portion of public networks

Concerning public national networks, satellite links can also be used in the access portion to connect remote users to the network (see figure 4).

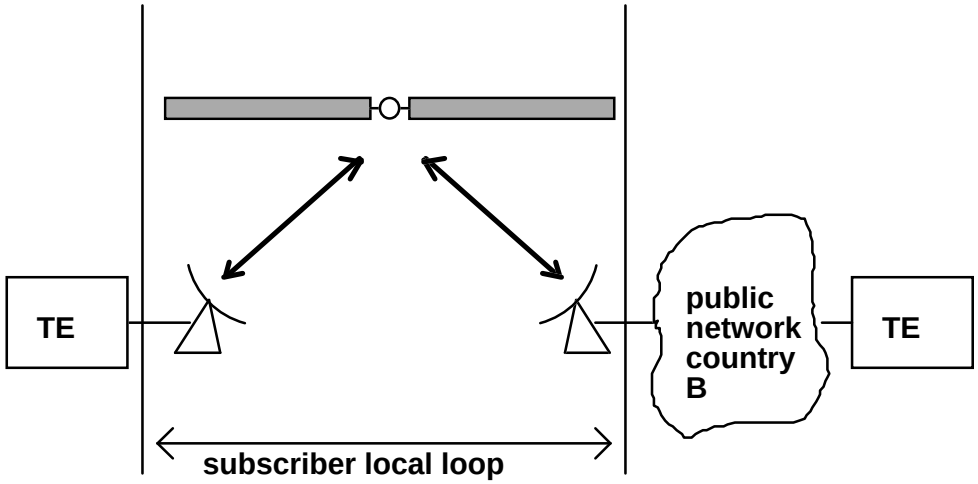

Figure 4: Satellite link used in the access portion of a public network

Private networks using satellites, often VSAT networks, can be used, for example, between different sites of a company, where satellite dishes are installed on the company's premises (see figure 5).

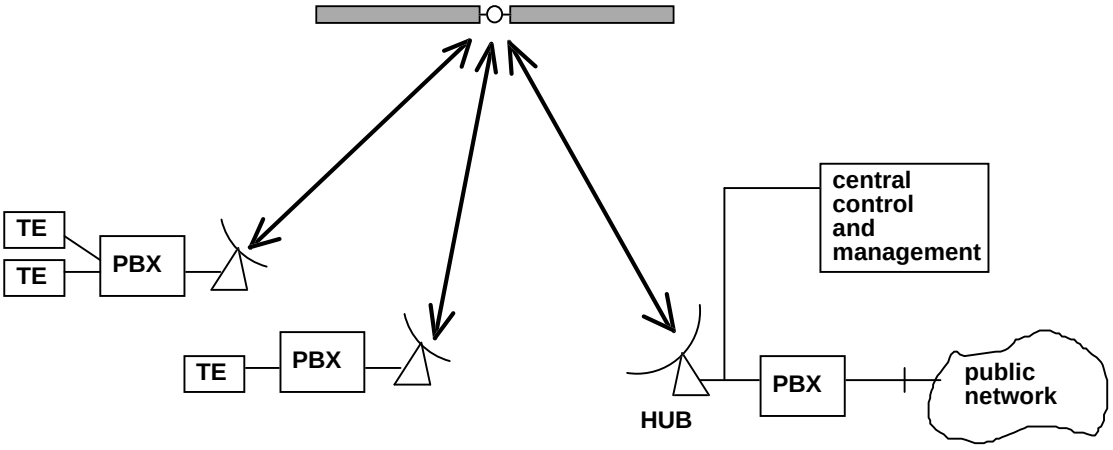

Figure 5: Satellite networks used as private networks

Finally, satellites are widely used and are very favourable for distribution services. This is because of the physical characteristics of satellite links, which are advantageous for point-to-multipoint connections - all earth stations in the coverage area can receive the transmitted signal (see figure 6).

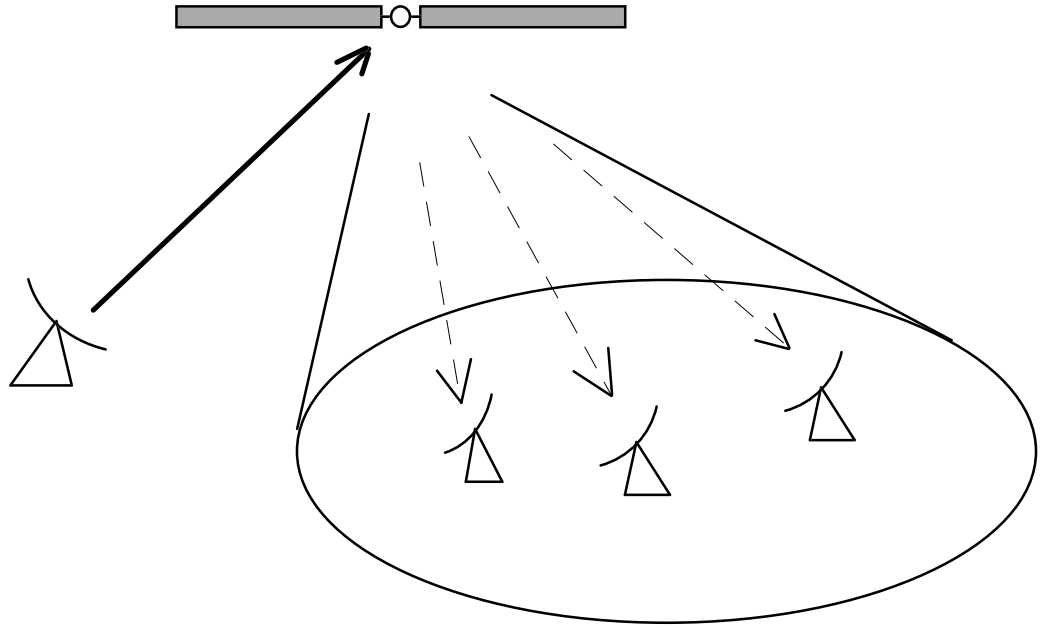

Figure 6: Satellite used for distribution services or point-to-multipoint connections

5 General satellite characteristics

5.1 Telecommunications satellites

Telecommunications satellites are generally located in a geostationary orbit at 36 000 km over the equator. The propagation delay involved when transmitting a signal from the earth to a geostationary satellite and down to earth again is around 260 ms (see ITU-T Recommendation G.114 [1]). This delay can not be reduced and may not degrade the services when protocols are properly designed for long delay/high bandwidth routes. The interconnection of two satellite links in tandem is possible but it adds the individual propagation delays and is therefore currently not recommended by ITU-T for voice services.

NOTE: The delay of a non geostationary satellite will differ from the mentioned figure depending on the orbit. Possible future non-geostationary satellite systems will have variable and generally lower propagation delays.

5.2 Satellite links quality

Satellite links are designed to fulfil the ITU-T quality requirements as defined in ITU-T Recommendation G.821 [2] and ITU-T Recommendation G.826 [3]. The quality obtained is strictly related to the cost in terms of earth station equipment and satellite capacity. Therefore, any wanted quality can be obtained by designing the link accordingly. In the design of satellite links, the attenuation caused by rain and other factors relevant in radio communication is taken into account by the addition of a margin. Due to these propagation factors link quality is not constant in time. Satellite links are therefore designed to meet the requirements during the worst month of the year. Thus, the link quality is much better than designed for most of the time. When speaking about the quality of a digital transmission over a satellite link, Bit Error Ratio (BER) values have to be linked to a percentage of time for the worst month. Recommended values for specific services are found in ITU-R Recommendation 614-3 [4] for Narrowband ISDN (N-ISDN) and ITU-R Recommendation 1062 [5] for Broadband ISDN (B-ISDN) (complying respectively with ITU-T Recommendation G.821 [2] and ITU-T Recommendation G.826 [3]).

5.3 Satellite links availability

The availability of satellite paths is very high. Interruptions due to rain attenuation last for short time periods (in the order of a few minutes), after which the path returns to the available state afterwards without the need of any repair.

5.4 Point-to-multipoint operation

Satellite links are advantageous for point-to-multipoint operations, since all earth stations within the coverage area can receive the same transmitted signal; this making efficient use of transmission capacity.

6 Guidelines

This clause aims at listing in what areas specific satellite characteristics should be taken into account when drafting or maintaining a standard, in order to insure efficient use of satellite links:

- propagation delay: the propagation delay when a geostationary satellite link is used is approximately 260 ms. This constraint should be compared to the service requirements on overall end-to-end delay. Examples are voice services, which have an end-to-end requirement of 400 ms (cf. ITU-T Recommendation G.114 [1]), and data services, which have no severe requirements on delay as long as the throughput is not affected. Interactive video is likely to have at worst the same delay requirements as interactive voice;

- processing delay: depending on the digital technique used for the transmission over the satellite link, some processing delay (2 to 80 ms for buffering and Doppler compensation) may need to be included as should any other processing delay (e.g. videoconferencing) to get the end-to-end delay of a connection;

- protocols: protocols at all layers of the Open Systems Interconnection (OSI) stack should be designed to work efficiently over long-delay routes. Matters of concern are timers and acknowledgement of received data;

  In some satellite network designs, the layer 2 protocol within the satellite network may be different from the layer 2 protocol at its external interfaces at the earth station in order to adapt to the satellite link transmission characteristics (delay, BER, etc.).

  In these designs, the appropriate actions to be taken in the case of a failure of the intermediate layer 2 need to be defined.

- signalling: although the signalling may use special routes through the network, there may be occasions when satellite links are the only means available for transporting signalling, e.g. for restoration purposes or when the satellite link is used in the access network. The signalling protocols should therefore be able to work properly over long-delay routes. In the case of a satellite being used in the access network, the signalling protocol shall provide the capability to convey the information that a satellite link is already present in the connection. Also, when the signalling is intended to support point-to-multipoint services, the signalling protocols should be designed to include point-to-multipoint operation making use of the inherent broadcasting capabilities of satellite links;

- management: satellite links may be managed together with the other links of the network. Therefore, in order to get an efficient overall network management, the specific supervising functions used for satellite links can be forwarded to the overall network management centres.

7 Conclusions

Considering that:

- the only characteristic proper to the fixed satellite communications is that they use geostationary satellites and therefore the propagation delay is around 260 ms;

- a satellite link can be part of a trunk or in the user access portion of a connection;

- the delay also impacts the user terminal protocols, e.g. for telematic terminals or user access signalling;

- it is desirable that terminals are able to offer similar operation whatever the transmission medium is;

- recommendations clearly express that "services should be able to be described in the context of multiple environments (e.g. Global System for Mobile Communications (GSM), Intelligent Network (IN), B-ISDN, satellite) and multiple network operator and service provider domains";

  NOTE: ETSI TC-NA are preparing a TCR-TR on this subject.

- any architecture adopted should not exclude the use of specific network technologies, e.g. satellite;

in ETSs the full compatibility with satellite transmission links should be included wherever possible. Whenever questions or difficulties are encountered in the establishment of the ETS versus the use of satellite transmission, TC-SES shall be informed in order to consider and advise on the difficulty.

History

Document history	
July 1995	First Edition
March 1996	Converted into Adobe Acrobat Portable Document Format (PDF)

ISBN 2-7437-0172-2
Dépôt légal : Juillet 1995