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**Satellite Earth Stations and Systems (SES);
Common Technical Regulations (CTRs)
in the satellite earth station equipment field**

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Foreword

This ETSI Technical Report (ETR) was produced by the Satellite Earth Stations and Systems (SES) Technical Committee of the European Telecommunications Standards Institute (ETSI).

ETRs are informative documents resulting from ETSI studies which are not appropriate for European Telecommunication Standard (ETS) or Interim European Telecommunication Standard (I-ETS) status. An ETR may be used to publish material which is either of an informative nature, relating to the use or the application of ETSs or I-ETSs, or which is immature and not yet suitable for formal adoption as an ETS or an I-ETS.

Introduction

This ETR has been produced by ETSI in response to BC-T-037-SI "Study and investigation mandate forwarded to CEN/CENELEC/ETSI in the field of information technology and telecommunication" on the subject "CTRs in the Satellite Earth Station Equipment field".

The preparation of the report has included studies of the Council Directives, references [1] to [5] inclusive to ascertain their relationship to standards prepared by ETSI, references [6] to [16], and by CENELEC, references [17] and [18], for equipment covered by the Satellite Earth Station (SES) Directive [1]

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1 Scope

This European Telecommunications Standards Institute (ETSI) Technical Report (ETR) has been produced in order to define the Technical Bases for Regulation (TBRs) that are needed for inclusion in Common Technical Regulations (CTRs) to be applied under the Satellite Earth Station Directive (93/97/EEC) [1].

TBRs are normally derived from base voluntary standards, and the following types of satellite earth stations and base standards have been considered:

- Ku-band TeleVision Receive Only (TVRO) earth stations (ETS 300 158 [7] and ETS 300 249 [11]);
- Ku-band Very Small Aperture Terminals (VSATs) (ETS 300 157 [6], ETS 300 159 [8], ETS 300 160 [9] and ETS 300 161 [10]);
- L-band and Ku-band land mobiles (ETS 300 254 [12], ETS 300 255 [13] and ETS 300 282 [14]);
- Ku-band Satellite News Gathering (SNG) transportable earth stations (ETS 300 327 [15]).

This ETR does not consider Satellite Earth Stations within the scope of other existing and future ETSs in the satellite field, in particular for Satellite Personal Communications Network (S-PCN) (DTR/SES-00002) and Universal Mobile Telecommunications Systems (UMTS).

This ETR contains:

- an analysis of the relationship between the SES Directive [1] and the Telecommunications Terminal Equipment (TTE) Directive (91/263/EEC) [2] and their application to satellite earth stations leading to recommendations on the form and contents of satellite earth station TBRs;
- a discussion and recommendations on the principles for the application of the essential requirements concerned with Electro-Magnetic Compatibility (EMC) and effective use of the radio spectrum;
- a detailed review of the base standards to identify which requirements should be included in TBRs;
- preliminary recommendations, including scopes, for the TBRs to be produced.

2 References

This ETR incorporates by dated and undated reference, provisions from other publications. These 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 ETR only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies.

- [1] Council Directive 93/97/EEC (1993): "Supplementing Directive 91/263/EEC in respect of satellite earth station equipment". (The SES Directive).
- [2] Council Directive 91/263/EEC (1991): "On the approximation of the laws of the Member States concerning telecommunications terminal equipment, including the mutual recognition of their conformity". (The TTE Directive).
- [3] Council Directive 89/336/EEC (1989): "On the approximation of the laws of Member States relating to electromagnetic compatibility". (The EMC Directive).
- [4] Council Directive 73/23/EEC (1973): "On the harmonisation of the laws of Member States relating to electrical equipment designed for use within certain voltage limits". (The Low Voltage Directive).
- [5] Council Directive 90/387/EEC (1990): "On the establishment of the internal market for telecommunications services through the implementation of open network provision". (The ONP framework Directive).

- [6] ETS 300 157 (1992): "Satellite Earth Stations (SES); Receive-only Very Small Aperture Terminals (VSATs) used for data distribution operating in the 11/12 GHz frequency bands".
- [7] ETS 300 158 (1992): "Satellite Earth Stations (SES); Television Receive Only (TVRO-FSS) Satellite Earth Stations operating in the 11/12 GHz FSS bands".
- [8] ETS 300 159 (1992): "Satellite Earth Stations (SES); Transmit/receive Very Small Aperture Terminals (VSATs) used for data communications operating in the Fixed Satellite Service (FSS) 11/12/14 GHz frequency bands".
- [9] ETS 300 160 (1992): "Satellite Earth Stations (SES); Control and monitoring functions at a Very Small Aperture Terminal (VSAT)".
- [10] ETS 300 161 (1992): "Satellite Earth Stations (SES); Centralised control and monitoring functions for VSAT networks".
- [11] ETS 300 249 (1993): "Satellite Earth Stations (SES); Television Receive-Only (TVRO) equipment used in the Broadcasting Satellite Service (BSS)".
- [12] ETS 300 254 (1994): "Satellite Earth Stations and Systems (SES); Land Mobile Earth Stations (LMESs) operating in the 1,5/1,6 GHz bands providing Low Bit Rate Data Communications (LBRDCs)".
- [13] ETS 300 255 (1994): "Satellite Earth Stations and Systems (SES); Land Mobile Earth Stations (LMESs) operating in the 11/12/14 GHz bands providing Low Bit Rate Data Communications (LBRDCs)".
- [14] ETS 300 282 (1994): "Satellite Earth Stations and Systems (SES); Network Control Facilities (NCFs) for Land Mobile Earth Stations (LMESs) operating in the 1,5/1,6 GHz bands and 11/12/14 GHz bands providing Low Bit Rate Data Communications (LBRDCs)".
- [15] ETS 300 327 (1994): "Satellite Earth Stations and Systems (SES); Satellite News Gathering (SNG) Transportable Earth Stations (TESs) (13-14/11-12 GHz)".
- [16] Draft prETS 300 339 (1993): "Radio Equipment and Systems (RES); Generic Electro-Magnetic Compatibility (EMC) for radio equipments".
- [17] EN 50081-1 (1991): "Electromagnetic Compatibility - Generic emission standard - Part 1: Residential, commercial and light industry".
- [18] EN 50082-1 (1991): "Electromagnetic compatibility - Generic immunity standard - Part 1: Residential, commercial and light industry".
- [19] Handbook on CTRs, Issue 3, 30 June 1993 (The CTR Handbook).
- [20] Radio Regulations of the International Telecommunications Union.
- [21] ETR 034 (1991): "Business Telecommunications (BT); Approval requirements for complex customer premises apparatus and installations connected to the Public Integrated Services Digital Network (ISDN) (including principles for the application of the essential requirements to any apparatus)".
- [22] TBR 005 (1993): "European digital cellular telecommunications system; Attachment requirements for Global System for Mobile communications (GSM) mobile stations; Access".

3 Definitions and abbreviations

3.1 Definitions

For the purposes of this ETR, the following definitions apply:

Network Termination Point (NTP): All physical connections and their technical access specifications which form part of the public telecommunications network and are necessary for access to and efficient communications through that public network.

NOTE 1: This definition is taken from the Open Network Provision (ONP) framework Directive [5].

public telecommunications network: The public telecommunications infrastructure which permits the conveyance of signals between defined network termination points by wire, by microwave, by optical means or by other electromagnetic means.

NOTE 2: This definition is taken from the TTE Directive. It does not clarify fully what is meant by the term "public" and the problems caused by this lack of clarity are discussed in the report.

NOTE 3: The term "public" is not defined clearly and is subject to the following interpretations:

- a public network is a network declared to be "public" by a Governmental decision at national or European level; or
- a public network is a network open to the public.

The Commission, Approvals Committee for Terminal Equipment (ACTE) and Technical Regulations Application Committee (TRAC) are invited to define which categories of network are considered public in order that ETSI is able to identify the locations of the NTPs where the essential requirements of the Directives have to be applied and for which TBRs have to be prepared.

satellite earth station equipment: Equipment which is capable of being used either for transmission only (transmit only), or for transmission and reception (transmit/receive), or for reception only (receive only), of radiocommunication signals by means of satellites or other space based systems, but excluding purpose built satellite earth station equipment intended for use as part of the public telecommunications network of a Member State.

NOTE 4: The phrase "purpose built" does not appear in the French text of the SES Directive and is omitted from Whereas (15) of the German text. This inconsistency has caused considerable difficulty and confusion. This ETR is written on the presumption that the phrase "purpose built" should be included.

terrestrial connection to the public telecommunications network: Any connection to the public telecommunications network which does not include a space segment.

terminal equipment: Equipment intended to be connected to the public telecommunications network, i.e.:

- a) to be connected directly to the termination of a public telecommunications network; or
- b) to interwork with a public telecommunications network being connected directly or indirectly to the termination of a public telecommunications network,

in order to send, process or receive information.

The system of connection may be wire, radio, optical or other electromagnetic system.

3.2 Abbreviations

For the purposes of this ETR, the following abbreviations apply.

ACTE	Approvals Committee for Terminal Equipment
BSS	Broadcasting Satellite Service
CTR	Common Technical Regulation
eirp	equivalent isotropically radiated power
EMC	Electro-Magnetic Compatibility
ERC	European Radiocommunications Committee
ERMES	European Radio Message System
FSS	Fixed Satellite Service
GSM	Global System for Mobile communications
ISDN	Integrated Services Digital Network
ITU-R	International Telecommunications Union - Radiocommunications
LMES	Land Mobile Earth Station
LNB	Low Noise Block downconverter
LO	Local Oscillator
NTP	Network Termination Point
ONP	Open Network Provision
PBX	Private Branch Exchange
RES	Radio Equipment and Systems
S-PCN	Satellite Personal Communications Network
SES	Satellite Earth Stations (and Systems; since June 1993)
SNG	Satellite News Gathering transportable earth station
TBR	Technical Basis for Regulation
TC	Technical Committee
TES	Transportable Earth Station
TRAC	Technical Regulations Application Committee
TTE	Telecommunication Terminal Equipment
TVRO	TeleVision Receive Only
UMTS	Universal Mobile Telecommunications Systems
VSAT	Very Small Aperture Terminal

4 Approach taken and structure of the report

The approach taken in the preparation of this report has been:

- to study the SES Directive [1] and the TTE Directive [2];
- to analyse how these Directives relate to actual satellite networks and earth station equipment;
- to cross check the interpretation of the Directives with the Commission and obtain up-to-date information on the policy of the Commission;
- to develop principles for the treatment of the essential requirements concerning EMC and effective use of the radio spectrum;
- to analyse the existing and draft base standards to identify essential requirements;
- to review the essential requirements from the base standards and identify where similar requirements are applied, or should be applied, to different types of satellite earth stations, or to different bands;
- to recommend a list of TBRs with scopes designed to maximize the utility of the documents;
- to draft scopes for the TBRs recommended;
- to draft contents lists for the TBRs recommended.

Consequently the clauses in this report are grouped as follows:

- analysis of the Directives and their relationship to satellite networks;
- identification of the essential requirements;
- discussion of the formulation of the essential requirements for EMC and effective use of the spectrum;
- analysis of existing and draft base standards;
- synthesis of findings and recommendations for TBRs;
- details of TBRs to be drafted.

5 Executive summary

This ETR contains the detailed assessment of the TBRs that need to be prepared for use as CTRs under the SES Directive [1].

The first part of the ETR considers the role of satellite TBRs under both the SES Directive [1] and the TTE Directive [2] and clarifies their application to satellite networks including VSAT and mobile services. Account is taken of advice from the Commission that the satellite air interface from a satellite earth station is not to be regarded as a NTP at which there is connection to a public network. Because of issues arising from this advice, the attention of the Commission, ACTE and TRAC is drawn to clause 19.

Detailed consideration is given to:

- the treatment of EMC requirements;
- requirements for the effective use of the radio spectrum and orbital resources;
- avoidance of harmful interference.

The effective use of the radio frequency spectrum issues are related to frequency coordination and licensing, because satisfactory operation in these respects is not only a function of the characteristics of the satellite earth station equipment but also of the way in which it is used and where it is located. The need for licensing and frequency coordination is recognized in the SES Directive [1].

A detailed analysis is given of all the requirements in the existing standards for satellite earth stations to identify which requirements are essential and should be included in the TBRs.

The main conclusions and recommendations are as follows:

- a) the satellite earth station TBRs should be designed to follow a modular approach which will allow them to be applied in conjunction with other TBRs to satellite earth stations. This approach minimises the repetition of requirements and maximizes the freedom for equipment designers;
- b) the TRAC Guidelines on the application of CTRs should be enhanced;
- c) using this modular approach, the preliminary analysis suggests that the essential requirements to be included in satellite earth station TBRs are:
 - EMC specific to satellite earth station equipment;
 - effective use of the radio spectrum, including effective use of orbital resources and the avoidance of harmful interference.

Other essential requirements, where applicable, are covered in other TBRs or, where there are no TBRs, in national approved standards. The final selection and specification of the requirements to be included in the TBRs will be decided by ETSI TC-SES and relevant STCs.

- d) the EMC requirements specific to satellite earth station equipment should be taken to be requirements that are not covered within a generic or product family standard that is a harmonised standard applied under the EMC Directive [3]. However immunity requirements should be included in the TBR only where they protect the operation of functions that are themselves the subject of essential requirements;
- e) further attention needs to be given to the overall approach to the issues of EMC, and effective use of the spectrum in order to achieve a clear and consistent structure that fits the requirements of the Directives;
- f) the objective of effective use of the spectrum cannot be achieved by the TBRs alone. Therefore, there is an important and continuing role for frequency coordination and licensing;
- g) further attention needs to be given to the provision of information (essential documentation) to the user on the intended use of the satellite earth stations. This is not covered explicitly by the SES Directive [1] but the subject is addressed briefly within the TRAC Guidelines. Likewise the provision of more detailed information is of course essential for the evaluation of the equipment;
- h) the scopes of the TBRs should be related to frequency bands and the class of earth stations considered;
- i) the following satellite TBRs should be developed:
 - L-band low bit rate data land mobiles;
 - Ku-band TVRO;
 - Ku-band VSAT satellite earth station;
 - Ku-band Land Mobile Earth Station;
 - Ku-band SNG transportable earth station.

Draft scopes are proposed for these TBRs.

6 The regulatory framework for TBRs

6.1 Introduction

The original purpose of a TBR was to express in technical terms the essential requirements for terminal equipment under the TTE Directive [2]. In the case of satellite terminals, this Directive has been supplemented by the SES Directive [1] which applies similar, but not identical, requirements to satellite earth station equipment.

A TBR, with a specific date, is produced by ETSI and adopted by a Commission Decision, after advice has been given by ACTE. In practice there is also consultation with TRAC, and with the European Radiocommunications Committee (ERC) on spectrum management issues. The Commission Decision states that its contents are being introduced as a CTR and contains non-technical information such as the date for the introduction of the CTR and the transitional arrangements. An annex to the decision refers to the TBR. The CTR does not exist as a separate self-contained document. CTRs are implemented in, and apply under, national law.

6.2 The essential requirements

Article 4.1 of the SES Directive [1] requires satellite earth station equipment to satisfy the same essential requirements as those in Article 4 of the TTE Directive [2]. The essential requirements specified in the TTE Directive [2] are the following:

- a) user safety, in so far as this requirement is not covered by Directive 73/23/EEC;
- b) safety of employees of public telecommunications networks operators, in so far as this requirement is not covered by Directive 73/23/EEC;
- c) electromagnetic compatibility requirements in so far as they are specific to terminal equipment;
- d) protection of the public telecommunications network from harm;

- e) effective use of the radio frequency spectrum, where appropriate;
- f) interworking of terminal equipment with public telecommunications network equipment for the purpose of establishing, modifying, charging for, holding and clearing real or virtual connection;
- g) interworking of terminal equipment via the public telecommunications network, in justified cases.

The cases where terminal equipment supports:

- i) reserved service according to Community law;
- ii) a service which the Council has decided that there should be Community-wide availability;

are considered as justified cases and the requirements concerning this interworking are determined in accordance with the procedure provided for in Article 14.

In addition, after consultation of representatives of the bodies referred to in Article 13 (3) and taking due account of the result of these consultations, the Commission may propose that this essential requirement is recognized as being justified for other terminal equipment in accordance with the procedure provided for in Article 14."

Although there may be essential requirements under Article 4(a) and 4(b) of the TTE Directive [2], according to Article 6 of the same Directive any such requirements are not to be included in a TBR but in a harmonised standard.

The SES Directive [1] adds the following clarifications and supplements:

Article 4.3: "..... the essential requirement concerning effective use of the radio frequency spectrum shall include the effective use of orbital resources and the avoidance of harmful interference between space-based and terrestrial communications systems and other technical systems";

Article 4.7: "... satellite earth station equipment which is not intended for connection to the public telecommunications network shall not be required to satisfy the essential requirements set out in Article 4 (b), (d), (f) and (g) of Directive 91/263/EEC".

Considerable discussion and effort has been expended on interpreting the essential requirements and establishing rather more detailed principles that address the practical technical issues involved in writing and applying TBRs to real products. The two main documents produced to date are:

- the CTR Handbook [19];
- Draft Guidelines for the Application of CTRs, NETs and National Standards to Products for Approval under Directive 91/263/EEC (this document is based on ETR 034 [21]).

6.3 The application of TBRs/CTR to products

At present TBRs/CTR apply only to:

- terminal equipment as defined under the TTE Directive [2], and
- satellite earth station equipment as defined in the SES Directive [1].

The definitions are given in clause 3.

Under the TTE Directive [2], TBRs/CTR do not apply to equipment within the public telecommunications network. Because terminal equipment is defined by reference to "interworking with" the public telecommunications network, there may be telecommunications equipment that is intended for indirect connection to a public telecommunications network, but does not interwork with it because the terminal equipment through which it is connected carries out all the interworking with the public telecommunications network. This issue has been clarified in the draft TRAC Guidelines which state that:

"Terminal equipment is equipment intended for:

- direct connection to the public telecommunications network (the system of connection may be wire, radio, optical or other electromagnetic system);
- indirect connection to the public telecommunications network, where the equipment interworks with the public telecommunications network by fulfilling part of the access signalling call control protocol that is subject to actual essential requirements; or
- (the following text is still under discussion) indirect connection where the equipment terminates a justified case service.

Equipment that may be considered in general terms to be telecommunications equipment but is outside the above definition of terminal equipment shall not be subject to any requirements under the TTE Directive [2] unless it falls under the provision of Article 2".

Under Article 3.1 of the TTE Directive [2], terminal equipment that makes use of a system of communication employing the radio spectrum is presumed to be intended for connection to the public telecommunication network. The precise effect of this Article is not entirely clear. The original intention was to include cordless telephone equipment and so to subject it to the essential requirement Article 4(e) (effective use of the radio spectrum). The existence of this Article is taken not to influence the effect of the SES Directive [1], under which Article 4(e) will be applied to all satellite earth station equipment.

There is a particular problem over the definition of satellite earth station equipment because the term "purpose built" is not present in the French text nor in Whereas (15) of the German text, although it is in the definition in the German text. This ETR assumes that the term "purpose built" is included in the Directive.

Under the definition in the SES Directive [1], "satellite earth station equipment" may include satellite earth station equipment within the public telecommunications network that is not purpose-built. It would appear that the requirements of the SES Directive [1] and hence TBRs/CTRs may apply to such earth stations, however such an interpretation is not consistent with the wording of other Articles (e.g. Articles 4.5, 4.6), nor with the formulation of the essential requirements under Articles 4(d), 4(f) and 4(g) of the TTE Directive [2] where the wording presupposes that the satellite earth station is outside the public telecommunication network. It would therefore appear that only Articles 4.3 and 4.4 of the SES Directive [1] can apply to satellite earth station equipment within the public network.

Thus, in terms of the Directives, there are four categories of telecommunications equipment that may be interconnected, and the four categories are not all mutually exclusive:

- a) equipment not part of the public telecommunications network that is neither terminal equipment nor satellite earth station equipment (Other Equipment), e.g. personal computers connected to the public network by modem, where the modem would be terminal equipment;
- b) terminal equipment as defined in the TTE Directive [2];
- c) satellite earth station equipment as defined in the SES Directive [1];
- d) equipment that is part of the public telecommunications network.

The relationship between the categories is shown in the figure 1.

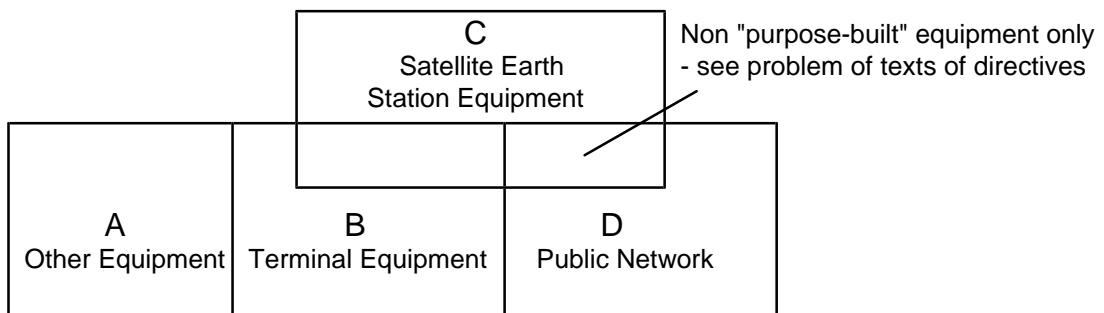


Figure 1: Relationship between equipment categories as defined in the Directives [1] and [2]

6.4 Advice from the Commission

During the production of this report, discussions were held between ETSI and the Commission to clarify the regulatory situation under the SES Directive [1]. In discussion the Commission stated the following points, which have important implications for the TBRs:

- the SES Directive [1] aims to provide a harmonised European set of requirements to be met for satellite earth station equipment to be placed on the market. It recognizes the existence of additional requirements under licensing arrangements which apply to the location and operation of satellite earth station equipment that is capable of transmitting signals. In contrast the TTE Directive [2] aims to provide requirements both for placing on the market and operation;
- requirements under Article 4(f) and 4(g) of the TTE Directive [2] are meant to apply only to the terrestrial interfaces of satellite earth station equipment, not to the interfaces towards the satellites.

The views expressed by the Commission are more restrictive than the text of the SES Directive [1] in that the Directive does not limit Articles 4(f) and 4(g) to terrestrial interfaces, and therefore conscious decisions will have to be taken on the application of these Articles in particular cases. The different possibilities are explored in the next clause.

NOTE: Guidance on the issue of whether Articles 4(f) and 4(g) should be applied to radio interfaces between satellite earth station equipment and satellites is needed from the Commission, ACTE and TRAC.

7 Satellite networks

The purpose of this clause is to describe the framework for the use of satellite earth stations.

7.1 Types of network

There are in principle the following different types of satellite network involving satellite earth stations covered by the SES Directive [1] as shown in table 1.

Table 1: Satellite network types

Type	Connection to Public Telecommunications Network via Satellite	Terrestrial Connection to Public Telecommunications Network
I	No	No
II	No	Yes
III	Yes	No

In addition, there may be both types of connection to public telecommunication networks, but this case is not described as a separate category because it is equivalent to both Types II and III applying simultaneously.

Each of the above types of network may be one way (involving receive-only earth stations) or two-way. The different types are now discussed in more detail. In the following diagrams the satellite earth station is shown as terminating the communication. In practice the communication may be terminated in a separate terminal.

7.2 Type I: no connection to the public telecommunication network

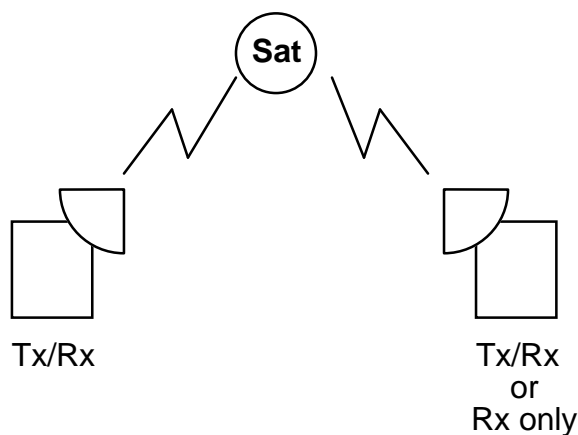


Figure 2: Diagram of Type I network

The most common examples would be specialised data distribution networks and TV broadcasting, however in many cases TV broadcasting is connected to the public telecommunications infrastructure, e.g. leased lines, which is used to feed programmes to the transmitting earth station, in which case the network would be Type II. Type I networks include those VSATs where there is no connection to the public network.

7.3 Type II: terrestrial connection to the public telecommunications network

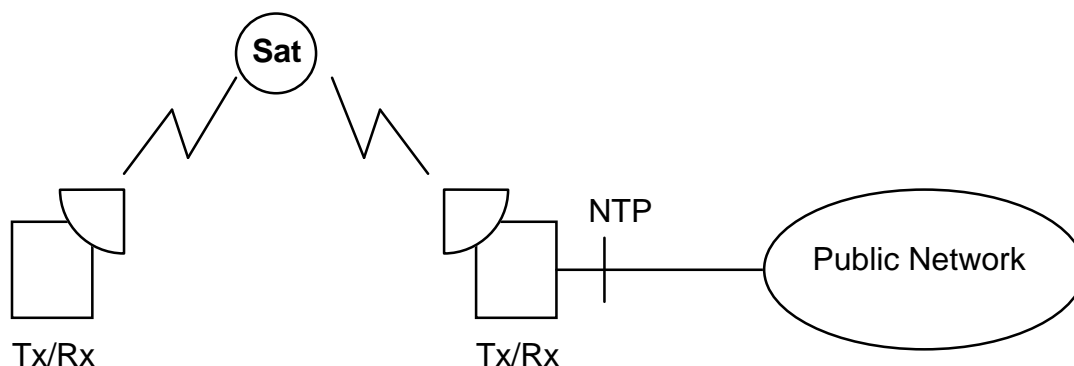


Figure 3: Diagram of a Type II network

A Type II network has a terrestrial connection to a public telecommunications network. The point of connection to the public network is the NTP. An example of a Type II network would be a VSAT network with a gateway earth station that is connected to the public network (e.g. the Integrated Services Digital Network (ISDN)). According to the principles in the draft TRAC Guidelines, there should be no direct requirements under Article 4(f) for the protocols used across a leased line. In order to be consistent with this approach, satellite earth station TBRs for Type II satellite connections should not place requirements on the protocols between the satellite earth stations.

The distinction between Type II and Type III is of particular importance because it affects the requirements that have to be applied to the satellite earth station. This issue is discussed later, after the explanation of the types of TBR.

NOTE: The location of the NTP in figure 3 (Type II network) assumes that the satellite network is not regarded as a public network under the SES and TTE Directives [1] and [2]. If the satellite network were regarded as a public network, the NTP would be between the satellite earth station equipment and the connected terminal equipment. The interface where the NTP is marked in figure 3 would then no longer be subject to regulation under the Directives [1] and [2].

7.4 Type III: connection to the public telecommunication network via satellite

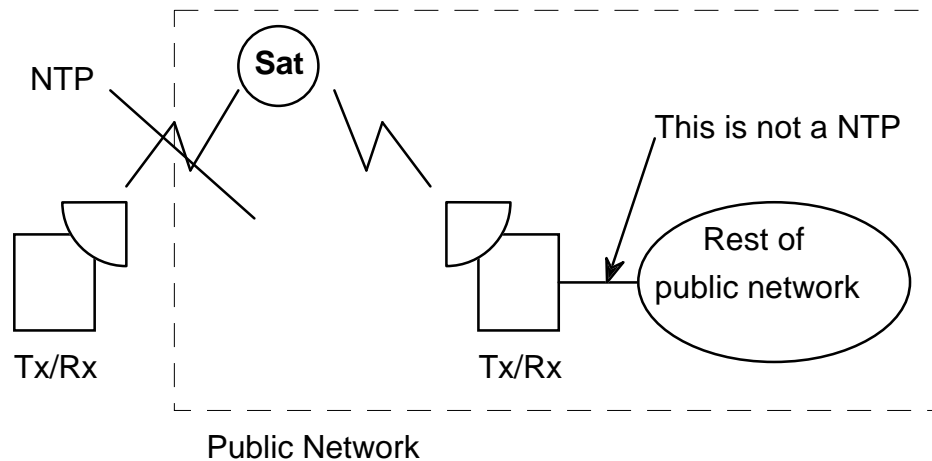


Figure 4: Diagram of a Type III network

Type III is where the satellite link is the means of access to the public network. This means that the air interface is the NTP.

The interface between a satellite network regarded as public and another public network is not an NTP and is therefore not subject to the Directives [1] and [2].

In discussion the Commission has advised that satellite networks are not to be regarded as public networks in terms of the SES Directive [1] and the TTE Directive [2], and that therefore the air interface will not be the NTP in terms of these Directives [1] and [2]. Whilst the Commission's approach may be applied readily to existing fixed networks such as VSAT and TV distribution networks, it may not always be appropriate in future. In particular the Commission approach seems to be inappropriate for some mobile networks. The main focus of this report is on existing fixed networks.

NOTE: The wording of Article 4 of the SES Directive [1] does not preclude the air interface from being the NTP.

7.5 Interworking with public network access protocols

Where a satellite earth station is connected to a public switched network service rather than to a leased line, the issue arises as to where the public network access protocol terminates. To put the issue in another way, the issue is how far away from the NTP the requirement on interworking with the public network extends.

This issue is addressed in the draft TRAC Guidelines. The interworking with the public network requirements end where the public network access requirements terminate. The following examples help to illustrate the approach:

- if the access is to ISDN, the requirements end where the layer 3 ISDN access protocols terminate. This may be in a through-connecting equipment adjacent to the NTP, even though this through-connecting equipment routes the call on to another equipment further away from the NTP using a different form of protocol. In this case the ISDN access requirements apply only to the through-connecting equipment, although the manufacturer may need to provide an additional terminal to stimulate the through-connecting equipment to make or answer calls for test purposes;

- alternatively, the equipment adjacent to the NTP may act as a layer 1 bridge and the access protocol may be terminated further away from the NTP. In this case when the equipment adjacent to the NTP is tested, the manufacturer must provide additional terminating equipment to enable all the tests to be carried out. Conversely, when the terminating equipment where the protocol terminates is tested, the manufacturer will need to supply an appropriate through-connecting equipment to present the signals in a form appropriate for the NTP.

Further information is contained within the draft TRAC Guidelines.

8 Type of satellite earth station TBRs

8.1 The need for a modular approach

The TBRs prepared to date exist in two main categories:

- access TBRs, which define the requirements for connection to an interface to a service provided by the public network. They contain the essential requirements under Articles 4(c) -4(f) of the TTE Directive [2]. They apply at the NTP;
- terminal TBRs, which define the requirements for interworking via the public network under Article 4(g) of the TTE Directive [2]. They apply to either or both the protocol at the NTP and the performance between the NTP and the user interface. Terminal TBRs normally apply in conjunction with a specific access TBR. European Radio Message System (ERMES) is the only case of a combined access and terminal TBR. The name "terminal" TBR is considered misleading by some but it is used fairly widely. The name "Article 4(g)" TBR would probably be better as there is no obvious way to describe this category.

These TBRs are deliberately not product specific. Their scopes are not related to a particular product category but to the type of access to the public network or the type of service. A product specific TBR would create the problem of defining the category of product to which the TBR applies. This is an almost impossible task because there is a continuum of products and no clear distinction between different categories (e.g. it is almost impossible to distinguish between Private Branch Exchange (PBXs) and multiplexers). Furthermore as technologies develop and designs change, the meaning of the names for particular product types may also change.

The existence of access and terminal TBRs is not in itself sufficient. It is necessary for there to be an established set of rules on how they should be applied to actual products. This set of rules provides the framework within which the TBRs can be used. ETSI proposed in ETR 034 [21] that this set of rules should be embodied in an "Application CTR" that would apply to all products and define principles for the use of both TBRs and national standards, because TBRs are not available for all forms of access to the public network. The draft TRAC Guidelines have been produced in response to the ETSI recommendation and these Guidelines are intended to fulfil the role of the Application CTR.

The TBRs for satellite earth stations should be consistent and compatible with the existing TBRs. If a product specific approach is adopted for satellite earth station the following problems will arise:

- there will be a clash of scopes with the terrestrial TBRs and the scopes of the terrestrial TBRs will need to be altered;
- the satellite earth station TBRs will need to include normative references to the terrestrial TBRs, and there will be a resulting need to update the satellite earth station TBRs when new terrestrial TBRs are created;
- the problem of definitions and scopes will lead to unnecessary restrictions on innovations in equipment and distortions of the market.

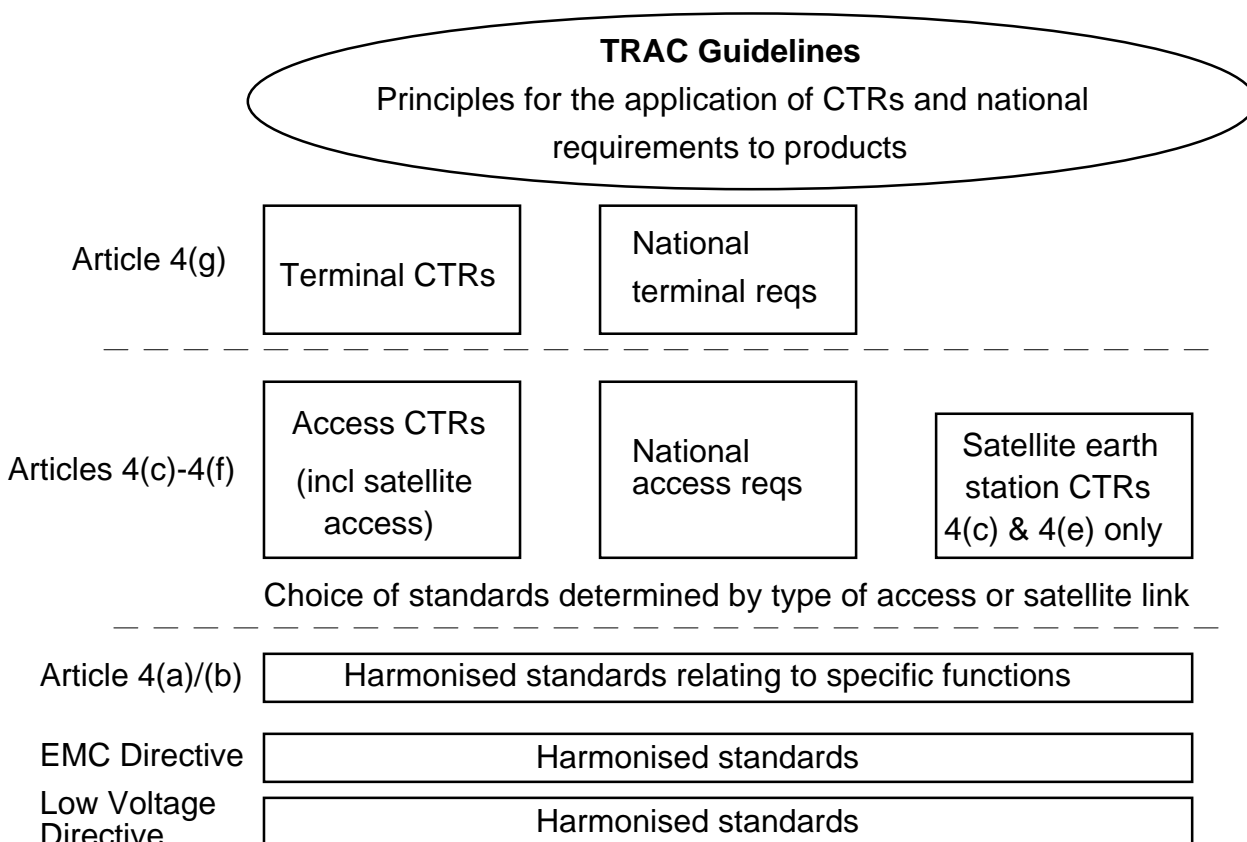
We therefore recommend that TBRs for satellite earth station equipment should be developed in a modular way to fit in with the existing terrestrial TBRs, and that the TRAC Guidelines should be extended to cover satellite earth station equipment as well as terminal equipment.

8.2 Basic types of satellite earth station TBRs

For Type I and Type II situations, this objective can be achieved by creating the "satellite earth station TBRs" for satellite earth station equipment, where the satellite earth station TBR is a new category of TBR that applies only to the radio characteristics of the satellite link and the EMC characteristics specific to the satellite earth station. Satellite earth station TBRs would apply to satellite earth station equipment irrespective of whether or not the satellite earth station equipment is also terminal equipment. They could also apply to satellite earth station equipment within the public network if it is not purpose built.

For Type III situations, the TBR for the interface towards the satellite would need to include the access protocols and would be an access TBR based on a radio interface. This is analogous to the TBR for Global System for Mobile communications (GSM) access (TBR 5 [22]). However, unlike GSM the access protocol would not necessarily be the same for all networks.

The following diagram will then illustrate the relationship between the CTRs based on the TBRs, equivalent national standards and the TRAC Guidelines. It is enhanced to show the relationship to harmonised standards used under Article 4(a) and (b) of the TTE Directive [2], the EMC [3] and Low Voltage [4] Directives:



NOTE: In this figure, the Articles refer to the TTE Directive [2].

Figure 5: Illustration of the relationship between CTRs, national requirements and the TRAC Guidelines

It should be noted that this approach is readily capable of extension to cover "radio" CTRs (analogous to satellite CTRs) if the Commission's proposal for an extension of the TTE Directive [2] to cover radio equipment goes ahead.

Whether or not the satellite earth station is connected terrestrially or indirectly to the public network will not affect the contents of the satellite earth station TBR or access TBR, although it will affect the procedure used for type approval according to Chapter II of the SES Directive [1]. Thus the same satellite earth station TBR may be used for network Types I & II.

Article 4.7 of the SES Directive [1] removes requirements under Articles 4(b), 4(d), 4(f) and 4(g) of the TTE Directive [2] for satellite earth stations that are not connected to the public network (Type I). This analysis is consistent with the above.

An important issue is what essential requirements should apply in practice to receive-only satellite earth stations. According to Article 4.1 of the SES Directive [1] all the essential requirements apply in principle, however Article 4.3 [1], which expands Article 4(e) [2] to include effective use of orbital resources and avoidance of harmful interference, specifically excludes receive-only-equipment. According to Article 4.7 [1], Articles 4(d) and 4(f) [2] do not apply. This leaves EMC, 4(c) and efficient use of the spectrum 4(e) [2].

8.3 Generic satellite earth station: example of the application of CTRs

Figure 6 shows a generic satellite earth station and the various possible interfaces:

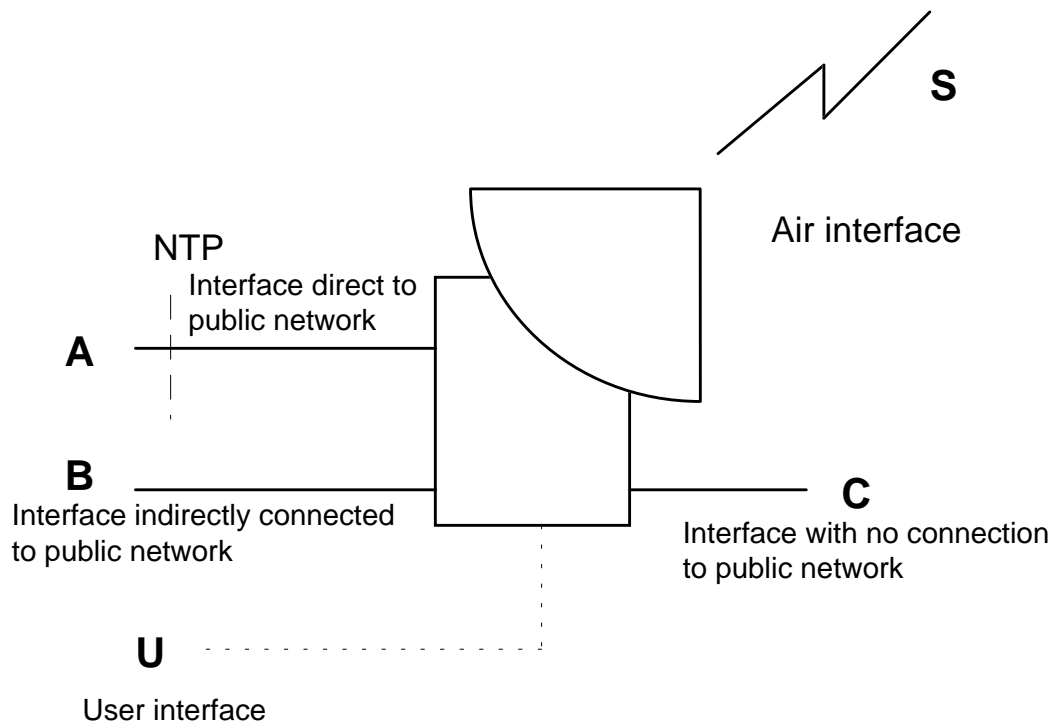


Figure 6: Generic satellite earth station

For the approval of this satellite earth station, the following requirements will apply:

- harmonised standard for safety under Low Voltage Directive [4] applied to whole equipment;
- harmonised standard (if any) for other safety issues under Article 4(a) of the TTE Directive [2] applied to whole equipment;
- harmonised standard for EMC under the EMC Directive [3] applied to whole equipment;
- satellite earth station TBR (Type I and Type II cases) or access TBR (Type III cases) applied to the air interface (S);
- terrestrial public network access TBR (e.g. ISDN), NET (e.g. NET 4) or national standard applied to interface A.

It should be noted that no specific requirements apply at B, unless there is interworking with the public network, or at C (see draft TRAC Guidelines).

9 Relationship between approvals, licensing and frequency coordination

9.1 Introduction

The purpose of this clause is to explain the differences between approvals under TBRs, frequency coordination and licensing and to consider what approach should be taken in the TBRs to the avoidance of harmful interference.

Approvals under the SES Directive [1] are concerned with the intrinsic characteristics of equipment, and cannot govern their use. Approval gives a right to place the equipment on the market but it does not address its use.

Licensing addresses the use of equipment and may address some of its technical characteristics. The usage characteristic that affects frequency coordination is the location of the satellite earth station. The location cannot be specified in a TBR because the TBR can address only the intrinsic characteristics of a satellite earth station.

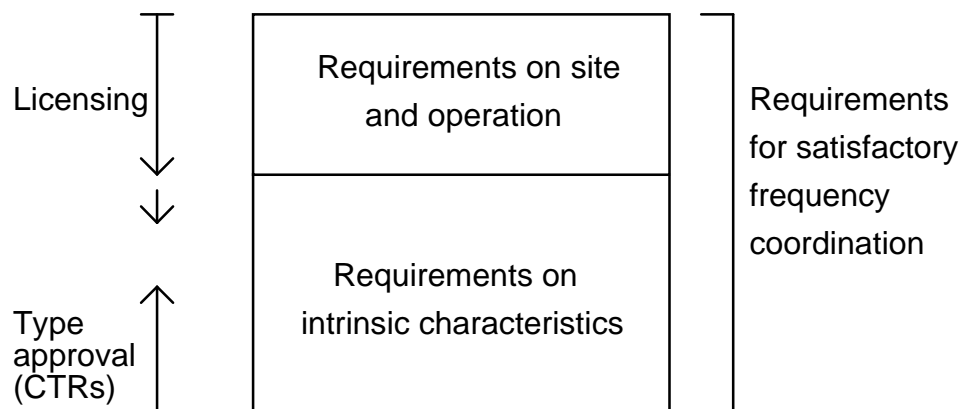
Frequency coordination is concerned with the avoidance of interference between systems. It is not the same as the effective use of the radio spectrum and orbital resources because different ineffective systems can be coordinated successfully, although with difficulty in congested bands. However both frequency coordination and effective use of the radio spectrum address some of the same technical parameters.

In the satellite area, different satellite services with proprietary (unpublished) designs share the same band, and some of the bands themselves are shared with other non-satellite services. This means that compliance with frequency coordination requirements are usually addressed separately, normally through licensing of transmitting stations, rather than approvals.

Frequency coordination for satellite systems is achieved internationally through the procedures defined in appendices 3 and 4 of the Radio Regulations [20]. These procedures cover both the satellite and the satellite earth station characteristics, although the latter may be defined in terms of a variety of different classes or a range of permissible parameters.

The relationship between approvals, licensing and frequency coordination are shown in figure 7.

In terms of the creation of a harmonised market for the provision and operation of networks, especially for VSATs, further attention needs to be given to the issues of frequency coordination and licensing.



NOTE: The more requirements that are included within a TBR, the narrower its scope.

Figure 7: Relationship between type approval, licensing and frequency coordination

9.2 Options for the TBRs

Some parameters used for frequency coordination are capable of being addressed within a TBR, however in order to attempt to address them sufficiently, it would be necessary to prepare a TBR for use with each satellite system. The service operator takes responsibility for intra-service issues such as allocating individual frequencies or time slots to individual satellite earth stations. Thus there is a need to decide whether the TBRs should be specific to a particular satellite network, or to a particular frequency band as defined in the Radio Regulations:

Option A: Develop a TBR for each common set of services within a band (or combination of similar bands);

This TBR would specify a minimum set (lowest common level) of requirements for the common services within the band but these requirements would not normally match those of the frequency coordination agreement. Thus the equipment characteristics declared in the frequency coordination data would in effect be an additional requirement. In the case of satellite earth stations with a transmit capability, requirements relating to these characteristics, and to the location of the satellite earth station, can be imposed through licensing, although the extent to which licensing imposes such requirements may vary from country to country.

Option B: Develop TBRs for each system that is the subject of frequency coordination.

This option would attempt to achieve more in terms of frequency coordination than option A because the requirements of the TBR could be based on the technical parameters declared in the frequency coordination agreement. This option alone would not be sufficient to prevent interference so licensing would still be needed for satellite earth stations with a transmit capability. The reason is that the TBR could not address the question of the location of the satellite earth station or the use of particular options within its capability, e.g. the use of specific frequencies. There are the following additional disadvantages:

- the number of TBRs, especially for VSATs, would become large, and the production of the TBR by ETSI would not be compatible with the timescale for implementing a VSAT network using leased space segment capacity;
- the technical characteristics used in practice often differ from those specified in the public frequency coordination data, and therefore the publicly available information would not provide a firm basis for the TBR. The only possibility would be for member states to reveal the technical part of the actual coordination agreements, which are not published by all member states;
- the necessary TBRs would not be available early in the design of a satellite system, and there would inevitably be differences in the treatment of different systems.

Therefore, on balance, the simpler approach appears to be to use the TBR to set some minimum level of requirements and to retain the member states' ability to set additional requirements through licensing. The existence of additional licensing requirements is envisaged in the "Whereas clause 25" of the SES Directive [1], and there is no legal conflict between the licensing and the TBR because the provision of Article 3 refers only to the free circulation and placing on the market of the satellite earth stations, not to their use; whereas licensing addresses their use.

The method of deciding the values of the technical parameters to be specified in the TBRs is discussed later, after the discussion of the effective use of the radio spectrum which generally concerns the same parameters.

10 Effective use of the radio spectrum

Although the Directives specify the effective use of the radio spectrum as an essential requirement, they do not indicate how the requirement is to be formulated. There are many different ways in which the requirement can be formulated. For example, some or all of the following factors can be considered:

- for digital signals, the average number of bits/sec/Hz calculated from the user signal, taking account of the guard bands as well as the used spectrum. This measure includes the efficiency of the protocol for satellite access and the effect of any coding. In the case of spread spectrum, the value of the bandwidth figures need to be adjusted because of the spectrum spreading and the fact that several signals can share the same frequencies;

- for analogue TV signals, the number of TV channels per 100 MHz;
- for analogue voice signals the number of voice channels per 100 kHz;
- satellite spacing and frequency reuse;
- for broadcast (or point-multipoint) signals, the number of receivers;
- the economic and/or social value of the communications.

The number of bits/sec/Hz is an easy measure of spectral efficiency. However it is not calculable without knowledge of the protocol and coding. This measure of efficiency has to be calculated or measured for a VSAT or Land Mobile Earth Station (LMES) network rather than individual earth stations.

The satellite spacing is related to the equivalent isotropically radiated power (eirp) and the off-axis radiation (or beamwidth) of the satellite earth station and the protection ratio required by the adjacent satellite network. These parameters are measurable.

The number of receivers and the economic and/or social value of the communications are not inherent characteristics of the satellite earth stations but are determined by the use of the system. Consequently they are not suitable for inclusion within the TBRs.

The figures for each of these criteria may vary widely from service to service and the overall efficiency will depend on a combination of these factors. However it is not clear how the factors should be weighted.

The orbit and frequency allocations are under the control of the individual Member States and also under the control of other ITU member nations because the current rule for the allocation of these resources is "first come, first served", provided that existing systems are not disturbed. Except for some bands, e.g. Broadcasting Satellite Service (BSS), these resources are not allocated to countries.

The effective use of the spectrum and of the "space", i.e. the zone around the geostationary orbit and the zone in the vicinity of the earth station, consists of using the minimum bandwidth and the minimum part of the "space" for the required capacity to be transmitted. The most efficient systems are ideal systems, very complex and very expensive. So, an effective system is the result of a compromise taking into account all parameters e.g. the feasibility of the technology, the size, the cost, the service to be provided and the potential number of users, etc. Comparison of similar services is possible but comparison between markedly different services is not unless a weighting function is applied to each service. The choice of a weighting function or the way to compute it is always arbitrary. Most of those parameters can not be standardised.

The determination of the effective use of the spectrum is not only a function of technical parameters but also of the economics and the political choices. For the effective use of the spectrum some common technical parameters may be specified, while others depend on the political choices.

One of the technical aspects of the effective use of the spectrum and of the "space" is the level of interference generated and received by a system.

Noise and interference received within a channel limit the capacity of that channel. These can be suppressed to some degree by the use of higher transmitter powers. Increased transmitter powers adversely affect other users of the frequency band.

Frequency co-ordination consists in finding a compromise on the levels of interferences generated and received by different systems. The frequency co-ordination process is performed between any new system and existing systems.

Ineffective systems may be designed so that co-ordination with existing systems is possible, but possibly not with future systems. In order to avoid this and to ensure an effective use of the frequency spectrum and of the "space" a minimum number of system parameters have to be taken into account. Based on such assumptions International Telecommunications Union - Radiocommunications (ITU-R) recommends limits for some of these parameters. The national authorities also use limits for other parameters in order to share their spectrum and their "space" in a efficient way, e.g. for radio relay links, and for TV broadcasting.

Such requirements from the ITU-R Recommendations are :

- the envelope of the sidelobe radiation pattern of earth station antennas for the efficient use of the geostationary orbit and the protection of terrestrial fixed services;
- out of band spurious emission in frequency bands allocated to other terrestrial and satellite services.

These requirements are already contained in the ETSSs.

Opinions are divided on whether there can be any requirements for the receiver of satellite earth stations. The two conflicting views are:

- no requirements can apply because satellite earth station receivers do not use the radio spectrum directly;
- requirements are needed because the widespread deployment of satellite earth stations with poor performance will lead to inefficiencies in the use of the radio spectrum.

11 EMC requirements specific to satellite earth stations

Article 4.4 of the SES Directive [1] applies EMC requirements as essential requirements in so far as they are specific to satellite earth station equipment.

In this report, only those requirements that are already contained within ETSSs have been considered for inclusion in the TBRs.

A distinction needs to be made between emission and immunity requirements.

The emission requirements are clearly essential because of the potential for affecting other equipment.

Immunity addresses the correct operation of a satellite earth station within an EMC environment and is covered under the EMC Directive [3], which provides simple conformance procedures. Requirements under the EMC Directive [3] are contained in harmonised standards. Immunity is addressed under the SES Directive [1] only where it is specific to satellite earth stations and these specific aspects are covered by more expensive and demanding procedures. Because the correct operation of a satellite earth station is not in itself an essential requirement under the SES Directive [1], it would be logical for immunity requirements to apply under that Directive only in so far as they are necessary to protect aspects of the operation of a satellite earth station that are themselves subject to essential requirements. This approach is generally consistent with the CTR Handbook [19] which expects that immunity requirements should apply only within a CTR for a justified case service. It also avoids the possible need to create additional points of observation other than air or access interfaces for the measurement of some aspects of performance within a specified electromagnetic environment. This approach means that only those immunity requirements will be included that are measured at either the air interface or an interface intended for connection to a terrestrial public network, because these are the interfaces to which access CTRs apply.

Any aspects of the operation of the satellite earth station that are not essential requirements under the SES Directive [1] but that need to be covered by immunity requirements should be addressed by a product standard (harmonised) under the EMC Directive [3].

There are three categories of standards:

- generic;
- product family;
- product.

Generic standards are produced by CENELEC, and there are two such standards EN 50081-1 [17] concerned with emission, and EN 50082-1 [18] concerned with immunity. A product family standard prETS 300 339 (expected to be re-named "General Electro-Magnetic Compatibility (EMC) for radio equipment") [16] has been produced by ETSI TC RES and is held prior to the voting stage. This standard replicates the requirements in the generic standards and adds additional requirements. The generic standards are already harmonised standards and have been referenced in the Official Journal for use with the EMC Directive [3]. It is expected that prETS 300 339 [16] will also be used in this way.

A number of product standards are being produced by ETSI TC RES for the EMC performance of radio equipment. They include a standard for VSATs and TVROs. The requirements in these standards replicate the requirements in prETS 300 339 [16] and add additional requirements. The additional requirements may include requirements of a type that are covered in the general EMC standards but where the frequency ranges for the requirements are extended. It is expected that these standards will also be categorised as harmonised standards in due course.

The approach is that a product standard is used if it is available, if not then a product family standard is used, if that is not available then the generic standard is used.

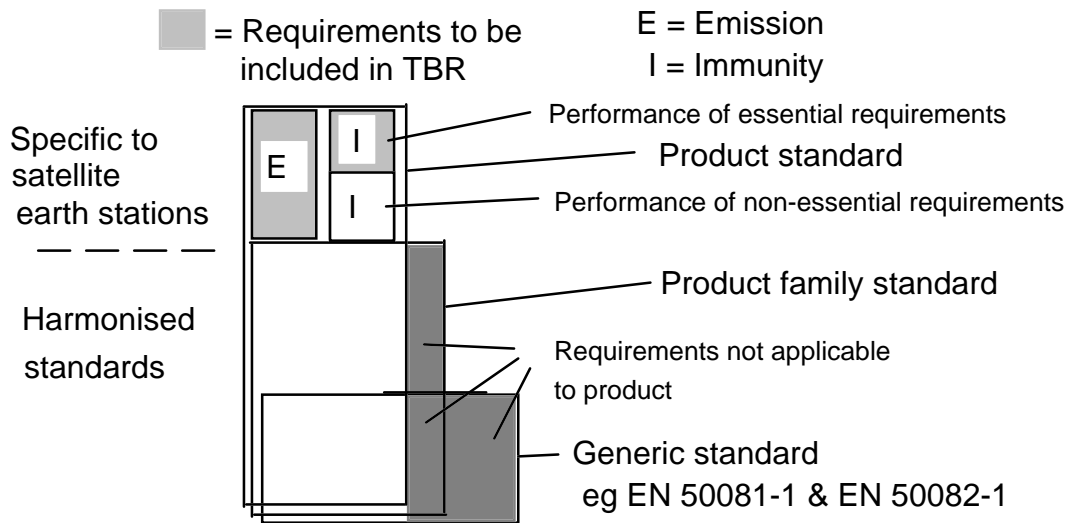
In addition, there are basic standards, which specify levels and test methods. These basic standards address specific parameters and are used by the product, product family and generic standards through normative references.

The base standards use the generic, product family and basic standards as required through normative references. Where no EMC product standard exists the base standard contains what would be in the product standard.

Only those requirements in the product standards that are not in the product family standards are considered to be specific to satellite earth station equipment, and so should be included in the TBRs. This avoids the duplication of requirements and the possible duplication of testing under the different approval procedures used under the different Directives.

The distinction between the scope of a product standard and the scope of a product family standard is somewhat arbitrary. The boundary of what is specific to satellite earth station equipment and its relationship to product or product family standards will depend on how the scopes of those standards have been defined.

This situation is illustrated in figure 8.



NOTE: All these standards may refer to basic standards for levels and test methods.

Figure 8: Set diagram of the contents of EMC standards

Thus, in summary, the requirements that are specific to satellite earth station equipment are the requirements that are in the product standards but are not in prETS 300 339 [16]. All such requirements for emission should be included, but for immunity only those requirements that affect aspects of performance covered by other essential requirements should be included.

12 Preliminary analysis of TVRO standards

The following analysis is preliminary. The final selection and specification of the requirements to be included in the TBRs will be decided by ETSI TC-SES and relevant STCs.

12.1 Outdoor unit

The following table lists and analyses the requirements and recommendations in the base ETSs, giving the justification for the inclusion or exclusion of the requirement within the TBR. In both ETSs clause 5 gives requirements and clause 6 gives recommendations.

For the ease of the reader, the essential requirements applicable are indicated in the fourth column.

Table 2: Preliminary analysis of essential requirements in standards for TVROs

Requirement	Ref in ETS 300 158 [7] FSS band	Ref in ETS 300 249 [11] BSS band	Ess. Req	Analysis
Safety, including purpose, mechanical, electrical shock, lightning protection, adverse conditions	5.2	5.2	-	Should not be in a TBR according to Article 5.1 of the SES Directive [1]. Should be in a harmonised standard.
Local Oscillator (LO) frequency	5.3	5.3	-	Not an essential requirement for TVRO.
Radiation from the outdoor unit	5.4	5.4	4(e)	The requirement limiting radiation from the LO is not a general EMC issue and is very specific to TVRO. The requirement for general radiation is different in part from that in prETS 300 339 [16], and extends to higher frequencies, and therefore goes beyond the general EMC requirements. (note)
Immunity (external)	5.5	5.5	-	An EMC issue. The requirements in the TVRO standards are not directly comparable with those in prETS 300 339 [16], and so may contain aspects specific to satellite earth station equipment. This requirement is not included because it is expected that it will be included in the harmonised standard on EMC.
Documentation	6.1	5.6		Not an essential requirement.

(continued)

Table 2 (concluded): Preliminary analysis of essential requirements in standards for TVROs

Requirement	Ref in ETS 300 158 [7] FSS band	Ref in ETS 300 249 [11] BSS band	Ess. Req	Analysis
RF input range	6.2	6.2	-	A design issue therefore not an essential requirement.
IF output range	6.3	6.3	-	A design issue therefore not an essential requirement.
Figure of merit	6.4	6.4	-	A spectrum and performance issue but not an essential requirement for TVRO.
Radiation from outdoor unit	6.5	6.5	-	An EMC issue. Figures specified are more stringent than the requirement in 5.4, but because these figures are recommendations rather than requirements, the figures in 5.4 should be used in the TBRs.
Antenna sub-system performance	6.6	6.6	-	A mixture of design, performance and spectrum issues. Not an essential requirement for TVRO.
Low Noise Block downconverter (LNB) performance	6.7	6.7	-	A mixture of design, performance and spectrum issues. Not an essential requirement for TVRO.
Internal immunity to unwanted signals	6.8	6.8	-	A mixture of design, performance and spectrum issues. Not an essential requirement for TVRO.
Power supply	6.9	6.9	-	A design issue, not an essential requirement.
Commands	6.10	6.10	-	A design issue, not an essential requirement.
NOTE:	These ETSS include limits on LO radiation as a separate requirement from general radiation. As stated, the requirements overlap, but the test methods are different. The reason why there is a separate requirement for the LOs in TVROs but not in the VSAT standards is that TVROs are more numerous.			

No additional requirements, not already in the base standards, have been identified for the TBR.

12.2 Indoor unit

The indoor unit is not expected to be subject to any essential requirements under the SES Directive [1].

13 Analysis of VSAT standards

The following analysis is preliminary. The final selection and specification of the requirements to be included in the TBRs will be decided by ETSI TC-SES and relevant STCs.

In the following tables the words "spectrum usage" are used as a shorthand to describe all the issues addressed by Article 4.3 of the SES Directive [1].

The following table lists and analyses the requirements and recommendations in the base ETSs, giving the justification for the inclusion or exclusion of the requirement within the TBR. In both ETSs clause 4 gives requirements and clause 5 gives recommendations.

For the ease of the reader, the essential requirements applicable are indicated in the fourth column.

Table 3: Preliminary analysis of requirements in VSAT standards

Requirement	Ref in ETS 300 159 [8] Tx/Rx	Ref in ETS 300 157 [6] Rx only	Ess req.	Analysis
Safety	4.1	4.1	-	Should not be in a TBR according to Article 5.1 of the SES Directive [1]. It should be in a Harmonised Standard.
Spurious radiation	4.2.1 1)	4.2.1 1)	-	A general EMC issue. The requirements in 4.2.1 1) reproduce the requirements in prETS 300 339 [16] except that a slightly different measurement band is used. These requirements are not specific to satellite earth station equipment.
Spurious radiation contd. (off axis, out of band)	4.2.1 2) & 3)	4.2.1 2)	4(e)	A spectrum usage issue. The requirements in 4.2.1 2) & 3) apply to frequencies higher than those in 4.2.1 1) and are therefore outside the general EMC requirements.
On axis spurious radiation	4.2.2	No requirement	4(e)	A spectrum usage issue to be included under Article 4(e). (It is not an EMC issue because the requirements apply only to in-band radiation).
Tx carrier centre frequency stability	4.2.3	No requirement	4(e)	A spectrum usage issue to be included under Article 4(e).
Off axis e.i.r.p in 14,0 to 14,5 GHz band	4.2.4	No requirement	4(e)	A spectrum issue to be included under Article 4(e). Requirement contains dependencies on off-axis angle and number of VSATs transmitting simultaneously, so is specific to satellite earth station equipment. Therefore an essential requirement.

(continued)

Table 3 (concluded): Preliminary analysis of requirements in VSAT standards

Requirement	Ref in ETS 300 159 [8] Tx/Rx	Ref in ETS 300 157 [6] Rx only	Ess req.	Analysis
Transmitter polarisation discrimination	4.2.5	No requirement	4(e)	A spectrum usage issue to be included under Article 4(e).
Carrier on-off	4.2.6	No requirement	4(e)	A spectrum usage issue to be included under Article 4(e).
Electromagnetic immunity	4.2.7	4.2.2	4(e)	A spectrum usage issue for verification conditions b, c and d. The requirements apply to frequencies higher than those in prETS 300 339 [16] and these are therefore outside the general EMC requirements.
Mechanical (antenna pointing)	4.3	5.2	4(e)	Inaccuracies can affect the performance of other satellites, and thus the effective usage of the radio spectrum. Therefore it is an essential requirement under Article 4(e). The case of the Receive Only VSAT needs further discussion.
Antenna transmit gain pattern	5.1	No requirement	-	A spectrum usage issue to be included under Article 4(e). However the requirements are subsumed under 4.2.4 and so do not need to be specified separately.
Antenna receive gain pattern	5.2	5.1.1	-	A spectrum issue but not an essential requirement.
Transmitter polarisation discrimination	5.3	No requirement	-	A spectrum usage issue to be included under Article 4(e). However the requirement is subsumed under 4.2.5 and so does not need to be included separately.
Receiver polarisation discrimination	5.4	5.1.2	-	A spectrum issue but not an essential requirement.
Electromagnetic immunity	5.5	5.1.3	-	An EMC issue. However the requirement is subsumed under 4.2.7/4.2.2 and so does not need to be included separately.

Control and monitoring functions are defined in:

- ETS 300 160 [9]: the functions at a VSAT;
- ETS 300 161 [10]: the functions of a centralised control system, that may be resident in a hub station or any other satellite earth station in the network.

The purpose of these functions is to prevent the VSAT from transmitting during a fault condition using both:

- internal monitoring; and
- external monitoring by the control system with the ability to turn the VSAT off.

The reason for these requirements is that VSATs are normally designed for unmanned operation, and therefore it is important that they are able to suppress transmissions or be suppressed from the hub terminal in the event of faults.

The operation of these functions is in principle an essential requirement under Article 4(e) (effective use of the radio spectrum). However some of the requirements are based on internal monitoring and are not testable without the manufacturer having to provide a mechanism to create an artificial fault to activate the operation of the monitoring system. Furthermore Article 2.2 of the SES Directive [1] applies the essential requirements only when the satellite earth station is properly installed and maintained and used for its intended purpose, and so is normally understood to exclude internal fault conditions. Therefore these requirements should not normally be included in the TBRs. However, because of the unmanned operation and the risk to other users of the spectrum, we recommend that in this particular case they should be included.

Because the VSAT protocol is not standardised, the control specification is written in generic terms and the tests will depend heavily on information provided by the supplier to define the implementation of the system. The formulation and testing of the requirements needs further work to make them suitable for inclusion in the VSAT TBRs.

The following table comments on the individual functions in ETS 300 160 [9], which applies to all VSATs.

For the ease of the reader, the essential requirements applicable are indicated in the third column.

Table 4: Preliminary analysis of requirements in VSAT control and monitoring standards

Requirement	Ref in ETS 300 160 [9]	Ess req	Analysis
Processor monitoring	5.3.1.1	4(e)	Essential for effective use of the spectrum, where the condition has any impact on the essential requirements.
Receive subsystem monitoring	5.3.1.2	-	Subsumed under 5.3.1.4.
Transmit subsystem monitoring	5.3.1.3	4(e)	Essential for effective use of the spectrum, where the condition has any impact on the essential requirements.
Control channel reception	5.3.1.4	4(e)	The only testable requirement is that the VSAT will suppress transmissions within 63 seconds following the interruption of the reception of all authorised control channels and will not transmit again until an enable message is received. This requirement is essential for effective use of the spectrum.
VSAT transmission validation	5.3.1.5	4(e)	Essential for effective use of the spectrum, however the requirement is badly worded and needs rewriting.
Suppression of transmission on receipt of a disable message	5.3.2.1	4(e)	Essential for effective use of the spectrum.
Enable message	5.3.2.2	-	Not an essential requirement because it is not essential that the satellite earth station should be able to transmit.
Power on/reset	5.3.3	-	Not an essential requirement.

The provision of the centralised control and monitoring functions giving the possibility of stopping any station in a network should not be included in a TBR but could be required by the national regulatory authorities for VSAT network licensing.

No additional requirements, not already in the base standards, have been identified for the TBR provided that the network is not regarded as Type III.

14 Preliminary analysis of satellite news gathering standard

The following analysis is preliminary. The final selection and specification of the requirements to be included in the TBRs will be decided by ETSI TC-SES and relevant STCs.

In the following tables the words "spectrum usage" are used as a shorthand to describe all the issues addressed by Article 4.3 of the SES Directive [1].

The following table lists and analyses the requirements and recommendations in ETS 300 327 [15], giving the justification for the inclusion or exclusion of the requirement within the TBR. Unlike the TVRO and VSAT ETSs, this ETS does not have separate clauses for requirements and recommendations, but presents both requirements and optional requirements under the same topic. All SNG earth stations are presumed to have both transmit and receive capabilities.

For the ease of the reader, the essential requirements applicable are indicated in the third column.

Table 5: Preliminary analysis of requirements in the standard for satellite news gathering

Requirement	Ref in ETS 300 327 [15]	Ess req.	Analysis
Safety	5	-	Should not be in a TBR according to Article 5.1 of the SES Directive [1]. It should be in a Harmonised Standard.
Off axis e.i.r.p density	6.1	4(e)	A spectrum issue to be included under Article 4(e). Requirement contains dependencies on off-axis angle, so is specific to satellite earth station equipment. Therefore an essential requirement.
Off-axis spurious radiation	6.2 1)	-	The requirements in 6.2 1) reproduce the requirements in prETS 300 339 [16] except that a slightly different measurement band is used. These requirements are thus covered by the general EMC requirements.
Spurious radiation contd.	6.2 2) & 3)	4(e)	A spectrum usage issue. The requirements in 6.2 2) and 3) apply to frequencies higher than those in 6.2 1) and are therefore not covered by the general EMC requirements.
On-axis spurious radiation	6.3	4(e)	A spectrum usage issue to be included under Article 4(e).
Transmit carrier centre frequency stability	6.4	4(e)	A spectrum usage issue to be included under Article 4(e).
Transmit antenna gain pattern	6.5	-	A spectrum usage issue to be included under Article 4(e). However the requirements are subsumed under 6.1 and so do not need to be specified separately.
Transmit antenna polarisation discrimination	6.6	4(e)	A spectrum usage issue to be included under Article 4(e).

(continued)

Table 5 (concluded): Preliminary analysis of requirements in the standard for satellite news gathering

Requirement	Ref in ETS 300 327 [15]	Ess req.	Analysis
Electromagnetic immunity	6.7	4(e)	A spectrum usage issue for verification conditions b, c and d. The requirements apply to frequencies higher than those in prETS 300 339 [16] and therefore are outside the general EMC requirements.
Assembly and disassembly	7.1	-	Not an essential requirement.
Pointing stability etc	7.2 - 7.6	4(e)	Inaccuracies can affect the performance of other satellites, and thus the effective usage of the radio spectrum. Therefore it is an essential requirement under Article 4(e).
Receive antenna	8.1 & 8.2	-	A spectrum issue but not an essential requirement.
Receive immunity	8.3	-	An EMC issue. However the requirement is subsumed under 6.7 and so does not need to be included separately.
Other	8.4 & 8.5	-	Not essential requirements.

No additional requirements, not already in the base standards, have been identified for the TBR.

15 Preliminary analysis of land mobile low bit rate data communications standards

The following analysis is preliminary. The final selection and specification of the requirements to be included in the TBRs will be decided by ETSI TC-SES and relevant STCs.

In the following tables the words "spectrum usage" are used as a shorthand to describe all the issues addressed by Article 4.3 of the SES Directive [1].

This clause applies to low bit rate land mobile networks that are not regarded as Type III.

The following table lists and analyses the requirements and recommendations in ETS 300 254 [12], and ETS 300 255 [13] giving the justification for the inclusion or exclusion of the requirement within the TBR. These ETSs have separate clauses for requirements and recommendations. The standards each apply at different bands.

In addition there is ETS 300 282 [14] on network control facilities for both L-band and Ku-band satellite earth stations.

For the ease of the reader, the essential requirements applicable are indicated in the fourth column.

Table 6: Preliminary analysis of LMES standards

Requirement	Ref in ETS 300 254 [12] L-band	Ref in ETS 300 255 [13] Ku-band	Ess Req.	Analysis
Safety	4.1	4.1	-	Should not be in a TBR according to Article 5.1 of the SES Directive [1]. It should be in a Harmonised Standard.
Unwanted emissions outside band	4.2.1	4.2.1	-	A general EMC issue. The requirements in table 1, ETS 300 254 [12] reproduce the requirements in prETS 300 339 [16] except that a slightly different measurement band is used. These requirements are not specific to satellite earth station equipment.
Unwanted emissions outside band contd.	4.2.1	4.2.1	4(e)	A spectrum usage issue. The requirements in table 2, ETS 300 254 [12] apply to frequencies higher than those in table 1, ETS 300 254 [12] and are therefore outside the general EMC requirements.
Unwanted emission in-band (on axis)	4.2.2	4.2.2	4(e)	A spectrum usage issue to be included under Article 4(e).
Off-axis e.i.r.p in-band	No requirement	4.2.3	4(e)	A spectrum issue to be included under Article 4(e). Requirement contains dependencies on off-axis angle, so is specific to satellite earth station equipment. Therefore an essential requirement.
Electromagnetic immunity	4.2.3	4.2.4	4(e)	The requirements apply to frequencies higher than those in prETS 300 339 [16] and these are therefore outside the general EMC requirements.
Protection of the radio astronomy service	4.2.4	No requirement	-	Relates to the operation more than the inherent characteristics of the satellite earth station equipment. Originates in RR8 of the Radio Regulations [20]. Could be classified as an essential requirement under Article 4(e) but is difficult to address within a TBR.
Processor monitoring	4.3.1.1	4.3.1.1	4(e)	Essential for effective use of the spectrum, where the condition has any impact on the essential requirements.

(continued)

Table 6 (concluded): Preliminary analysis of LMES standards

Requirement	Ref in ETS 300 254 [12] L-band	Ref in ETS 300 255 [13] Ku-band	Ess Req.	Analysis
Transmit subsystem monitoring	4.3.1.2	4.3.1.2	4(e)	Essential for effective use of the spectrum, where the condition has any impact on the essential requirements.
Power on / reset	4.3.2	4.3.2	-	Not an essential requirement.
Network control authorisation	4.3.3.1	4.3.3.1	4(e)	A spectrum usage issue. The essential requirement is that the LMES suppresses transmission when an enable signal has not been received for longer than 30 seconds.
Network control reception	4.3.3.2	4.3.3.2	4(e)	A spectrum usage issue.
Initial burst rate transmission	4.4	4.4	4(e)	A spectrum usage issue.
Initial burst rate transmission	4.4	4.4	4(e)	A spectrum usage issue.
Electrical safety while loading and unloading hazardous fuels or gases	5.1	5.1	-	Should not be in a TBR according to Article 5.1 of the SES Directive [1]. It should be in a Harmonised Standard.
Electromagnetic immunity between 2 GHz and 3 GHz	5.2	5.2	-	An EMC issue. However the requirement is subsumed under 4.2.3/4.2.4 and so does not need to be included separately.
Compliance with RF specifications under conditions of shock and vibration	5.3	5.3	-	Not an essential requirement because the requirement checks reliability, i.e. performance after shock and vibration. (note)
Method of attachment to the vehicle	5.4	5.4	-	Not an essential requirement. Could be in a CENELEC harmonised standard under user safety.
NOTE: GSM, which includes mobile terminals, does not have shock and vibration requirements.				

The provision of the network control and monitoring functions giving the possibility of stopping any station in a network should not be included in a TBR but could be required by the national regulatory authorities for LMES network licensing.

No additional requirements, not already in the base standards, have been identified for the TBR provided that the network is not regarded as Type III.

16 Documentation

The TRAC Guidelines lay down the principle that the manufacturer or supplier shall provide information in combination with the product. This information is to inform the user and any market surveillance authority of the intended purpose of the equipment as required under Article 2.1 of the SES Directive [1]. This information should provide a means whereby the consumer could ascertain if the equipment would operate as required in the specific circumstances relating to the intended use. Additional information would be required in the case of TVRO equipment to ensure compatibility between the outdoor and indoor units, the requirement for this information is not necessarily in the base ETSs. The supply of this information is essential to protect the consumer.

Furthermore, in some cases the TBRs should contain a requirement for there to be a warning in the documentation stating that in some countries some parts of the frequency bands for the Fixed Satellite Service (FSS) are allocated to other services and must not be used for satellite transmissions.

The question as to whether the provision of such information can be mandated through the TBR remains unclear and clarification is requested from the Commission.

17 TBRs required for satellite earth stations

In order to achieve the modular approach, each TBR should be specific to a radio frequency band and a common set of services, rather than product specific characteristics of the satellite earth station. However, it is possible for an individual TBR to cover more than one set of radio frequency characteristics because the TBR may contain a Requirements Table (TBR-RT) that relates the application of the requirements to the capabilities of the product. Therefore in designing the scope of the TBRs, account needs to be taken of the way in which they will be used so that the scopes are related to the anticipated use of the document as well as possible. Where there are few requirements, there can be a saving in widening the scope and avoiding having too many individual TBRs. A wider scope may be especially useful to manufacturers that manufacture general purpose sub-assemblies.

In principle we propose that there should be separate TBRs for each main frequency area:

- L-band;
- Ku-band.

However the Ku-band may be used by a wide range of services. Due to some differences in the requirements for VSATs, Transportable Earth Stations (TESs), TVROs and mobile earth stations, we recommend that each class of earth stations, as indicated in table 7, should be covered in separate TBRs.

Table 7: Table of proposed TBRs

New TBR	Base ETSs
L-band mobile	ETS 300 254 [12]
Ku-band TVROs	ETS 300 158 [7]
	ETS 300 249 [11]
Ku-band VSATs	ETS 300 157 [6]
	ETS 300 159 [8]
	ETS 300 160 [9]
	ETS 300 161 [10]
Ku-band Mobile	ETS 300 255 [13]
Ku-band Transportables	ETS 300 327 [15]

The scope of each TBR is given in the following clause.

18 Draft scopes for TBRs

18.1 L-band low data rate land mobile satellite earth stations

This TBR specifies those technical requirements under Articles 4.1 to 4.5 of Council Directive 93/97/EEC [1] that apply to satellite earth station equipment that is capable of operation in one or more of the following frequency ranges:

- 1 525,0 to 1 544,0 MHz and 1 555,0 to 1 559,0 MHz (Space - Earth);
- 1 626,5 to 1 645,5 MHz and 1 656,5 to 1 660,5 MHz (Earth to Space);

of the Mobile Satellite Service (MSS).

These requirements are taken from ETS 300 254 [12].

This TBR does not contain the essential requirements under Article 4.6 for interworking via the public telecommunications network in justified cases, and does not provide any guarantee of correct interworking between satellite earth station equipment.

This TBR specifies the requirements for satellite earth station equipment that:

- is capable of being used either for transmission only, or for transmission and reception (transmit-receive), or for reception only (receive-only), of radio-communications signals in any of the bands specified above;
- is not purpose built satellite earth station equipment intended for use as part of the public telecommunications network.

This TBR applies to all satellite equipment as described above, irrespective of whether the satellite earth station equipment provides additional interfaces, telecommunications services or functions. However additional TBRs may also apply.

18.2 Ku-band TVRO satellite earth stations

This TBR specifies those technical requirements under Articles 4.1 to 4.5 of Council Directive 93/97/EEC [1] that apply to satellite earth station equipment that is capable of operation in one or more of the following frequency ranges:

- the FSS Ku-band frequency ranges of 10,70 to 11,70 GHz and 12,50 to 12,75 GHz;
- the BSS Ku-band frequency range of 11,70 to 12,50 GHz.

These requirements are taken from ETS 300 158 [7] and ETS 300 249 [11].

This TBR does not contain the essential requirements under Article 4.6 for interworking via the public telecommunications network in justified cases, and does not provide any guarantee of correct interworking between satellite earth station equipment.

This TBR specifies the requirements for satellite earth station equipment that:

- is capable of being used for reception only (receive-only) of television audio-visual signals in either of the bands specified above, and is not capable of transmission;
- is not purpose built satellite earth station equipment intended for use as part of the public telecommunications network.

This TBR applies to all satellite equipment as described above, irrespective of whether the satellite earth station equipment provides additional interfaces, telecommunications services or functions. However additional TBRs may also apply.

18.3 Ku-band VSAT satellite earth stations

This TBR specifies those technical requirements under Articles 4.1 to 4.5 of Council Directive 93/97/EEC [1] that apply to satellite earth station equipment that is capable of operation in one or more of the following frequency ranges:

- 10,70 to 11,70 GHz (Space - Earth, shared);
- 12,50 to 12,75 GHz (Space - Earth, exclusive);
- 14,00 to 14,25 GHz (Earth - Space exclusive);
- 14,25 to 14,50 GHz (Earth - Space shared);

of the Fixed Satellite Service (FSS).

These requirements are taken from:

- ETS 300 157 [6];
- ETS 300 159 [8];
- ETS 300 160 [9].

This TBR does not contain the essential requirements under Article 4.6 for interworking via the public telecommunications network in justified cases, and does not provide any guarantee of correct interworking between satellite earth station equipment.

This TBR specifies the requirements for satellite earth station equipment that:

- is capable of being used either for transmission only, or for transmission and reception (transmit-receive), or for reception only (receive-only), of radio-communications signals in any of the bands specified above;
- is not within the scope of other Ku-band TBRs (TVRO, SNG, LMES);
- has a diameter of 3,8 m or less;
- is not purpose built satellite earth station equipment intended for use as part of the public telecommunications network.

This TBR applies to all satellite equipment as described above, irrespective of whether the satellite earth station equipment provides additional interfaces, telecommunications services or functions. However additional TBRs may also apply.

18.4 Ku-band land mobile satellite earth station

This TBR specifies those technical requirements under Articles 4.1 to 4.5 of Council Directive 93/97/EEC [1] that apply to satellite earth station equipment that is capable of operation in one or more of the following frequency ranges:

- 10,70 to 11,70 GHz (Space - Earth, shared);
- 12,50 to 12,75 GHz (Space - Earth, exclusive);
- 14,00 to 14,25 GHz (Earth - Space exclusive);

of the Fixed Satellite Service (FSS).

These requirements are taken from: ETS 300 255 [13].

This TBR does not contain the essential requirements under Article 4.6 for interworking via the public telecommunications network in justified cases, and does not provide any guarantee of correct interworking between satellite earth station equipment.

This TBR specifies the requirements for satellite earth station equipment that:

- is capable of being used either for transmission only, or for transmission and reception (transmit-receive), or for reception only (receive-only), of radio-communications signals in any of the bands specified above;

- is not within the scope of other Ku-band TBRs [TVRO, VSAT, SNG];
- is not purpose built satellite earth station equipment intended for use as part of the public telecommunications network.

This TBR applies to all satellite equipment as described above, irrespective of whether the satellite earth station equipment provides additional interfaces, telecommunications services or functions. However additional TBRs may also apply.

18.5 Ku-band satellite news gathering transportable earth station

This TBR specifies those technical requirements under Articles 4.1 to 4.5 of Council Directive 93/97/EEC [1] that apply to satellite earth station equipment that is capable of operation in one or more of the following frequency ranges:

- 10,70 to 11,70 GHz (Space - Earth, shared);
- 12,50 to 12,75 GHz (Space - Earth, exclusive);
- 12,75 to 13,25 GHz (Earth - Space shared);
- 13,75 to 14,25 GHz (Earth - Space exclusive);
- 14,25 to 14,50 GHz (Earth - Space shared);

of the Fixed Satellite Service (FSS).

These requirements are taken from: ETS 300 327 [15].

This TBR does not contain the essential requirements under Article 4.6 for interworking via the public telecommunications network in justified cases, and does not provide any guarantee of correct interworking between satellite earth station equipment.

This TBR specifies the requirements for satellite earth station equipment that:

- is capable of being used either for transmission only, or for transmission and reception (transmit-receive), or for reception only (receive-only), of radio-communications signals in any of the bands specified above;
- is not within the scope of other Ku-band TBRs (TVRO, VSAT, LMES);
- has a diameter of 5,0 m or less;
- is not purpose built satellite earth station equipment intended for use as part of the public telecommunications network.

This TBR applies to all satellite equipment as described above, irrespective of whether the satellite earth station equipment provides additional interfaces, telecommunications services or functions. However additional TBRs may also apply.

19 Summary of points for consideration by the Commission, ACTE and TRAC

During the preparation of this report, a number of issues have been identified where the regulatory framework is not clear and where the regulators will need to clarify European policy in order to achieve their objectives. The following list summarises these points:

- a) the term "public" is not defined clearly and is subject to the following interpretations:
 - a public network is a network declared to be "public" by a Governmental decision at national or European level; or
 - a public network is a network open to the public.

The Commission, ACTE and TRAC are invited to define which categories of network are considered public in order that ETSI is able to identify the locations of the NTPs where the essential requirements of the Directives have to be applied and for which TBRs have to be prepared;

- b) the phrase "purpose built" does not appear in the French text of the Directive and is omitted from Whereas (15) of the German text. This inconsistency has caused considerable difficulty and confusion. This ETR is written on the presumption that the phrase "purpose built" should be included;
- c) the issue of whether Articles 4(f) and 4(g) should be applied to radio interfaces between satellite earth station equipment and satellites needs to be discussed by the Commission, ACTE and TRAC. The wording of Article 4 of the SES Directive [1] does not preclude the air interface from being the NTP;
- d) the question as to whether the provision of information from the manufacturer can be mandated through the TBRs remains unclear, and clarification is requested.

History

Document history	
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