



**E**UROPEAN  
**T**ELECOMMUNICATION  
**S**TANDARD

**DRAFT**  
pr **ETS 300 326-1**

March 1998

**Second Edition**

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Source: ERM

Reference: RE/ERM-RP05-005-1

ICS: 33.020

**Key words:** TFTS, radio and speech

**Electromagnetic compatibility  
and Radio spectrum Matters (ERM);  
Terrestrial Flight Telecommunication System (TFTS);  
Part 1: Speech services, facilities and requirements**

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## Foreword

This draft second edition European Telecommunication Standard (ETS) has been produced by the Electromagnetic Compatibility and Radio spectrum Matters (ERM) Technical Committee of the European Telecommunications Standards Institute (ETSI), and is now submitted for the One-step Approval Procedure (OAP) phase of the ETSI standards approval process.

This ETS has been split into three parts as follows:

**Part 1: "Speech services, facilities and requirements";**

Part 2: "Speech services, radio interface";

Part 3: "Speech services, network aspects".

Proposed transposition dates	
Date of latest announcement of this ETS (doa):	3 months after ETSI publication
Date of latest publication of new National Standard or endorsement of this ETS (dop/e):	6 months after doa
Date of withdrawal of any conflicting National Standard (dow):	6 months after doa

## Introduction

The Terrestrial Flight Telecommunication System (TFTS) aircraft station was specified by the European Airlines Electronic Committee (EAEC) and has subsequently been adopted as Aeronautical Radio Incorporated (ARINC) Characteristic 752 [2] by the Airlines Electronic Engineering Committee (AEEC).

ARINC Characteristic 752 [2] makes reference to this ETS for the specification of certain radio and telecommunication matters to avoid ambiguity. The TFTS aircraft station is one of a set of facilities within an overall architecture being defined for aircraft on-board telecommunications by the AEEC.

There are supplementary specifications defining the provision of functions or services outside the scope of this specification.

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## 1 Scope

This European Telecommunication Standard (ETS) specifies the minimum technical requirements of the services, facilities and functions that the Terrestrial Flight Telecommunication System (TFTS) supports to provide a pan-European terrestrial aeronautical public correspondence service.

This ETS contains the specification of equipment for the provision of a terrestrial aeronautical public correspondence service working in the frequency spectrum bands allocated at World Administrative Radio Conference 1992 (WARC 92) (1 670 to 1 675 MHz and 1 800 to 1 805 MHz).

This ETS fully specifies aspects of the radio interface and Terrestrial Flight Telecommunication System (TFTS) ground network required to maintain inter-operability of equipment. ERC Decision ERC/DEC/(92)01 [1] is applicable to the TFTS frequency spectrum within Europe.

This ETS includes a general description of the TFTS which is of informative nature.

The specification of data application and facsimile is the subject of ES 200 794 [12].

The delivery mechanism for Packet Data Services is defined in ETS 300 752 [11].

The commercial aspects of service definition are outside the scope of this ETS except where it is necessary for this information to be considered due to its impact on technical specification matters.

The scope of this part of the ETS has been confined to the set of services to be provided by the phase 1 standard. An informative subclause 5.4 has been included describing the service definitions that may subsequently be specified for uplink calling, facsimile, data services and low rate speech services.

## 2 Normative references

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

- [1] ERC Decision ERC/DEC/(92)01 (1991): "Decision on the frequency bands to be designated for the coordinated introduction of the Terrestrial Flight Telecommunications System (TFTS)".
- [2] ARINC Characteristic 752 (1993): "Terrestrial Flight Telecommunication System (TFTS) Airborne Radio Subsystem".
- [3] ARINC Characteristic 746: "Cabin Communications System".
- [4] ETS 300 085 (1990): "Integrated Services Digital Network (ISDN); 3,1 kHz telephony teleservice Attachment requirements for handset terminals".
- [5] ETS 300 326-2: "Electromagnetic Compatibility and Radio Spectrum Matters (ERM); Terrestrial Flight Telecommunications System (TFTS); Part 2: Speech services, radio interface".
- [6] ETS 300 326-3: "Electromagnetic Compatibility and Radio Spectrum Matters (ERM); Terrestrial Flight Telecommunications System (TFTS); Part 3: Speech services, network aspects".
- [7] CCITT Recommendation G.165 (1988): "Echo cancellers".
- [8] CCITT Recommendation E.164 (1991): "Numbering plan for the ISDN era".

- [9] Inmarsat Aeronautical Satellite System Definition Manual Module 5 (March 1993): "Circuit mode service voice codec algorithm and terminal interface function specification for facsimile and data services, Version 3 and corrigenda".
- [10] ARINC Characteristic 741: "Aviation satellite Communication System, Parts 1 to 4".
- [11] ETS 300 752: "Radio Equipment and Systems (RES); Terrestrial Flight Telecommunications System (TFTS); Packet mode data".
- [12] ES 200 794: "Electromagnetic Compatibility and Radio spectrum Matters (ERM); Terrestrial Flight Telecommunications System (TFTS); Circuit-mode voice-band data services; Part 1: Group 3 fax support".
- [13] ITU-T Recommendation V.21 (1988): "300 bits per second duplex modem standardized for use in the general switched telephone network".
- [14] ITU-T Recommendation V.22 bis (1988): "2 400 bits per second duplex modem using the frequency division technique standardized for use on the general switched telephone network and on point-to-point 2-wire leased telephone-type circuits".

### 3 Definitions and abbreviations

#### 3.1 Definitions

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

**bearer service:** A type of telecommunication service that provides the capability for the transmission of signals between user - network interfaces.

**teleservice:** A type of telecommunication service that provides the complete capability, including terminal equipment functions, for communication between users according to protocols established by agreement between administrations and/or Recognized Private Operating Agencies (RPOAs).

#### 3.2 Abbreviations

For the purposes of this ETS, the following abbreviations apply:

AEC	Aircraft Equipment Code
AEEC	Airlines Electronic Engineering Committee
AEN	Aircraft Equipment Number
ARINC	Aeronautical Radio INCorporated
AS	Aircraft Station
ASI	Aircraft Station Identity
AT	Avionics Termination
ATE	Aircraft Telecommunications Equipment
ATEI	Aircraft Termination Equipment Identifier
ATISDN	Aircraft Termination ISDN
CCITT	Consultative Committee on International Telegraphy and Telephony
CDS	Cabin Distribution System
CS	Cabin Systems
CTU	Cabin Telecommunications Unit
DTMF	Dual Tone Multi Frequency
EAEC	European Airlines Electronics Committee
FAC	Final Assembly Code
GCC	Ground switching Centre Code
GCT	Ground station Cell Type
GEN	Ground station Equipment Number
GS	Ground Station



GSC	Ground Switching Centre
GSIC	Ground Station Identity Code
GSLAT	Ground Station Latitude
GSLONG	Ground Station Longitude
GSN	Ground station Serial Number
GSS	Ground Station System
ICAO	International Civil Aviation Organization
ISDN	Integrated Services Digital Network
MM	Mobility Management
MSB	Most Significant Bit
NDC	National Destination Code
NM	Network Management
PAD	Packet Assembler-Disassembler
PWRCTL	PoWeR ConTroL level adjustment
RMIN	Receiver MINimum acceptable signal level
RPOA	Recognized Private Operating Agency
SNR	Serial NumbeR
SP	Service Provider
TAC	Type Approval Code
TDMA	Time Division Multiple Access
TFTS	Terrestrial Flight Telecommunication System
TIM	network TIME
TO	Telecom Operator
UN	User Number
UTC	Coordinated Universal Time
WARC 92	World Administrative Radio Conference 1992

## 4 General description of the TFTS

This clause contains an informative description of the TFTS. The basic TFTS architecture is described together with a brief explanation of the various functional entities of the system. When appropriate, reference is made to other parts of this ETS where more detailed descriptions of functional entities are provided. Reference has also been made to possible connections to external systems which are beyond the scope of this ETS. These references are not intended to imply any technical or commercial implementation for the service provided by TFTS.

### 4.1 Purpose of the TFTS

The TFTS provides a radio communication link between aircraft and ground stations which have access to public fixed telecommunications networks. This enables aircraft passengers or users to access public telecommunications services from the air. The principal services supported by the TFTS are as follows:

- a) telephony;
- b) facsimile group 3;
- c) paging services;
- d) data services.

The services provided by TFTS are primarily aimed at commercial airliners but this does not preclude use of the system by smaller commercial regional aircraft operators or the general aviation sector.

#### 4.2 Service coverage

The radio system of the TFTS is similar in nature to the cellular systems of the land mobile service. There are some important differences, especially the cell radii (typically 240 km) and the height coverage (in excess of 43 000 feet). The mobiles of the service are aircraft in flight or on the ground in the starting or finishing phases of flight.

Three cell types are specified:

**en-route:** providing a large area coverage at altitude;

**intermediate:** providing coverage at lower altitude where required, especially in the vicinity of airports; and

**airport stations:** for use on or immediately above the ground.

#### 4.3 TFTS architecture

Figure 1 provides an illustrative overview of the telecommunications services to be provided to aircraft. Figure 2 provides a schematic block diagram of a terrestrial aeronautical telecommunication system showing the position of the TFTS elements.

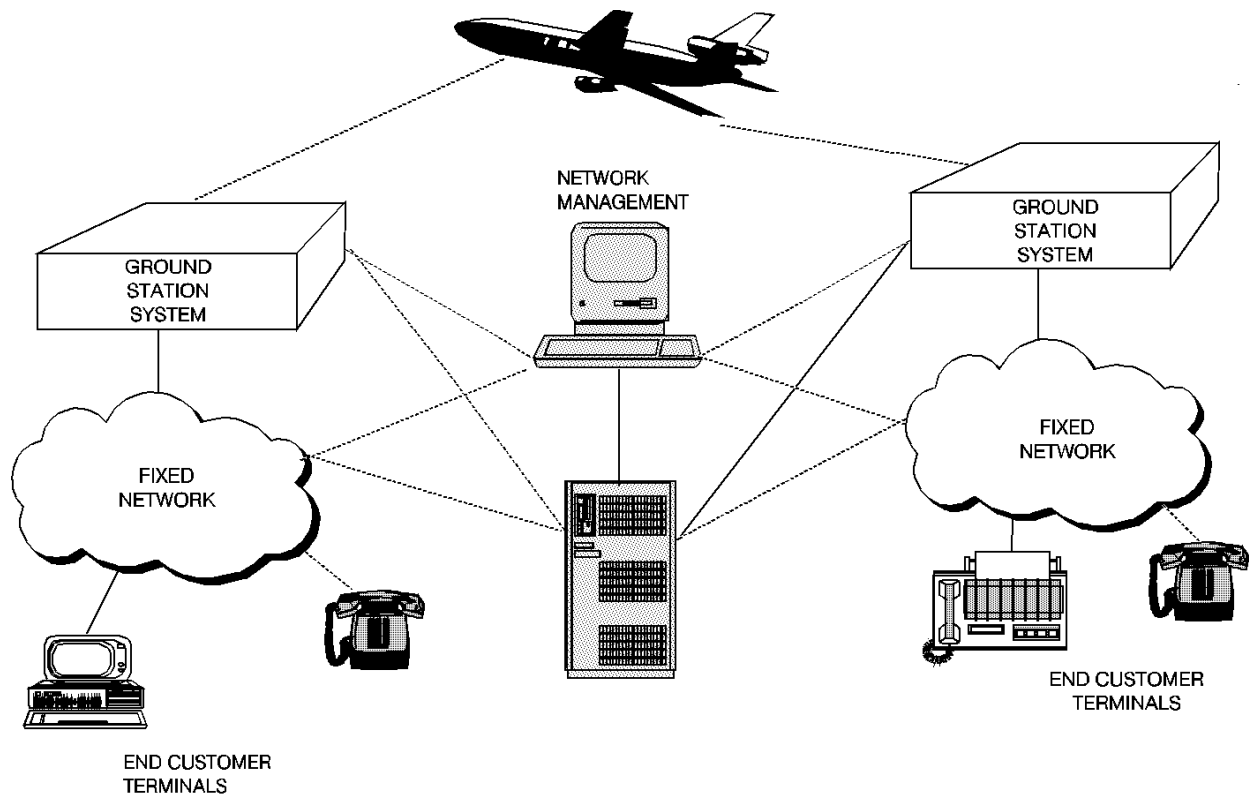


Figure 1: Aeronautical telecommunication services overview

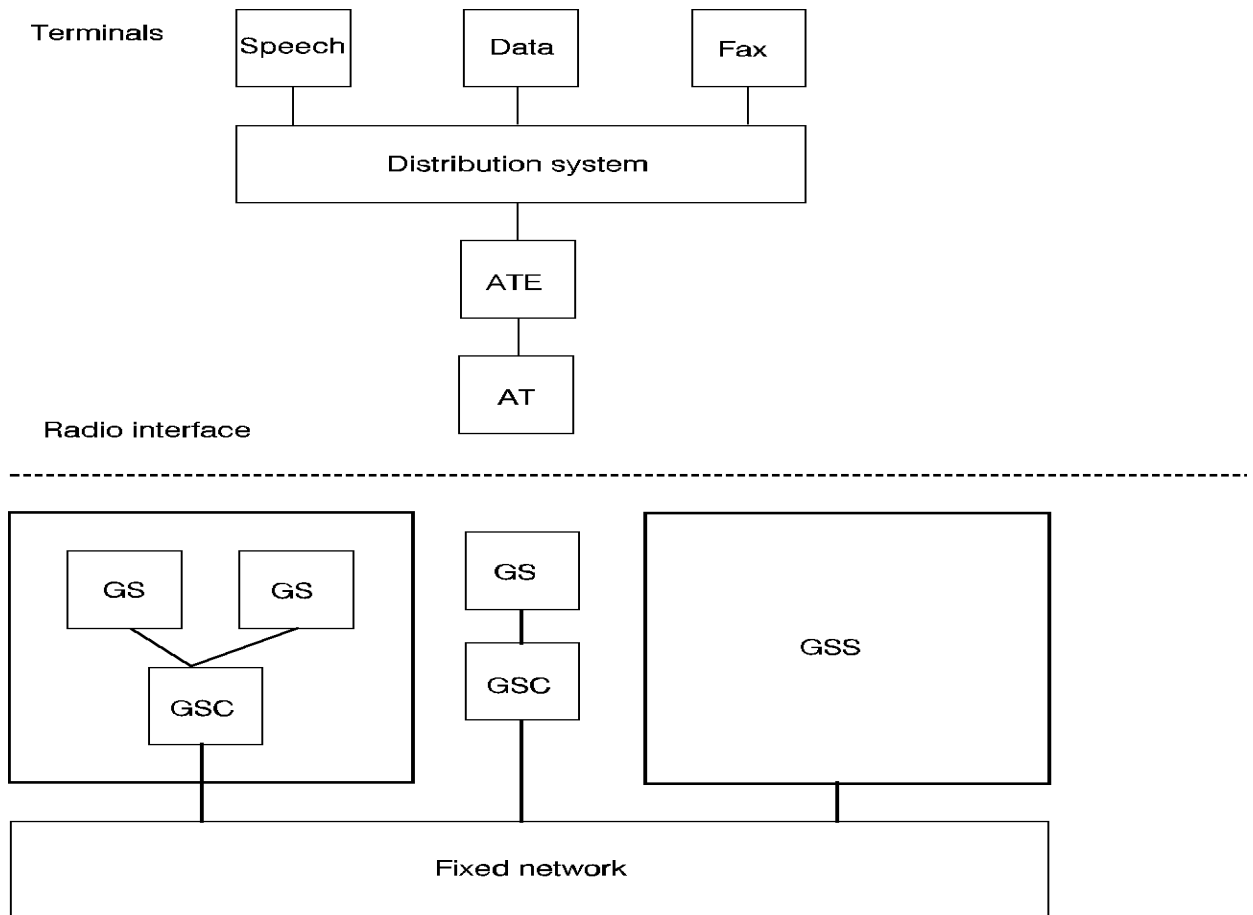


Figure 2: TFTS block diagram

#### 4.3.1 Aircraft Station (AS)

The AS consists of three main entities:

**Avionics Termination (AT):** provides the radio, control and telecommunications functions necessary for the TFTS;

**Aircraft Telecommunications Equipment (ATE):** provides on board switching and other functions for the aircraft telecommunication facilities. Many of these on-board facilities would be realized in the Cabin Telecommunications Unit (CTU) defined in ARINC Characteristic 746 [3]. ARINC are also defining the characteristics of a Cabin Distribution System (CDS); and

**Cabin System (CS):** provides telecommunication facilities to the passenger.

The ATE and the CS may be realized in several ways with a variety of facilities. The specification of these entities is outside the scope of this ETS. The ATE and CS may also support satellite and other terrestrial telecommunication services. Aviation aspects of the AT, ATE and CS have been characterized by the EAEC and the AEEC. Aspects of the AT are published in ARINC Characteristic 752 [2]. Aspects of the ATE are published in ARINC Characteristic 746 [3].

#### **4.3.2 Ground Station (GS)**

The GS provides the radio communication, line transmission and some limited control functions necessary for supporting simultaneous radio communication with several aircraft using the TFTS. The different types of ground station are analogous to the cell types of the TFTS which are described in subclause 4.2.

#### **4.3.3 Ground Switching Centre (GSC)**

The GSC provides the switching, control and fixed network access functions for the TFTS. Some transmission control functions such as echo control may also be provided at a GSC. In addition, the GSC may provide interfaces to other external systems required to provide a commercial public aeronautical correspondence service (e.g. billing system, network management system).

NOTE: A combination of GSs and an associated GSC is referred to as a Ground Station System (GSS).

#### **4.3.4 Radio interface**

The TFTS radio interface is described in ETS 300 326-2 [5]. The access types employed are Time Division Multiplex (TDM)/Time Division Multiple Access (TDMA) providing an aircraft capacity of four voice channels per radio carrier when using standard rate speech coding. The carrier may also be configured to provide several data services and a group 3 facsimile service. A lower rate speech service may also be supported when suitable voice coding devices are available.

#### **4.3.5 Fixed network interface**

The TFTS fixed network interface is characterized in terms of the services and facilities that would be required for the TFTS to fully, and correctly, inter-work with the fixed network. Detailed network interworking specifications are not provided within this ETS as it is recognized that network and signalling variations exist in each country's fixed network(s).

#### **4.3.6 Interfaces with other systems**

The TFTS may interface to one or more administrative and network management systems. The realization of these systems is outside the scope of this ETS and is a matter for the operators and users of the TFTS.

### **5 TFTS telecommunication services**

The telecommunication services supported by TFTS are described in the general framework of bearer services, teleservices and supplementary services. These descriptions are characterized by attributes defining particular aspects of the service to be provided.

#### **5.1 TFTS bearer services**

Bearer services are characterized by attributes including information transfer mode, information transfer rate, information transfer capability and structure.

The TFTS provides a bearer capability between the ATE side of the AT and the termination of the TFTS at the fixed network interface.

The TFTS shall support both circuit switched and packet switched bearer services.

### 5.1.1 Speech bearer service

The TFTS shall support a speech 9,6 kbits/s bearer service and the attributes shall be as specified in table 1.

**Table 1: Speech 9,6 kbits/s bearer service**

Information transfer	Circuit mode
Information transfer rate	Not applicable
Information transfer capability	Speech
Structure	Unstructured
Establishment	On demand
Configuration	Point-to-point
Symmetry	Bi-directional symmetric

### 5.1.2 Paging

The TFTS shall support a paging bearer service and the attributes shall be as defined in table 2.

**Table 2: Paging bearer service**

Information transfer	Unrestricted digital
Information transfer rate	Not applicable
Information transfer capability	Digital
Structure	Unstructured
Establishment	On demand
Configuration	Point-to-point or broadcast
Symmetry	Unit or Bi-directional

## 5.2 TFTS teleservices

Teleservices are characterized by attributes including bearer, higher layer and other general service attributes.

The TFTS provides some of the capabilities for the provision of teleservices. It should be recognized however that the full provision of a teleservice is dependent on the provision of terminal and other functionality in systems external to the TFTS.

The TFTS shall support speech teleservices and the attributes shall be as specified in table 3.

**Table 3: Speech teleservice attributes**

Higher Layer	User information	Speech
	layer 4 protocol	Not applicable
	layer 5 protocol	Not applicable
	layer 6 protocol	Not applicable
	layer 7 protocol	Not applicable
Bearer capability		Speech 9,6 kbits/s
General	Supplementary services	None
	Quality of service	clause 6 and clause 7
	Operational / commercial	None defined

**5.3 TFTS supplementary services**

No network based supplementary services have been specified for TFTS. This shall not preclude the provision of supplementary services to aircraft passengers which have been provided by other means.

**5.4 Others TFTS services**

This informative subclause lists those bearer services and teleservices which are already defined in another specification or which it is envisaged would be defined in subsequent phases of the TFTS if appropriate commercial requirements are shown to exist. No specific detail has been included other than an indication of the basic parameters that may be applicable.

For existing other services, the reader will refer to the relevant specifications.

**5.4.1 TFTS services defined in other specifications**

**5.4.1.1 Bearer services**

The additional bearer services listed in table 4 have been standardized in other specifications.

**Table 4: Other TFTS bearer services**

Packet Service	ETS 300 752 [11]
Facsimile group 3	ES 200 794 [12]

**5.4.1.2 Teleservices**

The additional teleservices listed in table 5 have been standardized in other specifications.

No specific teleservice types have been designated for TFTS data services.

**Table 5: Other TFTS teleservices**

Facsimile group 3
Asynchronous data

**5.4.2 Future services to be defined in later phases**

**5.4.2.1 Bearer services**

The additional bearer services listed in table 6 may be standardized in the future.

**Table 6: Future TFTS bearer services**

Speech Lower rate vocoder
Circuit mode data supporting MODEMs type V.21 [13] and V.22 bis [14] transparent
PAD services

### 5.4.2.2 Teleservices

The additional teleservices listed in table 7 may be standardized in the future.

No specific teleservice types have been designated for TFTS data services.

**Table 7: Future TFTS teleservices**

Lower rate speech air to ground
Full rate speech ground to air
Lower rate speech ground to air
Message service
Synchronous data

## 6 TFTS requirements

This clause specifies general requirements for the TFTS. Some specific parameter values are included here and these should be read in conjunction with the design parameters which are specified in clause 7. This part of this ETS is not exhaustive and other requirements will be found elsewhere within the other parts of the ETS. Those that have been included here represent the principal requirements of the TFTS.

### 6.1 Safety

#### 6.1.1 Aviation requirements

All airborne equipment shall be designed, installed, operated and maintained to the normal safety standards specified by the various administrative and regulatory bodies for aviation.

#### 6.1.2 Suspension of service by crew

The ability shall be provided for the crew of an aircraft to suspend TFTS services.

#### 6.1.3 Suspension of service from ground

Facilities shall be provided for ground personnel to suspend the TFTS services from a particular aircraft at any time.

#### 6.1.4 Ground equipment

The design of the ground stations shall ensure that all relevant safety standards of the various administrative and regulatory bodies for telecommunications and the relevant aspects of health and safety legislation are complied with in each country of operation.

#### 6.1.5 User safety

The design of the TFTS equipment shall ensure that regulations relating to the safety of users of the system are complied with.

## 6.2 Service coverage

### 6.2.1 Basic requirements

The design of the system shall be such that it is capable of providing continuous coverage in those territories where it is deployed. The system shall be capable of providing the following cell types:

- **en-route cells:** the required continuous altitude coverage will normally be between 15 000 feet and 43 000 feet. In certain areas there may be a requirement to cover lower level airways, lower than the normal minimum altitude given above;
- **intermediate cells:** the normal maximum required continuous altitude usage should be below 15 000 feet;
- **airport cells:** usage of airport cells should normally be confined to the runway, taxi-way and manoeuvring areas of the airport. Altitude usage should be limited to 100 feet.

### 6.2.2 Implementation of intermediate and airport cells

Provision of coverage by intermediate and airport cells is a matter for commercial implementation. The minimum TFTS implementation using en-route cells only shall be capable of functioning without the provision of intermediate or airport cells.

### 6.2.3 Radio network and cell planning

This ETS does not specify cell planning rules other than to give the basic usage and radio parameters which are specified here and elsewhere within this ETS.

## 6.3 Capacity and frequency utilization

### 6.3.1 Use of frequency spectrum

The TFTS shall be designed to make efficient use of the allocated frequency spectrum. The system design shall not preclude the reasonable protection of other services in adjacent frequency bands. Where necessary, the design of the system shall include that protection necessary to allow reasonable sharing with other services in the frequency spectrum allocated or designated to TFTS.

### 6.3.2 Specified frequency spectrum

The radio link aspects of this ETS have been written around the designation in ERC Decision ERC/DEC/(92)01 [1]. This decision designates the frequency bands for TFTS:

1 670 - 1 675 MHz for ground-to-air;

1 800 - 1 805 MHz for air-to-ground.

The frequency band 1 670 - 1 675 MHz is adjacent to a passive frequency band allocation used for the radio astronomy service. No measures have been specified within this ETS for protection of the radio astronomy allocation. Site specific protection and appropriate frequency planning measures may be required by administrations to protect the radio astronomy service and any other sharing or adjacent services. These specific measures may be more stringent than those generally specified within this ETS for the normal operation of the TFTS.

### 6.3.3 Capacity aspects

The TFTS shall be flexible in design to allow efficient frequency spectrum utilization as the capacity requirements of the system increases in given geographical areas. Facilities shall be provided to increase the capacity without changing the system concept.



## **6.4 Mobility Management (MM)**

### **6.4.1 Roaming and location registration**

This ETS does not define any roaming or location registration facility for the provision of ground to air calling.

### **6.4.2 GS selection**

The selection of a GS to be used by a given aircraft shall be based on the criteria of system efficiency. In this respect the TFTS shall use the same radio interface over the entire system coverage area. In areas where more than one network of GSs is available (e.g. competing networks) the aircraft should decide which network to access.

## **6.5 Handover**

### **6.5.1 Handover facilities**

The TFTS shall support the control and signalling features required to support handover. Several types of handover shall be possible allowing handover within a cell or handover between cells. The criteria for handover initiation and control are specified in ETS 300 326-2 [5] and ETS 300 326-3 [6].

### **6.5.2 Inter GSC handover**

The TFTS shall support handover facilities which require the provision of transmission and signalling capabilities at GSCs to allow handover between GSs connected to different GSCs.

## **6.6 Network interworking**

### **6.6.1 Fixed network interface**

The design of the TFTS shall ensure that no modification of the fixed networks will be necessary to provide a TFTS service.

### **6.6.2 Transmission and signalling requirements**

The transmission medium for connection to the fixed networks shall be based on 64 kbits/s A-law presentation of user information. Where this is not possible the connection to the fixed network should aim to provide the highest transmission quality available. Certain provisions regarding transmission aspects are specified elsewhere in this ETS (e.g. echo control). This ETS does not make specific provision for the signalling capabilities at the fixed network interface due to the variations that will continue to exist in national networks. However, certain features required from the signalling capabilities of the fixed network for the correct operation of the TFTS are specified in ETS 300 326-3 [6].

## **6.7 TFTS transmission performance**

Full compliance with the general characteristics of telephone circuits recommended by the Consultative Committee on International Telegraphy and Telephony (CCITT) cannot be achieved due to the nature of the TFTS and the associated airborne systems. Measures should be taken with regard to echo control, delay and other quality aspects to ensure that the overall quality delivered by a TFTS connection is of an acceptable level. The requirements in the following subclauses refer only to the speech 9,6 kbits/s bearer service.

### **6.7.1 Fixed network connections**

#### **6.7.1.1 Digital connectivity**

The provision of 64 kbits/s digital connectivity at the fixed network interface is described in subclause 6.6. The absence of 64 kbits/s digital connectivity at any point between the user and the fixed network interface may degrade the quality perceived by users of the system.

**6.7.1.2 Network devices**

The TFTS shall be able to enable or disable the echo controller placed closest to the interface with the fixed network. The echo controller shall cancel the echo path from the distant speech terminal (i.e. the echo controller facing into the fixed network). The enabling or disabling of this echo controller should be decided from the call destination information and the bearer capability in use.

**6.7.2 Aircraft equipment**

**6.7.2.1 Aircraft system standards**

There may be one or more other systems required on-board the aircraft to provide the TFTS to passengers. These systems will introduce distortion arising from voice coding or transcoding devices and contribute transmission delay to the end-to-end TFTS connection. Other parameters which should be considered for the design of the electro-acoustic part of the on-board equipment may be found in ETS 300 085 [4].

**6.7.2.2 Aircraft terminal echo sources**

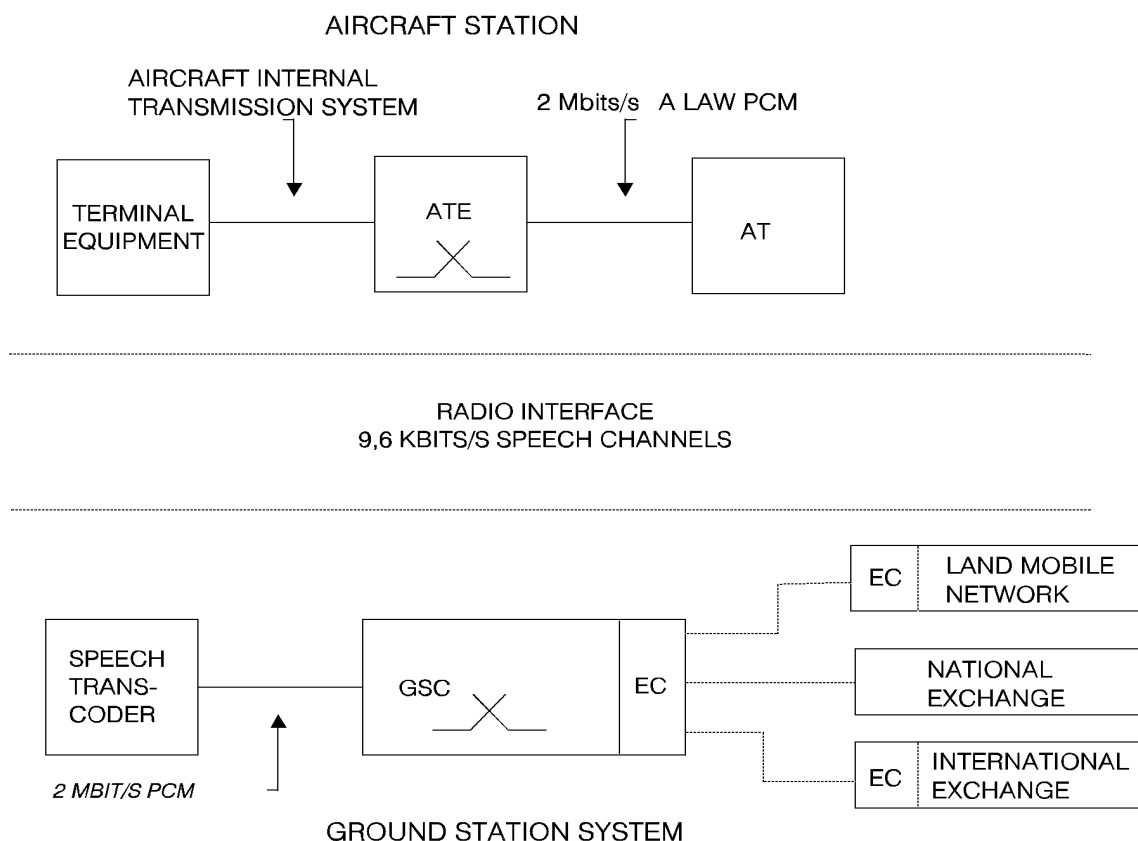
The handset or speech terminal device is likely to be a source of echo. The mean one way delay between the acoustic interface and the ATE/AT interface should be limited to a maximum of 15 ms.

**6.7.2.3 Handsets**

Due consideration should be given to the volume, sidetone and loudness characteristics of the speech terminal used on board the aircraft.

**6.7.3 TFTS reference models**

Figure 3 shows reference models which illustrate the general configurations and interworking scenarios which may be encountered in the TFTS.



**Figure 3: Examples of TFTS transmissions models**

## 6.7.4 TFTS delay budget

### 6.7.4.1 One way delay budget

Table 8 gives an example of a TFTS mean one way delay budget. It is possible that differing implementations may provide different delay values for these items. However, the maximum mean one way delay between the acoustic interface and the fixed network interface shall not exceed 90 ms.

**Table 8: Example TFTS mean one way delay budget**

Category	Mean one way delay (ms)
Speech coder sample loading	26
Codec TX processing	5
Compression buffer	18
Propagation delay	1,23
Filter delays	1
Overhead delay	0,35
Codec RX loading	9,16
Codec processing	1
RX sample slipping delay	2
GS GSC trunk delay (multiplexing)	5,25
GSC to fixed network	2

### 6.7.4.2 Echo control

Echo control capability shall be included at the GSC in accordance with CCITT Recommendation G.165 [7] with the exception that the cancellor shall be capable of cancelling echo over an echo path of 64 ms.

## 6.8 Voice coding

The TFTS shall support the 9,6 kbits/s speech coding algorithm which is already in use by the airline industry for some INMARSAT aeronautical satellite telecommunications developments. The detailed description of the algorithm is not included within this ETS but may be found in the Inmarsat Aeronautical Satellite System Definition Manual Module 5 [9] and ARINC Characteristic 741 [10].

Later developments of TFTS may be required to support both the 9,6 kbits/s function and a normalized lower rate voice coding device.

NOTE: The use of a lower rate device is outside the scope of this ETS and may require re-examination of aspects of TFTS transmission performance.

## 6.9 Call queuing

The TFTS is not required to directly support any call queuing capabilities.

The provision of call queuing capability may be implemented within the aircraft equipment. This may allow calls to be queued through periods of congestion arising from either high demand within the aircraft or congestion on the radio interface.

## 6.10 Transmission of Dual Tone Multi Frequency (DTMF) tones

The TFTS shall support a facility to permit the transmission of DTMF tones from air to ground through the system following a successful call set up. The mechanism shall be provided through use of a radio interface signalling facility thus avoiding problems that may occur with non-transparency of voice coding algorithms to MF tones.

The signalling capability for DTMF is specified in ETS 300 326-2 [5].

## 6.11 Call progress indications

### 6.11.1 Purpose and types of indication

The TFTS shall support mechanisms to enable information regarding call status to be passed to the ATE for onward transmission to the user. These indications shall be required during three distinct phases of the call given in the following cases:

- 1) prior to the establishing of a connection between the TFTS and the fixed network;
- 2) when a fixed network connection exists;
- 3) following call release or during an unintentional loss of the fixed network or radio interface connection.

The call progress indications provided may either be tone based from the fixed network, or signalling based from within the TFTS or the fixed network. This ETS does not specify the method of presentation of these indications to the user as this is dependent on the type of user terminal and the ATE/CS. TFTA signalling requirements for these indications are specified in ETS 300 326-2 [5].

### 6.11.2 Call conditions

The following subclauses contain information relating to the call conditions for which call progress indications shall be provided. The signalling capability for conditions transmitted from the GSS to the AS as part of the call control protocol are specified in ETS 300 326-2 [5].

#### 6.11.2.1 Case 1 of subclause 6.11.1

When no connection to the fixed network exists the TFTA and/or the other aircraft equipment shall be required to produce call progress indications. Examples of the types of indication required in this phase are:

- a) initial handset/terminal activation;
- b) credit card entry;
- c) local credit card validation failure;
- d) no capacity on radio interface, - queuing;
- e) TFTA unavailable;
- f) call being processed;
- g) service available indication.

Conditions a) to c) are functions performed by the other aircraft systems. Conditions d) to g) shall require signalling interaction between the AT and the ATE.

#### 6.11.2.2 Case 2 of subclause 6.11.1

Connection made to fixed network. Examples of the types of indications required during this phase are:

- a) call proceeding (awaiting answer);
- b) called number busy;
- c) number unobtainable;
- d) no capacity at fixed network interface;
- e) ground credit card validation check failure;
- f) other network indication;
- g) network announcement.

The procedure for handling these indications depends on the fixed network connection. The TFTA shall transmit appropriate network signalling messages to the ATE. Inband tones and announcements should be transmitted either as signalling messages, where accurate recognition of these indications is possible, or through the speech channel.

### 6.11.2.3 Case 3 of subclause 6.11.1

Connection loss or release. Examples of the types of indications required during this phase are:

- a) normal clear-down, ground initiated;
- b) normal clear-down, AS initiated;
- c) system clear-down (planned e.g. out of range of GS);
- d) system clear-down (fault).

The procedure for handling these indications depends on the fixed network connection and whether communication with the GS has been unintentionally interrupted. Cases a) - c) shall be handled by normal signalling mechanisms. In case d) either the AT or the GS shall provide the appropriate signalling messages to the ATE dependent on the existence of a radio link.

### 6.11.3 ATE interface

The AT/ATE interface contained in ARINC Characteristic 746 [3] contains the signalling protocol for onward transmission of call control indications to the system user (passenger).

## 6.12 Identification of separate networks and service providers

The TFTS shall support the facility to identify uniquely the separate network operators and service providers who will be implementing the TFTS. Examples of how this could be achieved include:

- a) making provision for call records to include information regarding from which network and service provider calls originate;
- b) identifying the network on which each ground station operates; and
- c) identifying the network operator on network management records.

## 7 Design parameters

This clause specifies certain of the major design parameters of the TFTS that affect the system as perceived by the user. Certain quality parameters have been specified in clause 6. To avoid duplication these are not repeated here.

### 7.1 General

The performance perceived by the user of the TFTS shall be a product of all the network and system elements involved in the end-to-end connection. It is not the intention to define aspects of networks and systems beyond the scope of this ETS. Unless otherwise stated the parameters specified here relate to performance to be achieved in at least 90 % of the cases. The ASs are assumed to have a speed varying from 0 to 1 100 km/h.

It is assumed that all elements of the connection are functioning correctly. Malfunctioning entities are not considered. Aspects of reliability or the repair times of the various elements comprising the end-to-end connection are excluded from these parameters as these are viewed as a matter for implementation. Similarly, aspects of performance adversely affected by inadequate network or infrastructure performance are excluded.

Some of the parameters specified within this subclause may contain components from several systems on board the aircraft and may contain a component related to the performance of the fixed network. It is recommended that manufacturers of TFTS equipment and integrators of aircraft on board equipment regard these parameters as design targets, especially in the area of transmission performance and delay.

## 7.2 TFTS design parameters

### 7.2.1 Call success rate

The probability that a call attempt made from an AS in the TFTS coverage area will be successfully offered to the fixed network should be better than 99 %.

### 7.2.2 Time to connect call

The maximum time from a call request being received by the AT to the call request being initiated to the fixed network should be 5 seconds. It is assumed that this time commences when all necessary information to process and route the call within the TFTS has been passed to the AT. This time does not take account of any credit or charge card validation functions that may be performed by other systems.

### 7.2.3 Time to release call

The maximum time for a call release or similar message received by the AT from the ATE to be signalled to the fixed network interface shall be 2 seconds.

### 7.2.4 Connection time remaining

This is defined as the estimate of time remaining before the aircraft reaches the normal usage boundary of the cell in which it is operating. When this time is less than 2 minutes the AS should not establish a new call to the current ground station.

### 7.2.5 Duration of interruption due to handover

The maximum interruption to a call due to a single handover shall be as stated in table 9.

**Table 9: Handover interruption times**

Type of handover	Maximum interruption
GS to any other GS	150 ms
Change of frequency on current GS	150 ms
Change of timeslot on current frequency	50 ms

### 7.2.6 Handover success rate

The probability of success of handover to each type of GS should be as stated in table 10. These parameters assume that sufficient circuit capacity is available at the new ground station.

**Table 10: Handover success rate**

Gs Type	Probability of Handover success
En-route	> 99 %
Intermediate	> 99 %
Airport	> 99 %

### 7.2.7 Telephony probability of intelligibility

The probability that a telephony call is intelligible should be greater than 99 %.

## **8 TFTS data requirements**

Whilst the data requirements for TFTS are outside the scope of this specification, the remainder of this subclause is included for information.

Call related data items are stored at the GSC and may be interrogated by external systems. Other data may reside at the appropriate functional element of the TFTS. Call related data stored at the GSC are securely stored and protected against corruption or loss through system or power failure. The data also need to be reasonably protected against unauthorized access.

The data fall into three broad categories as follows:

- a) identification of TFTS items;
- b) call processing;
- c) operation, network management and administration.

### **8.1 External data systems**

Data stored at the GSC may be accessed by one or more external data systems. This ETS does not specify how the interfaces to these systems should be structured and which protocols to use for data access. Batch handling of data and transactional links may be supported by the TFTS equipment.

### **8.2 TFTS data records**

These are considered in general form in this ETS in the following subclauses. Reference has been made to other parts of this ETS for the specification of the data items when appropriate. Table 11 summarizes the data items.

Whilst the data requirements for TFTS are outside the scope of this specification, the remainder of this subclause is included for information.

Table 11: TFTS data items

Data	Origin	TX on radio path	Part of call record	Part of NM record	Value/length	Definition
Aircraft Station Identity (ASI)	AS	Yes	Yes	Yes	ICAO 24 bit technical address	Subclause 8.2.1.1
Aircraft Equipment Number (AEN)	AS	Yes	Yes	Yes	2 bits	Subclause 8.2.1.2
Aircraft Termination Equipment Identifier (ATEI)	AS	Yes	Yes	Yes	26 bits	Subclause 8.2.1.3
Aircraft Equipment Code (AEC)	AS	Yes	Yes	Yes	Not Defined	Subclause 8.2.1.4
GSS Code (GCC)	GSS	No	Yes	Yes	16 Bits	Subclause 8.2.2.1
GS Serial Number (GSN)	GSS	No	Yes	Yes	6 Bits	Subclause 8.2.2.1
GS Cell Type (GCT)	GSS	Yes	Yes	Yes	2 Bits	Subclause 8.2.2.1
GS Equipment Number (GEN)	GSS	No	Yes	Yes	8 Bits	Subclause 8.2.2.2

(continued)



Table 11 (concluded): TFTS data items

Data	Origin	TX on radio path	Part of call record	Part of NM record	Value/length	Definition
GS Longitude (GSLONG)	GSS	Yes	No	No	12 Bits	Subclause 8.2.2.3
GS Latitude (GSLAT)	GSS	Yes	No	No	12 Bits	Subclause 8.2.2.3
Network Identifier (ATISDN)	GSS	No	No	No	CCITT E.164	Subclause 8.2.3.1
Weight on Wheels(for use on aircraft)	AS	No	No	No	Switch	AEEC ARINC 746
Altitude	AS	No	No	No		ARINC 746 AEEC ETS 300 326-2 [5], subclause 8.10.10
Network Time	GSS	Yes	Yes	Yes	UTC	
(TIM)					yymmdd hhmmss	ETS 300 326-2 [5], subclause 8.10.10
Minimum Signal Level Acceptable At GS Antenna (RMIN)	GSS	Yes	No	No	0 to 10 dB	ETS 300 326-2 [5] subclause 8.10.10
Power Level (PWRCTL)	GSS	Yes	No	No		ETS 300 326-2 [5], subclause 8.10.10.3
AS Timing Adjustment (TIMCTL)	GSS	Yes	No	No		ETS 300 326-2 [5], subclause 8.10.10.3
In Band Signal Type	AS GSS	Yes	Yes	Yes		ETS 300 326-2 [5], clause 10

### 8.2.1 Identification data

#### 8.2.1.1 Aircraft Station Identity (ASI)

The ASI shall be based on the International Civil Aviation Organization (ICAO) aircraft 24 bit technical address. The equipment operator of the TFTS equipment on board the aircraft shall supply the appropriate data information for inclusion in the TFTS equipment.

#### 8.2.1.2 Aircraft Equipment Number (AEN)

This uniquely identifies each set of TFTS equipment which may be installed on-board an aircraft. The field consists of two bits.

#### 8.2.1.3 Aircraft Termination Equipment Identifier (ATEI)

The ASI and AEN may be combined into one data field known as the ATEI as shown in figure 4.

<b>ASI</b>	<b>AEN</b>
3 octets	2 bits

Figure 4: ATEI

#### 8.2.1.4 Aircraft Equipment Code (AEC)

The aircraft equipment shall be identified by an AEC. This may be required for maintenance purposes. The AEC is coded as shown in figure 5.

<b>TAC</b>	<b>FAC</b>	<b>SNR</b>	<b>SP</b>
6 bits	2 bits	6 bits	1 bit

Figure 5: AEC

The fields are:

**Type Approval Code (TAC):** this refers to the telecommunications equipment type approval as a TFTS aircraft station and does not refer to any aviation type approvals required for the equipment.

**Final Assembly Code (FAC):** this refers to the place/time of final assembly or manufacture.

**Serial Number (SNR):** uniquely identifying each equipment.

**Service Provider (SP):** spare.

### 8.2.2 Identification data Ground Station System (GSS)

A GSS consisting of GSC & GSs shall be identified by two codes, the Ground Station Identity Code (GSIC) and the Ground station Equipment Number (GEN).

#### 8.2.2.1 Ground Station Identity Code (GSIC)

A unique GSIC shall be provided for each ground station. This shall be used for identification during handover, acquisition procedures for aircraft and for operation maintenance and administrative purposes. Two identifiers shall be as shown in figure 6.

<b>GCC</b>	<b>GSN</b>	<b>GCT</b>
16 bits	6 bits	2 bits

Figure 6: GSIC

The fields are:

**Ground switching Centre Code (GCC):** this identifies the GSC in the TFTS.

**Ground station Serial Number (GSN):** this identifies a GS belonging to a GSC.

**Ground station Cell Type (GCT):** identifies a cell as en-route, intermediate or low power.

#### **8.2.2.2 Ground Equipment Number (GEN)**

The GEN shall identify each radio transmitter/receiver in a given GS installation. The GEN consists of 8 bits.

#### **8.2.2.3 Latitude and longitude**

The latitude and longitude of a given GS shall be identified by two parameters, GS-LONG and GS-LAT. These parameters are defined in ETS 300 326-2 [5], subclause 8.10.10.

## History

Document history	
February 1996	First Edition
March 1998	One-step Approval Procedure OAP 9829: 1998-03-20 to 1998-07-17