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Part 1 : Speech services, facilities and requirements

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Contents

Foreword

This European Telecommunication Standard (ETS) has been produced by the Radio Equipment and Systems (RES) Technical Committee of the European Telecommunications Standards Institute (ETSI).

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.

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".

An ETSI Technical Report (ETR) is in preparation for those manufacturers and/or system operators who require a defined interface between the TFTS Ground Station (GS) and TFTS Ground Switching Centre (GSC).

Proposed transposition dates	
Date of adoption of this ETS:	26 May 1995
Date of latest announcement of this ETS (doa):	30 April 1996
Date of latest publication of new National Standard or endorsement of this ETS (dop/e):	31 October 1996
Date of withdrawal of any conflicting National Standard (dow):	31 October 1996

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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 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 intended to be an informative reference for readers of the ETS.

The specification for data application and facsimile will be the subject of a further I-ETS.

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 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): "Definition of frequency bands for the Pan European terrestrial flight telecommunication 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: "Radio Equipment and Systems (RES) - Terrestrial Flight Telecommunication System (TFTS) Part 2: Speech services, radio interface".

[6]   ETS 300 326-3: "Radio Equipment and Systems (RES) - Terrestrial Flight Telecommunication System (TFTS) Part 3: Speech services, network aspects".

[7]   CCITT Recommendation G.165 (1988): "Echo cancellers".

[8]   CCITT Recommendation E.164 (1988, 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".

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 Recognised 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
CC	Country Code
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
EC	Echo Controller
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 Organisation
ISDN	Integrated Services Digital Network
LSB	Least Significant Bit
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	Recognised Private Operating Agency
SNR	Serial NumbeR
TAC	Type Approval Code
TDMA	Time Division Multiple Access
TFTS	Terrestrial Flight Telecommunication System
TIM	network TIMe
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.
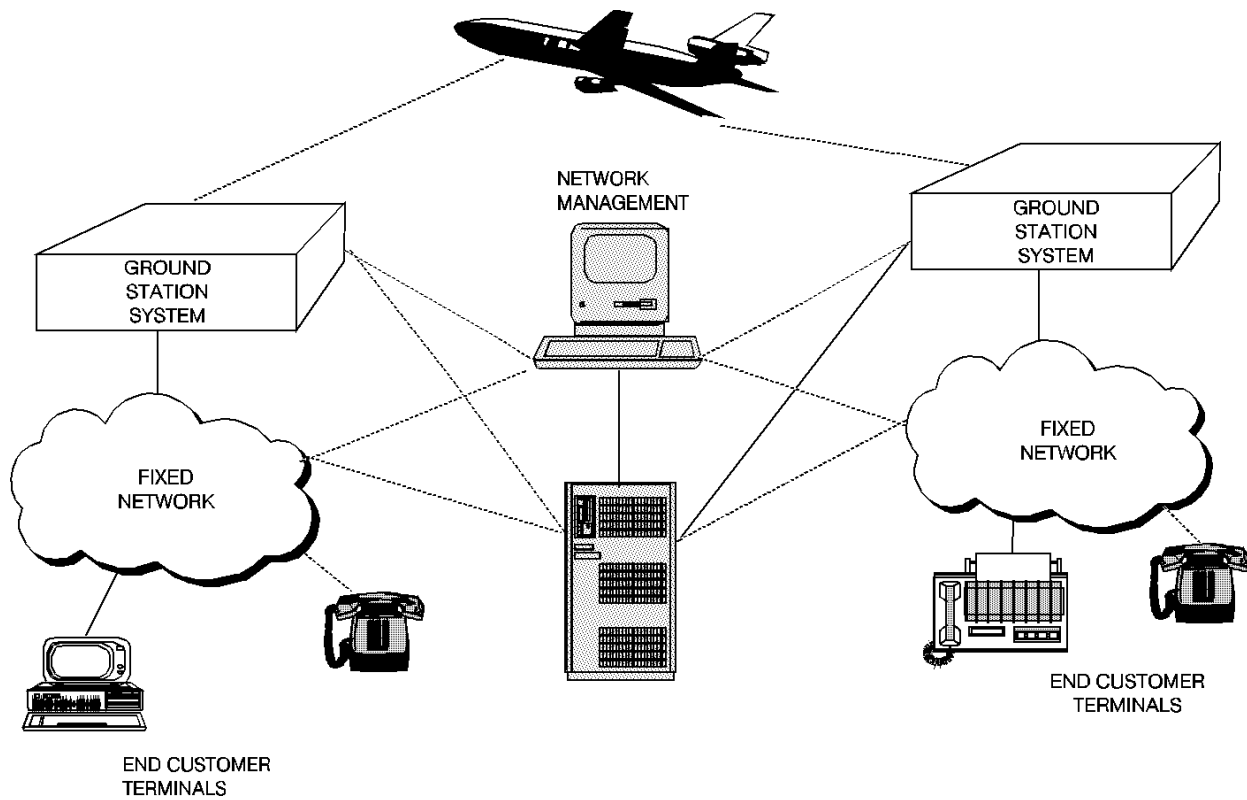
Figure 1: Aeronautical telecommunication services overview
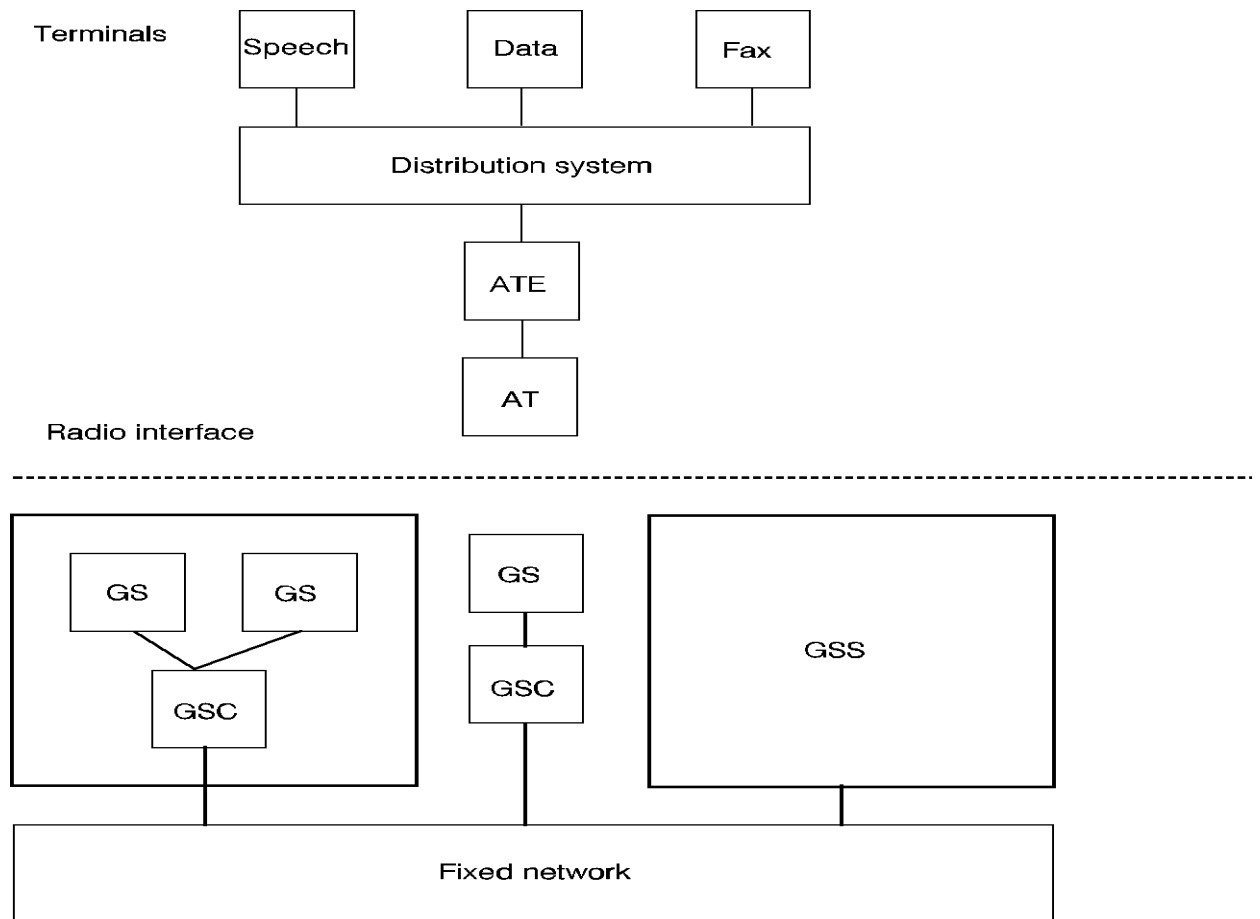
Figure 2: TFTS block diagram

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 realised 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 realised 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 characterised 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 characterised 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 recognised 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 realisation of these systems is outside the scope of this ETS and is a matter for the operators and users of the TFTS. This ETS includes certain items considered essential for the commercial operation of the TFTS (e.g. elements of call record data, network management data) which will form the basis of the external system interfaces.

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 characterised by attributes defining particular aspects of the service to be provided.

5.1 TFTS bearer services

Bearer services are characterised 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                         Uni or bidirectional
```

5.2 TFTS teleservices

Teleservices are characterised 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 recognised 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            )
  layer 5 protocol            )Not applicable
  layer 6 protocol            )
  layer 7 protocol            )

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 TFTS services to be defined in later phases

This informative subclause lists those bearer services and teleservices 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.

5.4.1 Bearer services

The additional bearer services listed in table 4 may be standardised in the future.

Table 4: Future TFTS bearer services

Speech Lower rate vocoder
Circuit mode unstructured Unrestricted digital capability Transparent
Circuit mode unstructured Unrestricted digital capability Non-transparent
PAD services
Packet service
Facsimile group 3

5.4.2 Teleservices

The additional teleservices listed in table 5 may be standardised in the future.

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

Table 5: Future TFTS teleservices

Lower rate speech air to ground
Full rate speech ground to air
Lower rate speech ground to air
Message service
Facsimile group 3
Synchronous data
Asynchronous 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 coverage should be below 15 000 feet;

- **airport cells**: Usage of airport cells should normally be confined to the runway, taxi-way and manoeuvrering areas of the airport. Altitude coverage 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 utilisation

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 utilisation 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

The TFTS does not support 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 (eg 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 Parts 2 and 3 [5] - [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 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 (ie 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. It is recommended that the mean one way delay between the acoustic interface and the ATE/AT interface is limited to a maximum of 15 ms.

6.7.2.3 Handsets

It is recommended that due consideration is 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.

AIRCRAFT STATION

AIRCRAFT INTERNAL
TRANSMISSION SYSTEM

2 Mbits/s   A LAW PCM

TERMINAL
EQUIPMENT — ATE — AT
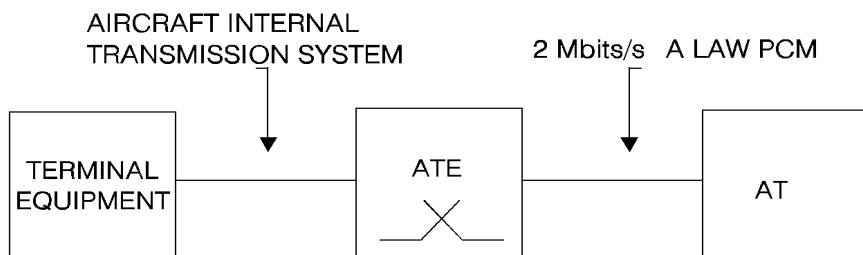
RADIO INTERFACE
9,6 KBITS/S SPEECH CHANNELS

SPEECH
TRANS-
CODER — GSC — EC

EC | LAND MOBILE NETWORK

NATIONAL EXCHANGE

EC | INTERNATIONAL EXCHANGE

2 MBIT/S PCM

GROUND STATION SYSTEM
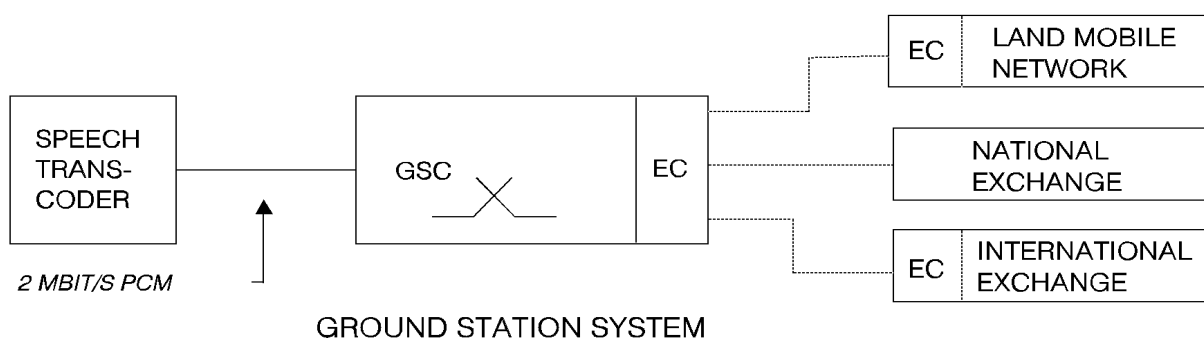
Figure 3: Examples of TFTS transmissions models

6.7.4   TFTS delay budget

6.7.4.1   One way delay budget

Table 6 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 6: 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 normalised 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. TFTS 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 TFTS 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)   TFTS 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 TFTS 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 cleardown, ground initiated;
b)   normal cleardown, AS initiated;
c)   system cleardown (planned e.g. out of range of GS);
d)   system cleardown (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 746 Attachment 11 [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 integraters 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 shall 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 shall 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 7.

Table 7: 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 shall be as stated in table 8. These parameters assume that sufficient circuit capacity is available at the new ground station.

Table 8: 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 shall be greater than 99 %.

8 TFTS data requirements

This clause specifies those aspects of system data which the TFTS shall provide in order for the system to be effectively operated and for TFTS calls to be correctly charged.

Call related data items shall be 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 shall be securely stored and protected against corruption or loss through system or power failure. The data shall also be reasonably protected against unauthorised 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 9 summarises the data items.

Table 9: 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 SSR 24 bit 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 9 (continued): 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 ARINC4 746	AEEC
Altitude	AS	No	No	No	ARINC 746 ETS 300 326-2 [5], subclause 8.10.10	AEEC
Network Time (TIM)	GSS	Yes	Yes	Yes HHMMSS	UTC 8.10.10 YYMMDD	ETS 300 326-2 [5], subclause
Minimum Acceptable Signal Level At GS Antenna (RMIN)	GSS	Yes	No	No	0 to 10 dB	ETS 300 326-2 [5] subclause 8.10.10

(continued)

Table 9 (concluded): TFTS Data Items

Data	Origin	TX on radio path	Part of call record	Part of NM record	Value / length	Definition
Power Level Adjustment (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 Organisation (ICAO) aircraft 24 bit 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 below.
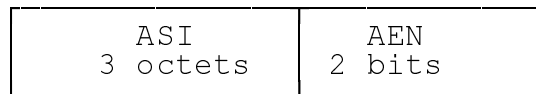
```
┌─────────────────────┬──────────────┐
│        ASI          │     AEN      │
│      3 octets       │    2 bits    │
└─────────────────────┴──────────────┘
```

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.

```
┌────────────┬────────────┬────────────┬────────────┐
│    TAC     │    FAC     │    SNR     │    SP      │
│   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;

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:

```
┌────────────┬────────────┬────────────┐
│    GCC     │    GSN     │    GCT     │
│  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.

8.2.3 Network identifiers for TFTS equipment

8.2.3.1 Aircraft Termination ISDN (ATISDN)

TFTS mobile stations shall be allocated a network address identification in accordance with CCITT Recommendation E.164 [8]. This identifier shall be called the Aircraft Termination ISDN (ATISDN) and the format of the identifier shall be as shown in figure 7.

CC	NDC	UN

Figure 7: ATISDN

The fields are:

Country Code (CC): the country where the TFTS aircraft installation is registered;

National Destination Code (NDC): the code of the TFTS service provider for that equipment;

User Number (UN): the number of the TFTS terminal.

This ETS does not specify how the ATISDN code shall be used or allocated.

History

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