INTERNATIONAL STANDARD

IEC 61603-7

First edition
2003-05

Transmission systems of audio and/or video and related signals using infra-red radiation –

Part 7: Digital audio signals for conference and similar applications

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

TRANSMISSION SYSTEMS OF AUDIO AND/OR VIDEO AND RELATED SIGNALS USING INFRA-RED RADIATION –

Part 7: Digital audio signals for conference and similar applications

FOREWORD

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International Standard IEC 61603-7 has been prepared by Technical Area 3, Infrared systems and applications, of IEC technical committee 100: Audio, video and multimedia systems and equipment.

This first edition cancels and replaces 2.6.2 of IEC 61603-3 (1997).

The text of this standard is based on the following documents:

FDIS	Report on voting
100/649/FDIS	100/676/RVD

Full information on the voting for the approval of this standard can be found in the report on voting indicated in the above table.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

The committee has decided that the contents of this publication will remain unchanged until 2005. At this date, the publication will be

- reconfirmed;
- withdrawn;
- replaced by a revised edition, or
- amended.

TRANSMISSION SYSTEMS OF AUDIO AND/OR VIDEO AND RELATED SIGNALS USING INFRA-RED RADIATION –

Part 7: Digital audio signals for conference and similar applications

1 Scope

This part of IEC 61603 describes the characteristics of a digital multiple channel, multiple carrier audio transmission system as an extension to conference interpretation or similar systems using the frequency ranges 45 kHz to 1 MHz and 2 MHz to 6 MHz.

NOTE These frequency ranges are also covered by analogue pulse systems used for the same applications. Interference is not expected because both transmission systems are normally not applied at the same time in the same room.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 61603-1:1997, *Transmission of audio and/or video and related signals using infrared radiation – Part 1: General*

IEC 61603-3:1997, *Transmission of audio and/or video and related signals using infrared radiation – Part 3: Transmission systems for audio signals for conference and similar systems*

IEC 61920, *Infrared transmission systems – Free air applications*[1]

ISO/IEC 7498-1:1994, *Information technology – Open Systems Interconnection – Basic Reference Model: The Basic Model*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 61603-1 apply.

4 Abbreviations

APCM	Adaptive pulse code modulation
AQM	Audio quality mode
CAT	Channel allocation table
CM	Configuration message
CRC	Cyclic redundancy check
DCI	Display changed identifier
DM	Display message
DM-CRC	Data message CRC

[1] To be published. For the purposes of the reference in C.1, IEC 61920:1998 is equally valid.

DMI	Data message identifier
DML	Data message length
DQPSK	Differential quadrature phase shift keying
HQ	High quality
MAXCN	Maximum channel number
MHQ	Mono high quality
MMQ	Mono medium quality
MQ	Medium quality
OSI	Open systems interconnection
PCM	Pulse code modulation
PRBS	Pseudo-random binary sequence
SCI	Source coding identifier
SEI	Setting changed identifier
SF	Scale factor
SHQ	Stereo high quality
SMQ	Stereo medium quality
SRRC	Square root raised cosine
XOR	Exclusive OR

5 Explanation of terms and general information

For the purposes of this part of IEC 61603, the explanation and information given in IEC 61603-3, Clause 2, apply.

6 System considerations

For the purposes of this part of IEC 61603, the considerations given in IEC 61603-3, Clause 3, apply.

NOTE With regard to the primary band, the special caution advised in IEC 61603-3, 3.3 should be observed, especially for inductive lighting and future developments.

7 Basic system concept

The basic system concept is shown in Figure 1.

The system consists of a number (N) of audio sources, either analogue or digital, which are connected to a transmitter. The transmitter processes the audio signals (in accordance with the protocol described in Clause 8) into an electrical output to feed the infrared radiator. The infrared signal is received by the infrared receiver that processes the signal and outputs an audio signal and/or associated data.

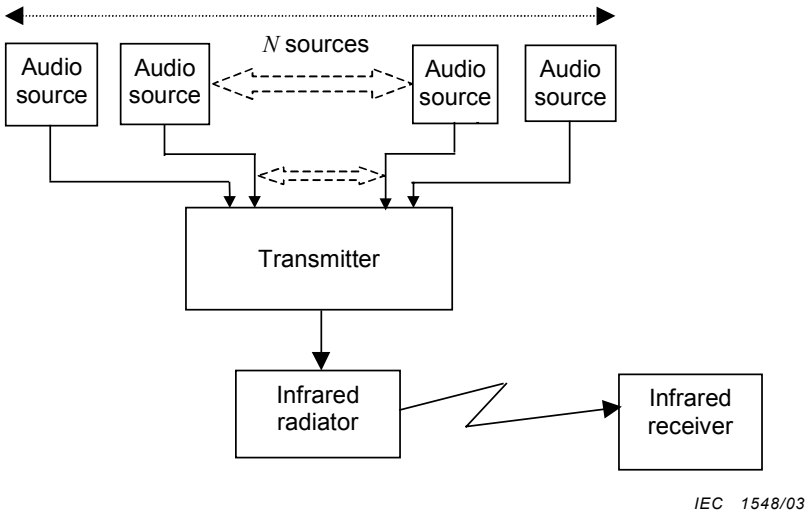

Figure 1 – System

8 Protocol

8.1 System context

In terms of the conceptual OSI reference model, the transmission protocol shall implement the following layers:

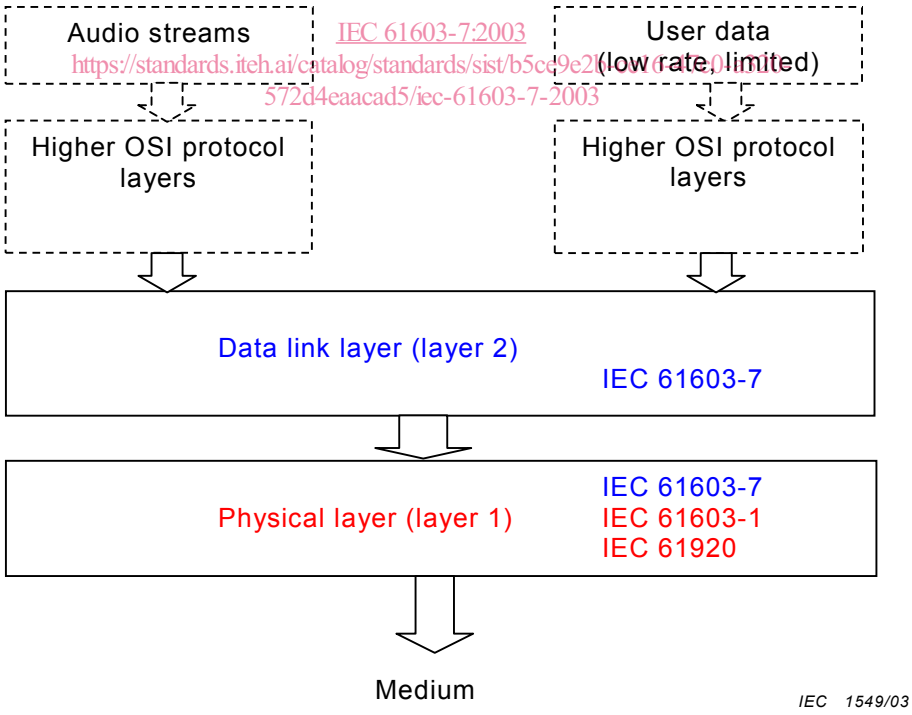

Figure 2 – Conceptual model

Figure 2 shows the system context using the OSI reference model. Layers 1 and 2 will be part of the transmission protocol defined in this standard.

8.2 Physical layer

8.2.1 General

OSI layer 1 (physical layer) shall use infrared radiation as the transfer medium between radiator and receiver as specified in IEC 61920 and IEC 61603-1.

8.2.2 Carrier

Optical wavelength at the optical peak intensity λ_P : 875 nm ± 25 nm

8.2.3 Sub-carriers

Primary frequency band (band IV): 2 MHz – 6 MHz

Secondary frequency band (band II): 45 kHz – 1 MHz.

NOTE The secondary frequency band, 45 kHz to 1 MHz, is under consideration.

Figure 3 shows the wideband allocation in the primary band, with the frequencies of each sub-carrier. A guard band between the transmission bands has been included. Table 1 shows the frequencies of each sub-carrier.

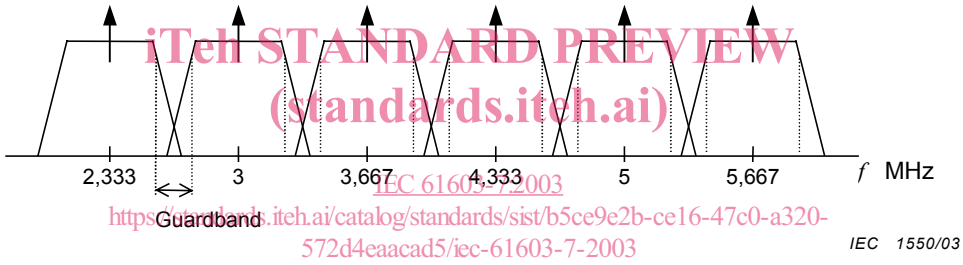

Figure 3 – Band allocation for 6 modulated sub-carriers

Table 1 – Sub-carrier centre frequencies

Sub-carrier	Frequency kHz
CC1	2333,333
CC2	3000
CC3	3666,667
CC4	4333,333
CC5	5000
CC6	5666,667

8.2.4 Occupied bandwidth

The occupied bandwidth is defined as follows.

$$B_{occ} = r_S \cdot (1 + \beta)$$

where

B_{occ} is the occupied bandwidth;

r_S is the symbol rate (= $\frac{r_b}{2}$ for (D)QPSK, $r_b$is the bit rate (see 8.3));

β is the roll-off factor (see 8.2.6).

8.2.5 Sub-carrier modulation

The modulation method is (D)QPSK. The constellation is shown in Figure 4a. The differential decoding algorithm is shown in Figure 4b. The phase transitions for the differential encoding algorithm are also listed in Table 2.

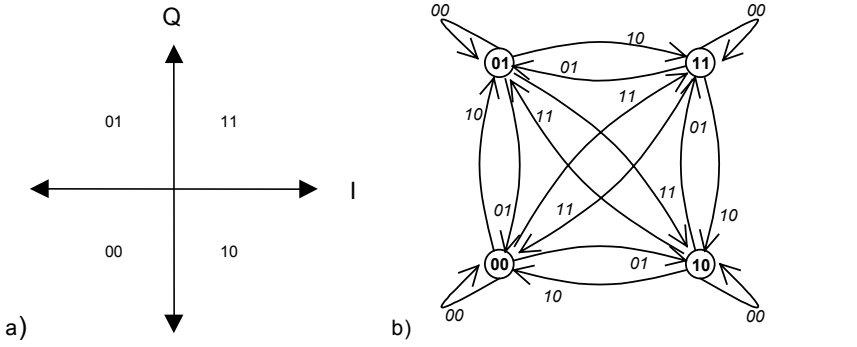

Figure 4 – (D)QPSK constellation and differential decoding algorithm

Table 2 – Phase transitions of the differential encoding algorithm

Phase change	Symbol IQ
0°	00
90°	01
180°	11
–90°	10

8.2.6 Filter characteristics

A channel filter is included. A square root raised cosine (SRRC) characteristic, as illustrated in Figure 5, is implemented in both the transmitter and the receiver resulting in a total transfer characteristic of a raised cosine.

The roll-off factor of the filter is β = 0,4.

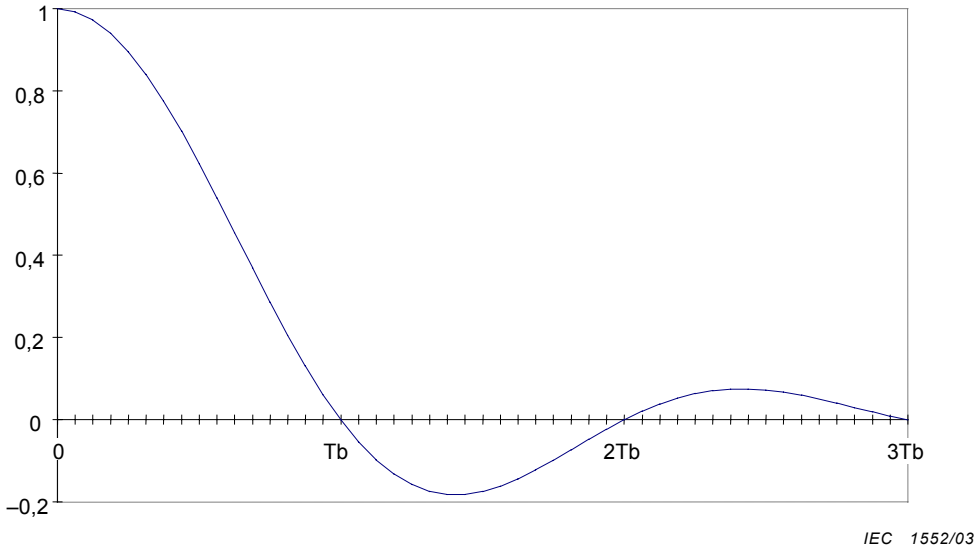

Figure 5 – Pulse response of a raised cosine channel filter

The combined filter characteristic from the transmitting and receiving filter shall be in accordance with the following equation:

$$P_r(f) = \begin{cases} T_b & |f| \le \frac{r_b}{2}(1-\beta) \\ T_b \bullet \cos^2 \frac{\pi}{4\beta}\left(|f| - \frac{r_b}{2}(\beta+1)\right) & \frac{r_b}{2}(1-\beta) < |f| \le \frac{r_b}{2}(1+\beta) \\ 0 & |f| > \frac{r_b}{2}(1+\beta) \end{cases}$$

where

$P_r(f)$ is the power transfer function;

f is the frequency (Hz);

r_b is the bit rate (bit/s);

$T_b = 1/r_b$

β is the roll-off factor.

8.2.7 Channel coding

8.2.7.1 Reed-Solomon encoder

A shorted Reed-Solomon encoder (n,k,d) = (28,24,5) on 8-bit symbols is used. The Reed-Solomon encoder operates in Galois Field GF(2^8).

The field generator polynomial is:

$$p(x) = x^8 + x^4 + x^3 + x^2 + 1$$