



INTERNATIONAL TELECOMMUNICATION UNION

# ITU-T

TELECOMMUNICATION  
STANDARDIZATION SECTOR  
OF ITU

## G.173

(03/93)

**TRANSMISSION SYSTEMS AND MEDIA  
TRANSMISSION PLAN ASPECTS OF SPECIAL  
CIRCUITS AND CONNECTIONS USING  
THE INTERNATIONAL TELEPHONE  
CONNECTION NETWORK**

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**TRANSMISSION PLANNING ASPECTS  
OF THE SPEECH SERVICE IN DIGITAL  
PUBLIC LAND MOBILE NETWORKS**

**ITU-T Recommendation G.173**

(Previously "CCITT Recommendation")

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## FOREWORD

The ITU Telecommunication Standardization Sector (ITU-T) is a permanent organ of the International Telecommunication Union. The ITU-T is responsible for studying technical, operating and tariff questions and issuing Recommendations on them with a view to standardizing telecommunications on a worldwide basis.

The World Telecommunication Standardization Conference (WTSC), which meets every four years, established the topics for study by the ITU-T Study Groups which, in their turn, produce Recommendations on these topics.

ITU-T Recommendation G.173 was prepared by the ITU-T Study Group XII (1988-1993) and was approved by the WTSC (Helsinki, March 1-12, 1993).

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## NOTES

1 As a consequence of a reform process within the International Telecommunication Union (ITU), the CCITT ceased to exist as of 28 February 1993. In its place, the ITU Telecommunication Standardization Sector (ITU-T) was created as of 1 March 1993. Similarly, in this reform process, the CCIR and the IFRB have been replaced by the Radiocommunication Sector.

In order not to delay publication of this Recommendation, no change has been made in the text to references containing the acronyms "CCITT, CCIR or IFRB" or their associated entities such as Plenary Assembly, Secretariat, etc. Future editions of this Recommendation will contain the proper terminology related to the new ITU structure.

2 In this Recommendation, the expression "Administration" is used for conciseness to indicate both a telecommunication administration and a recognized operating agency.

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**Recommendation G.173****TRANSMISSION PLANNING ASPECTS OF THE SPEECH SERVICE  
IN DIGITAL PUBLIC LAND MOBILE NETWORKS***(Helsinki, 1993)***1 Introduction**

The purpose of this Recommendation is to describe the special transmission planning aspects of digital public land mobile networks (PLMN). This Recommendation is limited to PLMN implemented with terrestrial-based facilities only. Mobile networks that include satellite links are not covered by this Recommendation, but are under separate consideration. In addition, this Recommendation provides guidelines and advice to Administrations and recognized network operators as to the kind of precautions, measures and minimum requirements which are needed for a successful interworking of digital public land mobile networks with the national and international PSTN and ISDN. Transmission planning aspects of analogue public land mobile networks are not covered in this Recommendation.

The performance objectives of digital public land mobile networks are to reach a quality as close as possible to CCITT Recommendations. Due to the technical and economical factors of such mobile networks a full compliance with the general characteristics of international telephone connections and circuits recommended by CCITT is not guaranteed on all connections.

The interworking between a public land mobile network and the PSTN/ISDN, especially the signalling system between both networks is described in Recommendation Q.70.

A summary of transmission requirements for digital public land mobile systems is presented below. Annex A provides a more complete discussion of definitions and factors which may prevent full compliance with CCITT Recommendations. Annex B gives examples of PLMN and ISDN/PSTN interconnections and configurations, Supplement No. 32 (to this Recommendation) provides information on characteristics of specific systems.

**2 Transmission performance**

A model of a connection between a PLMN and the PSTN/ISDN is shown in Figure 1. A more detailed model of PLMN and the relevant interfaces are described in Annex A.

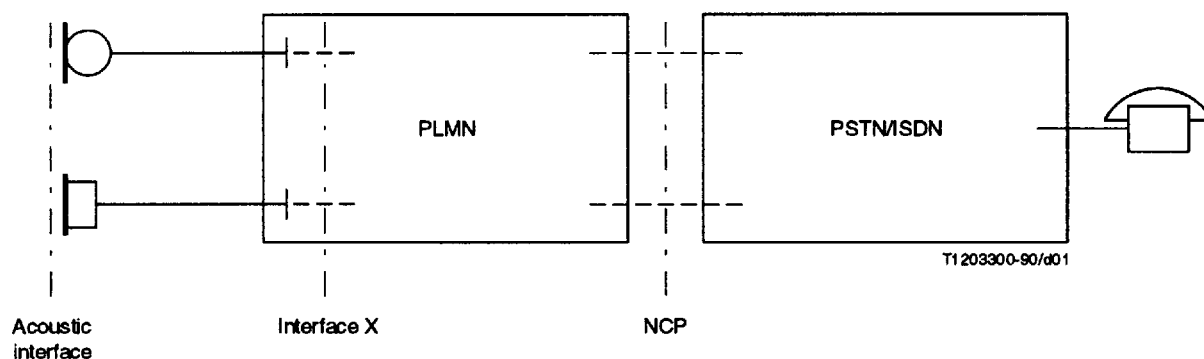


**FIGURE 1/G.173**  
**Connection between a PLMN and PSTN/ISDN**

The overall transmission performance of a connection from the PLMN to the PSTN/ISDN can be considered as a summation of the effects of:

- the audio part between the acoustic interface and interface X;
- the speech transcoder part including the effects of radio transmission and speech processing between interface X and the network connection point (NCP), see A.1.5;
- the overall characteristics of the connection between the NCP and the other user.

There is not only a linear addition of these effects but there is also an influence from different parts of the connection on the performance of the speech transcoder and other speech processing devices.

However, in several cases the main determining factors are the characteristics of the audio part when the additional call path in the PLMN is digital.

Where possible, the transmission performance is specified between the acoustic interface and interface X. The transmission aspects of the whole digital mobile system depend on the technical design and may be different from network operator to network operator. To control the end-to-end transmission quality recommended by CCITT the requirements given below should be met by the PLMN.

2.1 Loudness ratings

The recommended values for the loudness ratings are:

|     | Short-term objectives | Long-term objectives |
|-----|-----------------------|----------------------|
| SLR | 7 dB to 9 dB          | 8 dB                 |
| RLR | 1 dB to 3 dB          | 2 dB                 |

These values are directly applicable to the case of a mobile station operating in a conventional non-mobile noise environment. Studies have shown that in a PLMN noise environment, speech levels are likely to be higher. Hence, in order to avoid clipping in the speech transcoder it may be necessary to increase the value of the SLR.

The loudness rating values should be measured between the acoustic interface and the interface X. In the usual case where the PLMN introduces no additional loss or attenuation distortion between interface X and the NCP, the loudness ratings up to the PSTN/ISDN will be the same as loudness ratings measured at interface X. For more details see A.3.1.

2.2 Stability

The stability requirements will be met if the attenuation between the digital input and digital output of the PLMN at the NCP is at least 6 dB. For more details see A.3.2.

2.3 Propagation time

The following values are given for the mean one-way propagation time of the PLMN:

recommended value < 40 ms (see Note).

NOTE – Technical and practical considerations do not permit the recommended value to be achieved at this time. Existing PLMNs should provide acceptable service on many connections but compliance with Recommendations G.114 and G.131 may not be assured on all connections (see A.3.3).

2.4 Echo control

Due to the high propagation time, echo control is necessary within the PLMN. For reducing the PSTN/ISDN network echo, an echo control device is needed at the NCP. The PLMN echo loss at the NCP shall be greater than 45 dB. If there is no additional loss in the PLMN, the terminal coupling loss of the MS has to fulfil the echo requirements.

For discussion related to connections involving PLMN echo control devices and PSTN/ISDN echo control devices, see A.3.4. Subclause A.3.4 also included discussion on PLMN echo loss objectives for the evolving PSTN/ISDN.

Technical and practical considerations do not permit the recommended value to be achieved at this time. According to Recommendation P.31 the weighted terminal coupling loss ( $TCL_w$ ) of a digital telephone should be greater than 40 dB.

The characteristics of the PLMN, including the PLMN canceller used to cancel PSTN/ISDN network echoes, must not compromise the operation of network based G.165 cancellers.

## 2.5 Quantizing distortion

For the quantizing distortion of the PLMN in error free conditions between the acoustic interface and the NCP, the following values are given:

recommended value < 4 qdu (see Note 1).

The qdu of PLMN under realistic bit-error-rate conditions (conditions to be determined):

recommended value < 7 qdu (see Note 1).

### NOTES

1 Technical and practical considerations do not permit the recommended values to be achieved at this time by all systems. Existing PLMNs should provide acceptable service on many connections but compliance with Recommendation G.113 may not be assured on all connections (see A.3.5).

2 It should be noted that in some cases such as low bit rate ( $\leq 8$  kbit/s) non-waveform codecs, the concept of quantizing distortion units (qdu) may not apply.

## 2.6 Clipping

For clipping no specific requirement is given. For more information see A.3.6.

## 2.7 Noise contrast

For noise contrast no specific requirement is given. For more information see A.3.7.

## 2.8 Other requirements

The PLMN should be designed to be in accordance with relevant CCITT Recommendations concerning:

- sidetone;
- noise;
- sensitivity/frequency characteristics;
- distortion;
- out-of-band signals;
- go/return crosstalk.

The transmission requirements of handset MS should be derived from the requirements of digital telephones stated in Recommendation P.31. For headset telephones, information can be found in Recommendation P.38 and for handsfree telephones using loudspeakers, see Recommendation P.34.

## Annex A

### Definitions and detailed transmission aspects

(This annex forms an integral part of this Recommendation)

#### A.1 Definitions

For the purpose of this Recommendation, the following definitions apply:

**A.1.1 base station (BS):** A base station (BS) is a radio transmitter/receiver station in a PLMN which provides the radio transmission path to the mobile station. Several base stations are connected via leased lines to a mobile services switching centre.

**A.1.2 digital mobile system:** The basic configuration of a digital mobile system is shown in Figure A.1. A digital mobile system consists of the mobile station, radio transmission path, base station, leased line and the mobile services switching centre up to the network connection point (NCP).

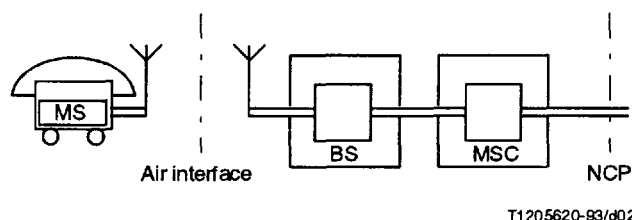


FIGURE A.1/G.173

Basic configuration of a digital mobile system

**A.1.3 mobile services switching centre (MSC):** The MSC performs all necessary signalling and transmission functions in order to establish connections to and from mobile stations. A mobile station is registered at one MSC which functions as its home-MSC for charging and billing purposes.

In order to obtain radio coverage in a given geographical area, a number of base stations are normally required, i.e. each MSC is interconnected with several base stations. In addition, several MSCs may be required in order to cover the area of a PLMN.

**A.1.4 mobile station (MS):** A mobile station (MS) is transportable terminal equipment providing different services to the customer in a PLMN. It provides access via a base station to the PSTN/ISDN and to other mobile stations.

**A.1.5 network connection point (NCP):** A network connection point is a point at which, in general, two independent networks are interconnected. In the context of this Recommendation, NCP refers to the connection point between a PLMN and the PSTN/ISDN.

**A.1.6 public land mobile network (PLMN):** A public land mobile network may be defined as a number of mobile services switching centre areas within a common numbering plan and a common routing plan.

With respect to their functions, the PLMNs may be regarded as independent communications entities, even though different PLMNs may be interconnected through the PSTN/ISDN for the forwarding of calls or network information. The MSCs of a PLMN can be interconnected similarly to allow interaction.