INTERNATIONAL TELECOMMUNICATION UNION

ITU-T

TELECOMMUNICATION
STANDARDIZATION SECTOR
OF ITU

Supplement 22

(Series P)

(03/93)

TELEPHONE TRANSMISSION QUALITY

SUBSCRIBERS' LINES AND SETS

TRANSMISSION CHARACTERISTICS OF WIDEBAND AUDIO TELEPHONES

Supplement 22 to

ITU-T Series P Recommendations

(Previously "CCITT Recommendations")

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.

Supplement 22 to ITU-T Series P Recommendations was prepared by the ITU-T Study Group XII (1988-1993) and was approved by the WTSC (Helsinki, March 1-12, 1993).

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 Similarly, in this reform process, the CCIR and the IFRB have been replaced by the Radiocommunication Sector.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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Supplement 22

TRANSMISSION CHARACTERISTICS OF WIDEBAND AUDIO TELEPHONES

(Helsinki, 1993)

(referred to in Series P Recommendations)

1 Introduction

This supplement provides preliminary audio performance requirements for telephones capable of transmitting an audio bandwidth extending beyond the conventional telephony bandwidth of 300 to 3400 Hz, to a bandwidth of approximately 150 to 7000 Hz. Such telephones are known as wideband audio telephones, and will make use of digital encoding schemes such as Recommendation G.722. Wideband audio represents a considerable departure from traditional telephony, offering significantly improved quality. However, since this is a new technical area, the requirements in this supplement are not complete, and studies are on-going. Guidance on making wideband audio measurements may be found in the Annex A to this supplement.

2 Handset sending characteristics

2.1 Levels

Pending completion of a method for calculating wideband loudness ratings, the electro-acoustic gain in the send direction should be adjusted in terms of a narrow-band loudness rating calculated according to Recommendation P.79 (calculated over the range 200 to 4000 Hz). When measured in this manner the provisional send loudness rating (SLR) should be +8 dB (consistent with Recommendation P.31).

NOTE – The overload point for wideband audio is defined as +9 dBm0.

2.2 Sensitivity/frequency characteristics

The sending sensitivity/frequency characteristic from the mouth reference point (MRP) to the digital interface should fall within a mask which can be drawn between the points given in Table 1, also shown in Figure 1. All sensitivities are dB on an arbitrary scale.

TABLE 1

Frequency (Hz)	Upper limit (dB)	Lower limit (dB)
100	4	–∞
125	4	–7
200	4	–4
1000	4	–4
5000		–4
6300	9	–7
8000	9	–∞

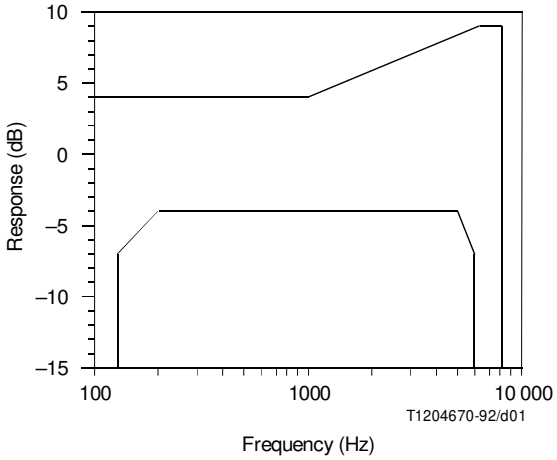

FIGURE 1

Handset send characteristic

2.3 Noise

With the microphone muted acoustically, the noise produced by the apparatus in the sending direction at the digital interface should not exceed –68 dBm0 (A-weighted).

2.4 Distortion

The distortion of the apparatus in the sending direction should be measured in terms of the total distortion (harmonic and quantizing) arising from the application of 1 kHz and 6 kHz tones applied separately. The limits shall be as shown in Table 2. The tone input level is in terms of an acoustic reference level (ARL) which is defined as the acoustic level at MRP which results in a –10 dBm0 output at the digital interface.

TABLE 2

Input level (dB re ARL)	Signal-to-distortion ratio limit (dB)	
	1 kHz	6 kHz
+18 to –20	35	29
–30	26.5	25
–46	12.5	11

NOTE – These limits only apply up to the maximum sound pressure level which can be produced by the artificial mouth (+10 dBPa).

2.5 Discrimination against out-of-band input signals

The level of any in-band image frequencies at the output resulting from application of input signals above 8 kHz should be attenuated by at least 25 dB compared to the output level of a 1 kHz input signal.

3 Handset receiving characteristics

3.1 Levels

Pending completion of a method for calculating wideband loudness ratings, the electro-acoustic gain in the receive direction should be adjusted in terms of a narrow-band loudness rating calculated according to Recommendation P.79 (calculated over the range 200 to 4000 Hz). When measured this way, the provisional receive loudness rating (RLR) is +10 dB. This is derived from the RLR of +2 dB specified in Recommendation P.31, with 6 dB loss added to account for the effective loudness gain going from narrow-band to wideband, and a further 2 dB loss to account for the loudness loss introduced by the Type 3.2 artificial ear specified in Recommendation P.57.

It is anticipated that wideband audio telephones will incorporate a receive volume control, and the above requirement is taken to apply at the nominal volume level.

NOTE – The overload point for wideband audio is defined as +9 dBm0.

3.2 Sensitivity/frequency characteristics

The receiving sensitivity/frequency characteristics from the digital interface to the ear reference point should fall within a mask which can be drawn between the points given in Table 3, also shown in Figure 2. All sensitivities are dB on an arbitrary scale.

TABLE 3

Frequency (Hz)	Upper limit (dB)	Lower limit (dB)
100	4	–∞
160	4	–7
200	4	–4
1000	4	–4
5000	4	–4
6300	4	–7
8000	4	–∞

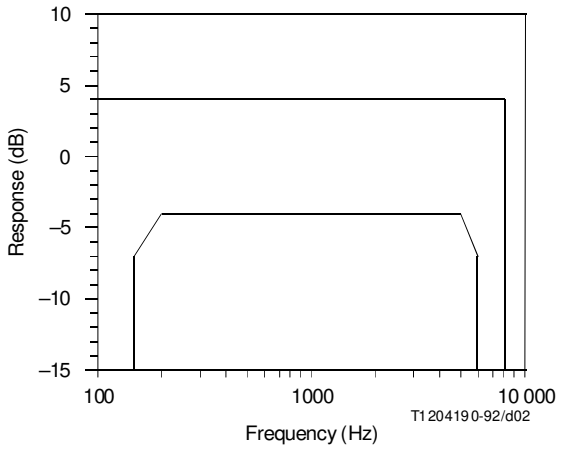

FIGURE 2

Handset receive characteristic

3.3 Noise

The noise produced by the apparatus in the receiving direction at the nominal receiving level specified in 3.1 should not exceed 35 dBA.

3.4 Distortion

The distortion of the apparatus in the receiving direction should be measured in terms of the total distortion (harmonic and quantizing) arising from the application of 1 kHz and 6 kHz tones applied separately. The limits shall be as shown in Table 4.

TABLE 4

Receive level (dBm0)	Signal-to-distortion ratio limit (dB)	
	1 kHz	6 kHz
+8 to –30	35	29
–40	26.5	25
–56	12.5	11

3.5 Spurious out-of-band receiving signals

The level of any spurious out-of-band signals arising from application of in-band signals at a level of 0 dBm0 should be attenuated by the following amounts relative to the output level of a 1 kHz sine wave applied at an input of 0 dBm0:

9 kHz 40 dB

14 kHz and above 60 dB

4 Handset sidetone characteristics

Under study.

5 Handset echo path loss characteristics

Under study, but provisional value of Weighted Terminal Coupling Loss is 40 dB.

6 Hands-free sending characteristics

6.1 Levels

Following the approach used for narrow-band hands-free telephones in Recommendation P.34, the levels in the hands-free send direction are related to those in handset mode with an allowance of 5 dB for higher talking levels and the difference in speaking position. The provisional value of SLR is therefore +13 dB, measured in terms of a narrow-band loudness rating according to Recommendation P.79.

NOTE – The overload point for wideband audio is defined as +9 dBm0.

6.2 Sensitivity/frequency characteristics

The sending sensitivity/frequency characteristics from mouth reference point to the digital interface should fall within a mask which can be drawn between the points given in Table 5, also shown in Figure 3.

TABLE 5

Frequency (Hz)	Upper limit (dB)	Lower limit (dB)
100	4	–∞
125	4	–7
200	4	–4
1000	4	–4
5000		–4
6300	9	–7
8000	9	–∞

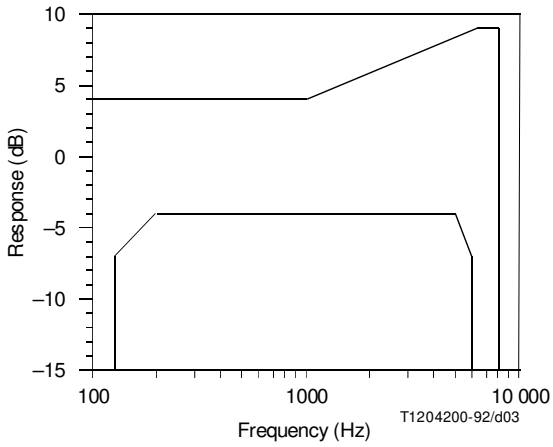

FIGURE 3

Hands-free send characteristic

6.3 Noise

With the microphone acoustically muted, the noise produced by the apparatus in the sending direction at the digital interface should not exceed –68 dBm0 (A-weighted).

6.4 Distortion

The distortion of the apparatus in the sending direction should be measured in terms of the total distortion (harmonic and quantizing) arising from the application of 1 kHz and 6 kHz tones applied separately. The limits shall be as shown in Table 6. The tone input level is in terms of an acoustic reference level (ARL) which is defined as the acoustic level at MRP which results in a −10 dBm0 output at the digital interface.

TABLE 6

Input level (dB re ARL)	Signal-to-distortion ratio limit (dB)	
	1 kHz	6 kHz
+18 to −20	35	29
−30	26.5	25
−46	12.5	11
NOTE – These limits only apply up to the maximum sound pressure level which can be produced by the artificial mouth (+10 dBPa).		

6.5 Discrimination against out-of-band input signals

The level of any in-band image frequencies resulting from application of input signals above 8 kHz should be attenuated by at least 25 dB compared to the output level of a 1 kHz input signal.

7 Hands-free receiving characteristics

7.1 Levels

Following the approach used for narrow-band hands-free telephones in Recommendation P.34, the levels in the hands-free receive direction are related to those in handset mode. The provisional value of RLR is +24 dB.

It is anticipated that wideband audio telephones will incorporate a receive volume control, and the above requirement is taken to apply at the nominal volume level.

NOTE – The overload point for wideband audio is defined as +9 dBm0.

7.2 Sensitivity/frequency characteristics

The receiving sensitivity/frequency characteristics from the digital interface to the ear reference point should fall within a mask which can be drawn between the points given in Table 7, also shown in Figure 4.

7.3 Noise

Requirements under study.

7.4 Distortion

The distortion of the apparatus in the receiving direction should be measured in terms of the total distortion (harmonic and quantizing) arising from the application of 1 kHz and 6 kHz tones applied separately. The limits shall be as shown in Table 8.

TABLE 7

Frequency (Hz)	Upper limit (dB)	Lower limit (dB)
100	6	–∞
160	6	–7
200	6	–4
250	6	–4
400	4	–4
1000	4	–4
5000	4	–4
6300	4	–7
8000	4	–∞

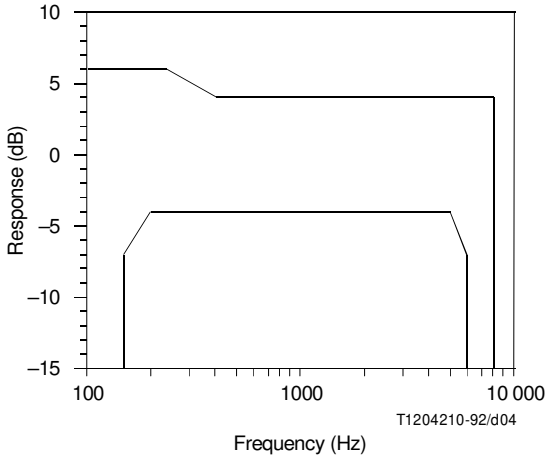

FIGURE 4

Hands-free receive characteristic

TABLE 8

Receive level (dBm0)	Signal-to-distortion ratio limit (dB)	
	1 kHz	6 kHz
+8 to –30	35	29
–40	26.5	25
–56	12.5	11

7.5 Spurious out-of-band receiving signals

The level of any spurious out-of-band signals arising from application of in-band signals at a level of 0 dBm0 should be attenuated by the following amounts relative to the output level of a 1 kHz sine wave applied at an input of 0 dBm0:

9 kHz	40 dB
14 kHz and above	60 dB

8 Hands-free echo path loss characteristics

Requirements under study, but it should be noted that a wideband hands-free terminal may be required to provide inherent talker echo control.

9 Hands-free switching characteristics

Requirements under study.

10 Delay

Requirements under study.

Annex A

Objective measurement methods for wideband audio telephones

A.1 Introduction

This annex describes methods which may be used to measure the performance of wideband audio telephones, that is, telephones capable of transmitting an audio bandwidth extending beyond the telephony bandwidth of 300 to 3400 Hz, to a bandwidth of approximately 150 to 7000 Hz. Wideband audio is a new technical area, and measurement techniques are still evolving and studies on this topic are on-going. In general, reference will be made in this annex to existing Recommendations where possible, noting any differences required to accommodate the wider bandwidth.

A.2 Electrical interface specifications

Wideband audio will be implemented by a digital encoding scheme such as Recommendation G.722, and will therefore require a suitable interface for test purposes. Detailed requirements for such an interface are not yet available, but the same approach should be followed as for making measurements on narrow-band digital telephones in Recommendation P.66, see Figure A.1.

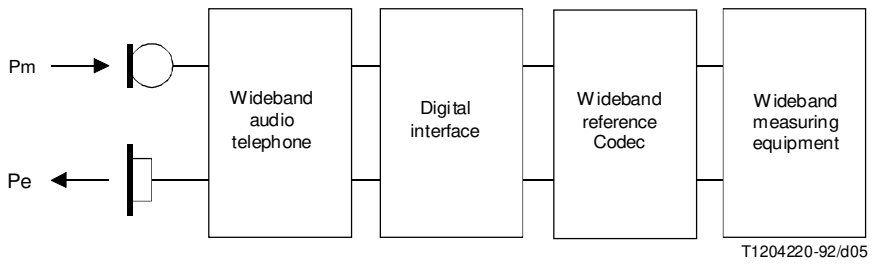

FIGURE A.1

A.3 Electro-acoustic measurement considerations

A.3.1 Artificial mouths and ears

The artificial mouth specified in Recommendation P.51 may be used for making wideband transmit measurements in handset and hands-free modes. If the Brüel and Kjaer type 4227 artificial mouth is used, the rounded face plate is recommended.

For making handset receive measurements, the Type 3.2 artificial ear described in Recommendation P.57 is recommended.

For making handset measurements, the Loudness Rating Guard-Ring Position (see Annex A/P.76) is recommended.

For making hands-free measurements, the test configuration in Figure 3/P.34 is recommended.

The mouth reference point (MRP) and ear reference point (ERP) used for wideband audio measurements are defined in the same manner as for narrow-band (see Annex A/P.64).

A.3.2 Stimulus signals

In general, a speech-like stimulus signal is preferred, but care should be taken that the signal contains sufficient high-frequency components to obtain an adequate signal-to-noise ratio for the measurement.

A.4 Handset measurement methods

A.4.1 Sending measurements

Under study, but guidance may be found in 6.1.1/P.66.

A.4.2 Receiving measurements

Under study, but guidance may be found in 6.2.1/P.66.

A.4.3 Sidetone measurements

Under study, but guidance may be found in 6.3/P.66.

A.4.4 Echo path measurements

Under study, but guidance may be found in 6.4/P.66.

A.5 Hands-free measurement methods

A.5.1 Sending measurements

Under study, but guidance may be found in Recommendation P.34.

A.5.2 Receiving measurements

Under study, but guidance may be found in Recommendation P.34.

A.5.3 Switching measurements

Under study, but guidance may be found in Recommendation P.34.