



INTERNATIONAL TELECOMMUNICATION UNION

ITU-T

TELECOMMUNICATION
STANDARDIZATION SECTOR
OF ITU

H.110

**LINE TRANSMISSION
OF NON-TELEPHONE SIGNALS**

**HYPOTHETICAL REFERENCE CONNECTIONS
FOR VIDEOCONFERENCING USING PRIMARY
DIGITAL GROUP TRANSMISSION**

ITU-T Recommendation H.110

(Extract from the *Blue Book*)

NOTES

1 ITU-T Recommendation H.110 was published in Fascicle III.6 of the *Blue Book*. This file is an extract from the *Blue Book*. While the presentation and layout of the text might be slightly different from the *Blue Book* version, the contents of the file are identical to the *Blue Book* version and copyright conditions remain unchanged (see below).

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

Recommendation H.110

HYPOTHETICAL REFERENCE CONNECTIONS FOR VIDEOCONFERENCING USING PRIMARY DIGITAL GROUP TRANSMISSION

(Malaga-Torremolinos, 1984; amended at Melbourne, 1988)

The CCITT,

considering

- (a) that there is growing evidence of a customer demand for a videoconference service;
- (b) that circuits to meet this demand can, at present, be provided effectively by digital transmission using the primary digital group;
- (c) that switched digital transmission networks known as the Integrated Digital Network (IDN) and Integrated Services Digital Network (ISDN) are under study, but the methods of exploiting these networks for the transmission of primary digital groups will not become clear until the studies have progressed further;
- (d) that the existence of different digital hierarchies and different television standards in different countries complicates the problems of defining hypothetical reference connections;
- (e) that a hypothetical reference connection may be used as a guide to simplify the problems of connections between countries with different television standards and digital hierarchies,

appreciating

that rapid advances are being made in research and development of video coding and bit-rate reduction techniques which may lead to further Recommendations being proposed for hypothetical reference connections for videoconferencing at bit rates which are multiples or sub-multiples of 384 kbit/s during subsequent study periods, so that this may be considered as the first of an evolving series of Recommendations,

noting

- (a) that a hypothetical reference connection is a model in which studies relating to overall performance may be made, thereby allowing comparisons with standards and objectives; on this basis, limits for various impairments can be allocated to the elements of the connection;
- (b) that such a model may be used:
 - by an Administration to examine the effects on transmission quality of changes of impairment allocations in national networks,
 - by the CCITT for studying the allocation of impairments to component parts of international networks,
 - to test national rules for prima facie compliance with any impairment criteria which may be recommended by the CCITT for national systems;
- (c) that hypothetical reference connections are not to be regarded as recommending particular values of impairments allocated to constituent parts of the connection, and they are not intended to be used for the design of transmission systems,

and recognizing

that the planning of the necessary transmission networks for a videoconference service will be facilitated if recommended hypothetical reference connections are available, even if only in a preliminary form without details of all transmission and switching arrangements,

(1) that the hypothetical reference connection and means for digital transmission illustrated in Figures 1/H.110 and 2/H.110 shall be used as the model for studies of the overall performance of international videoconference connections, both intra-regional¹⁾ and inter-regional¹⁾, which are provided using minimum numbers of encoding and decoding equipments;

(2) that hypothetical reference connections of a more complex type, as, for example, those illustrated in Figure 3/H.110, being representative of many connections that may be employed in practice, should be studied further.

Note 1 – The hypothetical reference connection shown in Figure 1/H.110 contains the basic transmission elements, but is incomplete because switching has been excluded and the local ends and parts of the national network at each end of the connection have been left unspecified.

Note 2 – Because the arrangements of transmission systems interconnecting regions using different digital hierarchies have not yet been standardized, and because videoconferencing is likely to be a minority service in such transmission systems, it seems prudent to consider videoconference connections both where the primary hierarchical level on the inter-regional link is 1.5 Mbit/s and where it is 2 Mbit/s. In Figure 2b/H.110, the change between 2048 kbit/s and 1544 kbit/s transmission is placed at the 2048 kbit/s end of the long international network. The long distance part of the connection is thus operated at the lower bit rate. Where the international network is provided on a system which uses the 2048 kbit/s hierarchy, Figure 2c/H.110 maintains the efficiencies offered by the arrangement shown in Figure 2b/H.110, by making available the six vacated time slots for other use. Figure 2d/H.110 offers the possibility of improved picture quality compared with Figures 2b/H.110 and 2c/H.110 by making full use of the available 2048 kbit/s for the videoconferencing signal. This arrangement would require a 2048 kbit/s codec compatible with 525-line Video Standards, or the use of an external standards converter. This is for further study.

Note 3 – The lengths which have been assigned to the parts of the connections have been arbitrarily chosen, but have some consistency with existing CCITT and CCIR Recommendations. They are intended to be representative of long international connections, but not the longest possible. The lengths will likely require revision when studies on the error rates of digital paths have progressed to the stage when the error rates of the paths used in the connections can be predicted.

Note 4 – The propagation delay is one of the main factors to be studied based upon the structures and lengths of the connections in Figures 1/H.110, 2/H.110 and 3/H.110. However, in the absence of subjective test results, the specification of requirements for videoconferencing connections must await further study. This study and particularly operational experience are required to determine the extent to which Recommendation G.114, which applies to telephone connections, relates to videoconferencing connections.

Note 5 – In Figures 1/H.110 and 3/H.110, the codecs may be located anywhere within the international or national networks including the international gateway or the customer's premises.

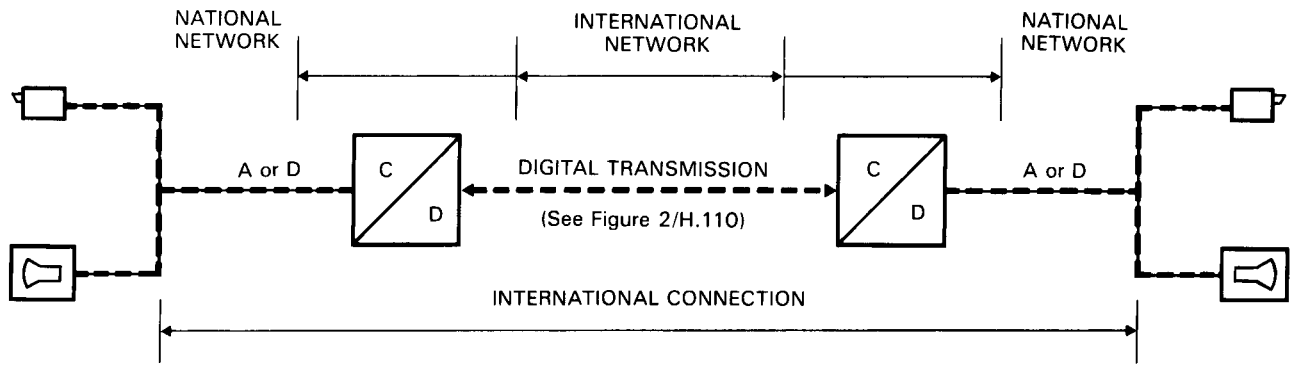
Note 6 – The extensions beyond the codec shown as A or D in Figures 1/H.110 and 3/H.110 may include wideband analogue or high-speed digital transmission systems on terrestrial bearers. It is not expected that these transmission systems will have any significant influence on the quality of the picture or sound, or, on the propagation delay, other than that due to their length.

Note 7 – For inter-regional operation, television standards conversion between 525-line and 625-line video signals may be required. This conversion may be performed by the codecs themselves, or provided by external equipment.

Note 8 – The arrangements shown in Figure 2/H.110 provide for the simplest means of transmission. More complex means are possible and are not precluded.

Note 9 – The hypothetical reference connection shown in Figure 3/H.110 is of a more complex type than the connection shown in Figure 1/H.110, in that it includes codecs in cascade, and, possibly an external Television Standards Converter. The picture quality attainable with these more complex connections may be degraded with respect to that attainable using the connection illustrated in Figure 1/H.110. This and other aspects of the more complex connection must be studied further.

¹⁾ The term "intra-regional" is used here to describe connections "within a group of countries which share a common television scanning standard and a common digital hierarchy, and may or may not be in geographical proximity. The term "inter-regional" is used here to describe connections between groups of countries which have different television scanning standards and/or different digital hierarchies.



A or D -- Wideband analogue or digital transmission or both all providing equivalent quality.

National option.

Digital transmission -- Circuits for intra-regional or interregional digital transmission at the primary rate. This includes the international network and any national digital extensions thereof (see Figure 2/H.110).

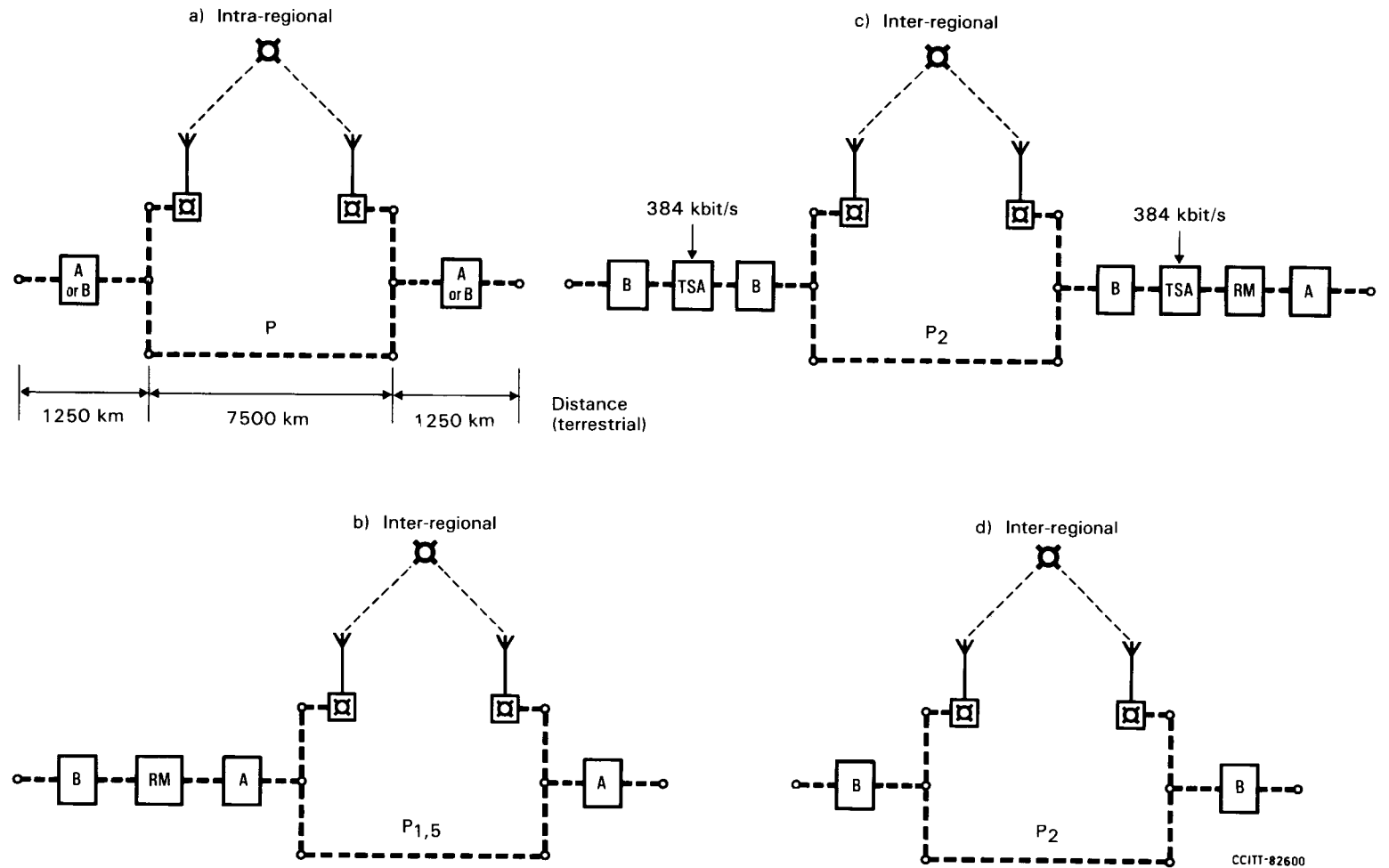


-- Types of codec which may be used in the hypothetical reference connections are indicated below. Each can work with others of the same type and can interwork with other types shown, using a remultiplexer, if required. Codecs which perform these functions are described in Recommendation H.120.

Analogue			Digital		
1)	625 Line	↔		↔	2048 kbits/s capable of interworking with 3
2)	625 Line	↔		↔	2048 kbits/s with 6 time slots vacated capable of interworking with 4
3)	525 Line	↔		↔	2048 kbits/s capable of interworking with 1
4)	525 Line	↔		↔	1544 kbits/s capable of interworking with 2
5)	525 Line	↔		↔	1544 kbits/s capable of interworking with 6
6)	625 Line	↔		↔	1544 kbits/s capable of interworking with 5

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FIGURE 1/H.110
Hypothetical reference connection



Note – The distances shown in Figure 2a/H.110 are applicable to Figures 2b/H.110, 2c/H.110 and 2d/H.110. These distances refer to terrestrial transmission. Equivalent distances relating to satellite transmissions are for further study.

FIGURE 2/H.110
Means for digital transmission

Symbols for Figure 2/H.110



Termination of a 1544 kbit/s circuit with G.733 interface.



Termination of a 2048 kbit/s circuit with G.732 interface.



Remultiplex Unit. This provides bit rate conversion between the 1544 kbit/s frame and 2048 kbit/s frame from which 6 timeslots have been vacated.

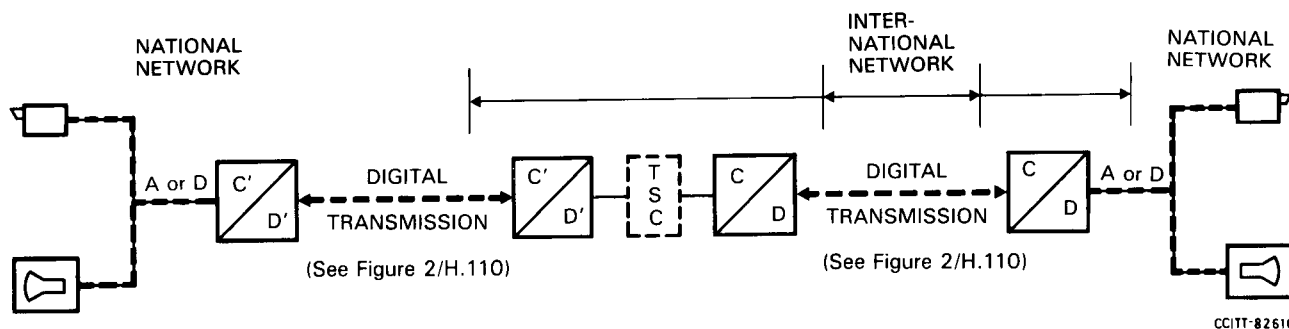


Optional Time Slot Access Unit. This provides means of inserting and extracting 384 kbit/s from the 2048 kbit/s frame which is not used for video conferencing.

P Primary level of digital hierarchy ($y + n \times 384$ kbit/s, where $n = 5$ or 4 and $y = 128$ or 8 kbit/s, respectively).

P_{1,5} 1544 kbit/s.

P₂ 2048 kbit/s.



Same symbols as Figure 1/H.110, and



Codecs in the HRC of Figure 3/H.110 which may be any compatible (with one another) combination of those defined as C/D in Figure 1/H.110 but not capable of interworking with the specific C/D codecs in Figure 3/H.110.



External Television Standards Converter.
May or may not be required in the connection.

FIGURE 3/H.110
Complex hypothetical reference connection

Symbols for Figure 3/H.110:

