AVC-747

INTERNATIONAL TELECOMMUNICATION UNION

ITU-T

DRAFT H.321

TELECOMMUNICATION
STANDARDIZATION SECTOR
OF ITU

May 10, 1995

LINE TRANSMISSION OF NON-TELEPHONE SIGNALS

ADAPTATION OF H.320 VISUAL TELEPHONE TERMINALS TO B-ISDN ENVIRONMENTS

DRAFT ITU-T Recommendation H.321

ADAPTATION OF H.320 VISUAL TELEPHONE TERMINALS TO B-ISDN ENVIRONMENTS

(Place, 199x)

1. Scope

This Recommendation describes technical specifications for adapting narrowband visual telephone terminals, as defined in Recommendation H.320, to broadband ISDN environments. The terminal conforming to this Recommendation interworks with the same type of terminals (i.e., other H.321 terminals) accommodated in B-ISDN as well as existing H.320 terminals accommodated in N-ISDN.

It is noted some of the functionalities supported by H.321 terminals are also supported by broadband audiovisual terminals defined in Recommendation H.310. The interworking among H.310, H.321, and H.320 terminals is a mandatory requirement. Interworking between H.320 and H.321 terminals is achieved since the different H.321 terminal types, defined in this Recommendation, includes the *same* functions supported by the corresponding H.320 terminal types. (See § 4.4 for more details.) Interworking between H.320/H.321 and H.310 terminals is achieved through a common set of H.320/H.321 functions (defined in § 7 of this Recommendation). For example, in addition to supporting the ITU-T H.262 video (MPEG-2 video) standard, H.310 terminals shall support Recommendation H.261 which is part of both Recommendation H.320 and Recommendation H.321.

In H.321 terminals, the adaptation of H.320 functions over B-ISDN is achieved through ATM Adaptation Layer 1 (AAL 1). Both Segmentation-and-Reassembly (SAR) and Convergence Sublayer (CS) functions, as defined in Recommendation I.363, are considered in this Recommendation.

H.321 terminals have the same inband functionalities as the ones supported by narrowband H.320 terminals, i.e. as defined in Recommendations H.242, H.230, and H.221. Extra broadband-related signaling functions, such as negotiation for the use of the Adaptive Clock Recovery method (asynchronous mode), can be accomplished through Q.2931 Information Elements as shown in §5.7 of this Recommendation.

2. References

ITU-T Recommendations

H.221 Frame structure for a 64 to 1920 kbit/s channel in audiovisual teleservices (revised at Helsinki, 1993)

H.230	Frame-synchronous control and indication signals for audiovisual systems (revised at Helsinki, 1993)
H.242	System for establishing communication between audiovisual terminals using digital channels up to 2 Mbit/s (revised at Helsinki, 1993)
H.243	Procedures for establishing communication between three or more audiovisual terminals using digital channels up to 2 Mbit/s (Helsinki, 1993)
H.261	Video coded for audiovisual services at px64 kbit/s (revised at Helsinki, 1993)
H.320	Narrowband visual telephone systems and terminal equipment (revised at Helsinki, 1993)
H.310	Broadband audiovisual communication systems and terminals (February, 1995)
H.32Z.1	Visual telephone systems and terminal equipment for guaranteed bandwidth local area networks (February, 1995)
I.361	B-ISDN ATM layer specification (revised at Helsinki, 1993)
I.363	B-ISDN ATM adaptation layer (AAL) specification (revised at Helsinki, 1993)
I.431	B-ISDN user-network interface (Geneva, 199?)
I.580	General arrangements for interworking between B-ISDN and 64 kbit/s based ISDN (Geneva, 199?)
Q.2931	B-ISDN Digital Subscriber Signaling System No. 2 (DSS 2) - User Network Interface Layer 3 Specification for Basic Call/Connection Control, ITU-T SG11/WP2 Working Document, July 1994, Edinburgh.
Q.939	Typical DSS 1 Service Indicator Codings for ISDN Telecommunications Services

3. Definitions

{Editor's note - a list of terms and abbreviations will be added here or in a dedicated Annex of this recommendation. During the Experts Group meeting in Singapore, it was agreed that a common list of definitions for H.310, H.222.1, H.321, and H.32Z can be used. This list can be the extension of other lists found in H.320 and other ITU-T/ISO standards (e.g., Q.2931 and MPEG-2). It is also understood that not all definitions used in H.310, for example, are applicable to H.321. However, it is agreed that there is a value in keeping a superset of (consistent) terms and definitions where the different recommendations (i.e., H.310, H.222.1, H.321, and H.32Z) can use different subsets of. A volunteer is requested to be the Editor of this list of terms and definitions.}

4. System description

4.1 Applications

This terminal can be used for various applications such as conversational services, distributive services, retrieval services, messaging services as the existing H.320 terminal can. This Recommendation does not specify any particular service.

4.2 System configuration

The H.321 terminal is mapped onto the B-ISDN reference configuration, which is depicted in Recommendation I.413, as shown in Figure 1.

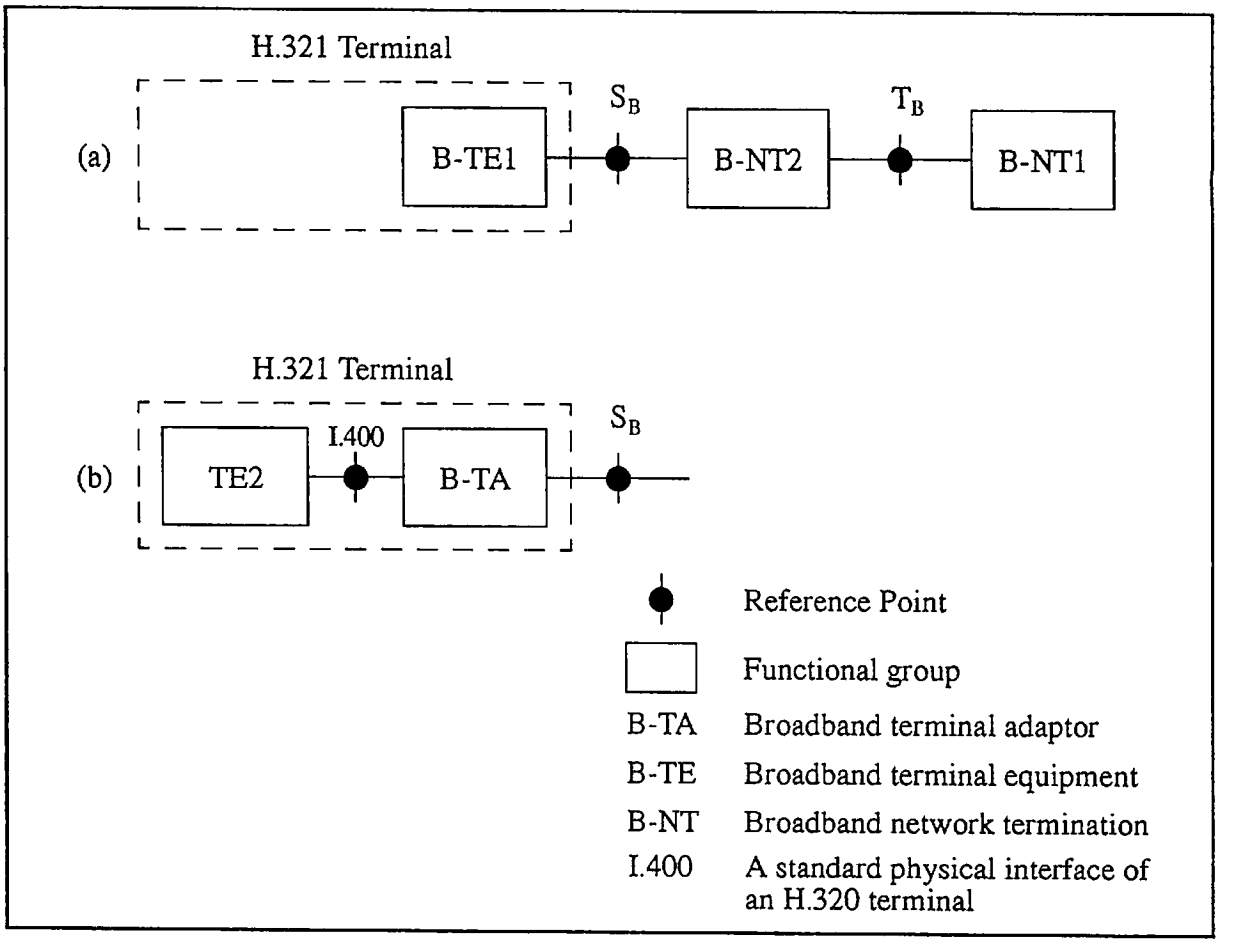

FIGURE 1/H.321: Reference Configuration

There are two possible implementations of an H.321 terminal. The first one is of an integrated design which includes H.320, ATM Adaptation Layer (AAL), and ATM functions in a single terminal unit (i.e., B-TE1 in Figure 1).

The second implementation consists of an H.320 terminal equipment (TE2) and a broadband terminal adaptor (B-TA). In this case, an H.320 signal (i.e., with an H.221 framing format) is transmitted at the interface between the H.320 terminal equipment (TE2) and the terminal adaptor (B-

TA). Moreover, terminal-to-network signalling is performed in B-TA with possible interaction with TE2.

4.3 Generic terminal architecture

A generic architecture of an H.321 terminal (corresponding to the configuration of Figure 1-a) is shown in Figure 2, where constituent elements and corresponding Recommendations are indicated. The figure includes the following functional units: a video I/O equipment, an audio I/O equipment, a telematic equipment, a system control unit, video and audio codecs, an audio delay unit, and a mux/demux unit. These functional units are defined in § 3.1 of Recommendation H.320.

The AAL, ATM, and physical units provide the adaptation and interface functions required for accommodating an H.321 terminal over a broadband network.

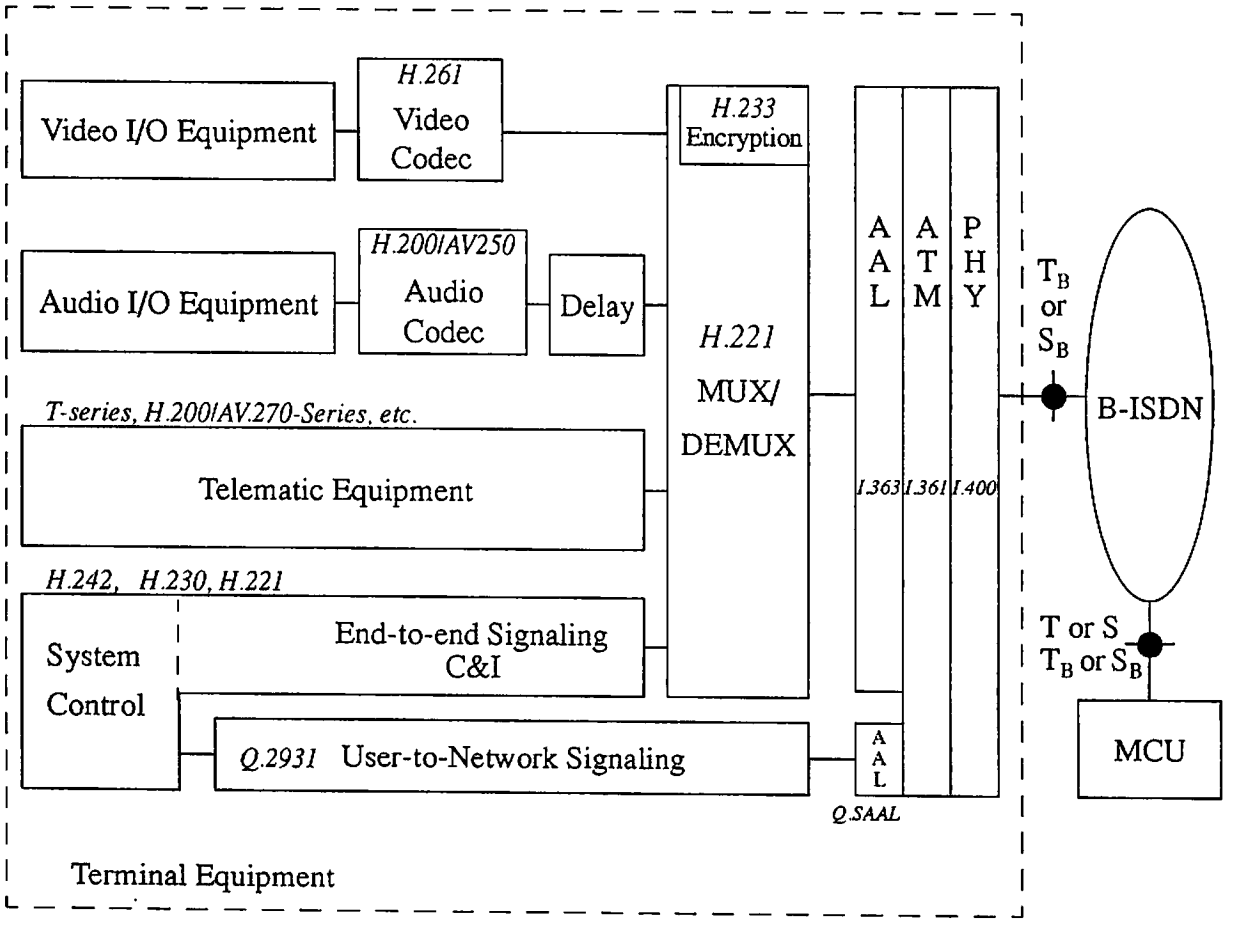

FIGURE 2/H.321: Protocol stack of the H.321 terminal

4.4 Terminal type

Several H.321 terminal types are defined according to the channel access capability (e.g., B, H0, and H11/H12), bit rate classes, and audio coding schemes. Each H.321 terminal type has a corre-

sponding terminal defined in Recommendation H.320. Table 1/H.321 outlines the different communication and audio coding modes supported by this Recommendation. (This table corresponds to Table 1/H.320.)

A special attention should be paid to the ATM virtual channel capabilities and AAL functions supported by the different H.321 terminals. (ATM and AAL related characteristics are highlighted in Table 1/H.321.)

Table 1/H.32Y: Communication modes of H.321 terminals

Visual telephone mode		Channel rate (kbit/s)	N-ISDN channel (Note 1)	Number of ATM Virtual Channels (VC)	AAL Functions	Coding	
						Audio	Video
a^y	a^y_0	64	B	1	AAL Type 1 with both SAR and CS functions. (See § 5.6)	G.711 (Note 2)	Not applicable
	a^y_1					G.728	H.261
b^y	b^y_1	128	2B	2		G.711	
	b^y_2					G.722	
	b^y_3 (Note 3)					G.728	
g^y (Note 4)	g^y_1	nx64	nB	n		G.711	
	g^y_2					G.722	
	g^y_3					G.728	
g^y		384	H_0	1		G.722 (Note 5)	
h^y		768	$2H_0$	2			
i^y		1152	$3H_0$	3			
j^y		1536	$4H_0$	4			
k^y		1536	H_{11}	1			
l^y		1920	$5H_0$	5			
m^y		1920	H_{12}	1			

Note 1 - For multiple B/H_0 connections, all channels are synchronized at the receiving terminal using the multiframe structure mechanism as described in § 2.7 of Recommendation H.221.

Note 2 - If a visual telephone interwork with a G.725 terminal, G.722 audio may be used instead of G.711 audio.

Note 3 - (Audio coding of mode b_3) In addition to G.728, higher quality audio coding such as H.200/AV.253 may be used for this mode.

Note 4 - g=c/d/e/f corresponds to n=3/4/5/6, respectively. This mode is applicable to the ISDN basic rate interface if multiple basic accesses are used.

Note 5 - Other audio modes (G.711 and G.728) can be invoked using the appropriate H.242 procedures.

The number of ATM VC's supported by a given H.321 terminal is the same number of N-ISDN channels (i.e., B or H0 channels) supported by that terminal type (or the corresponding H.320 terminal). For example, under the $\mathbf{b}^y$ transfer mode, two separate channels are established between two H.321 terminals. Multimedia synchronization (e.g., audio and video) between the two channels is achieved through the multiframe structure described in Recommendation H.221. Similarly, an H.320 terminal using the **b** transfer mode (i.e., two B channels over a N-ISDN network) can communicate with an H.321 terminal that is capable of supporting the $\mathbf{b}^y$ mode (i.e., two B channels each of which is carried by an ATM VC over a B-ISDN network through circuit emulation).

4.5 Point to point communication

An H.321 terminal may have a variety of capabilities. In point to point communications, a common set of them is determined on a call by call basis through the communication procedures defined in H.242.

4.6 Multipoint communication

An H.321 terminal can participate with other H.321 or H.320 terminals in multipoint communications through MCUs which are accommodated in B-ISDN or N-ISDN. An example of a multipoint configuration is shown in Figure 3/H.321. Necessary communication procedures are found in Recommendation H.243.

5. Infrastructure

5.1 Audio coding

As per G.711, G.722, G.728 or other standardized coding methods which may be added in the future.

5.2 Video coding

As per H.261.

5.3 Multimedia multiplexing and synchronization

As per H.221.

5.4 End-to-end control

Mandatory Control & Indication signals are defined in Table 4/H.320. Other C&I signals are defined in H.230.

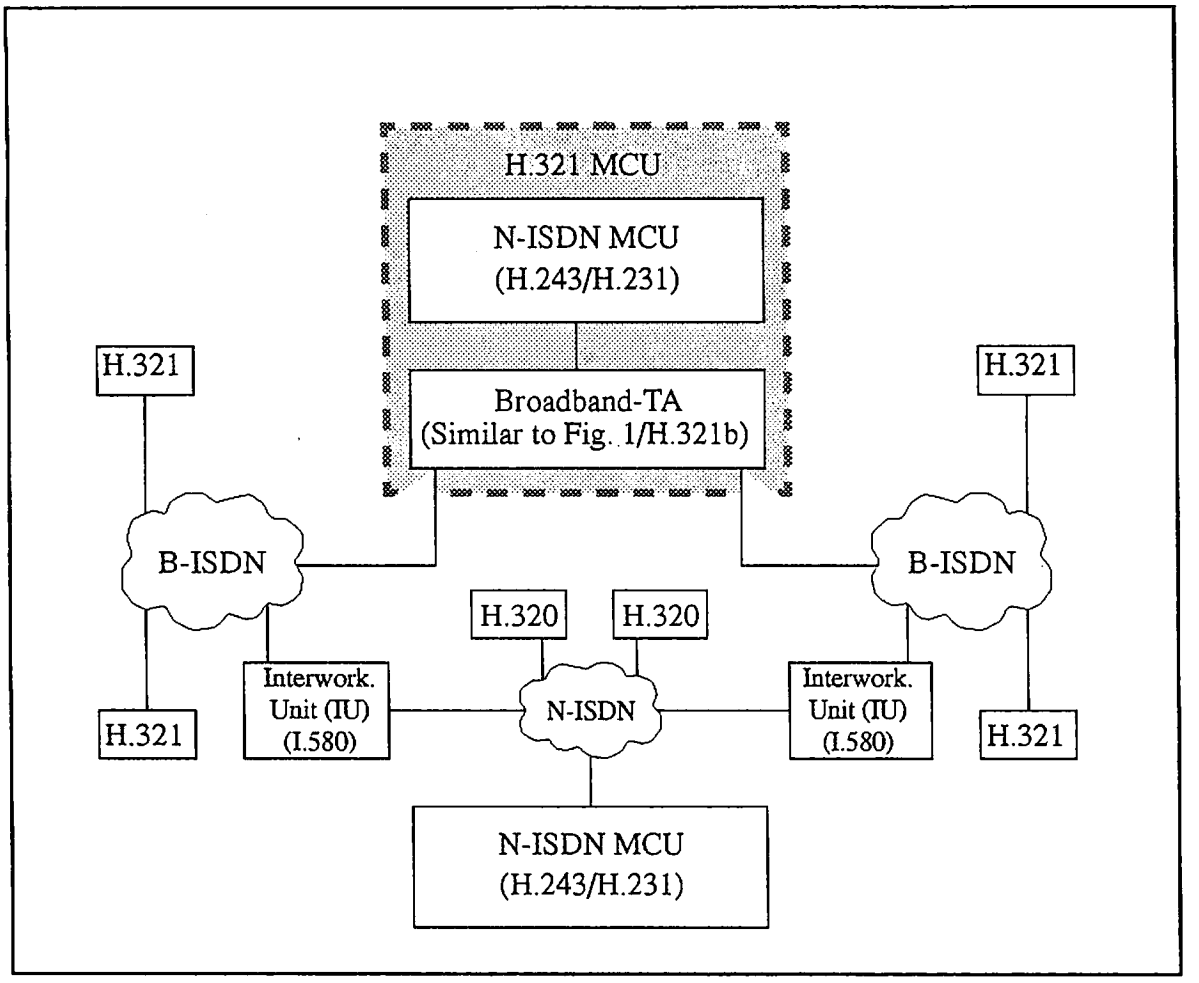

FIGURE 3/H.321: An example of a multipoint configuration for H.321/H.320 terminals

5.5 Communication procedures

As per H.242 and H.243.

5.6 AAL functions

Segmentation-and-Reassembly (SAR) and Convergence Sublayer (CS) functions of AAL Type 1 (AAL-1) shall be supported by H.321 terminals. Figure 3/H.321 shows a functional architecture for the SAR and CS functions and their interfaces within an H.321 terminal. At the AAL Service Access Point (AAL-SAP) the CS sublayer receives AAL Service Data Units (AAL-SDU's) from the H.320 layer. The AAL-SDU is an octet of a constant bitrate (CBR) H.320 signal.

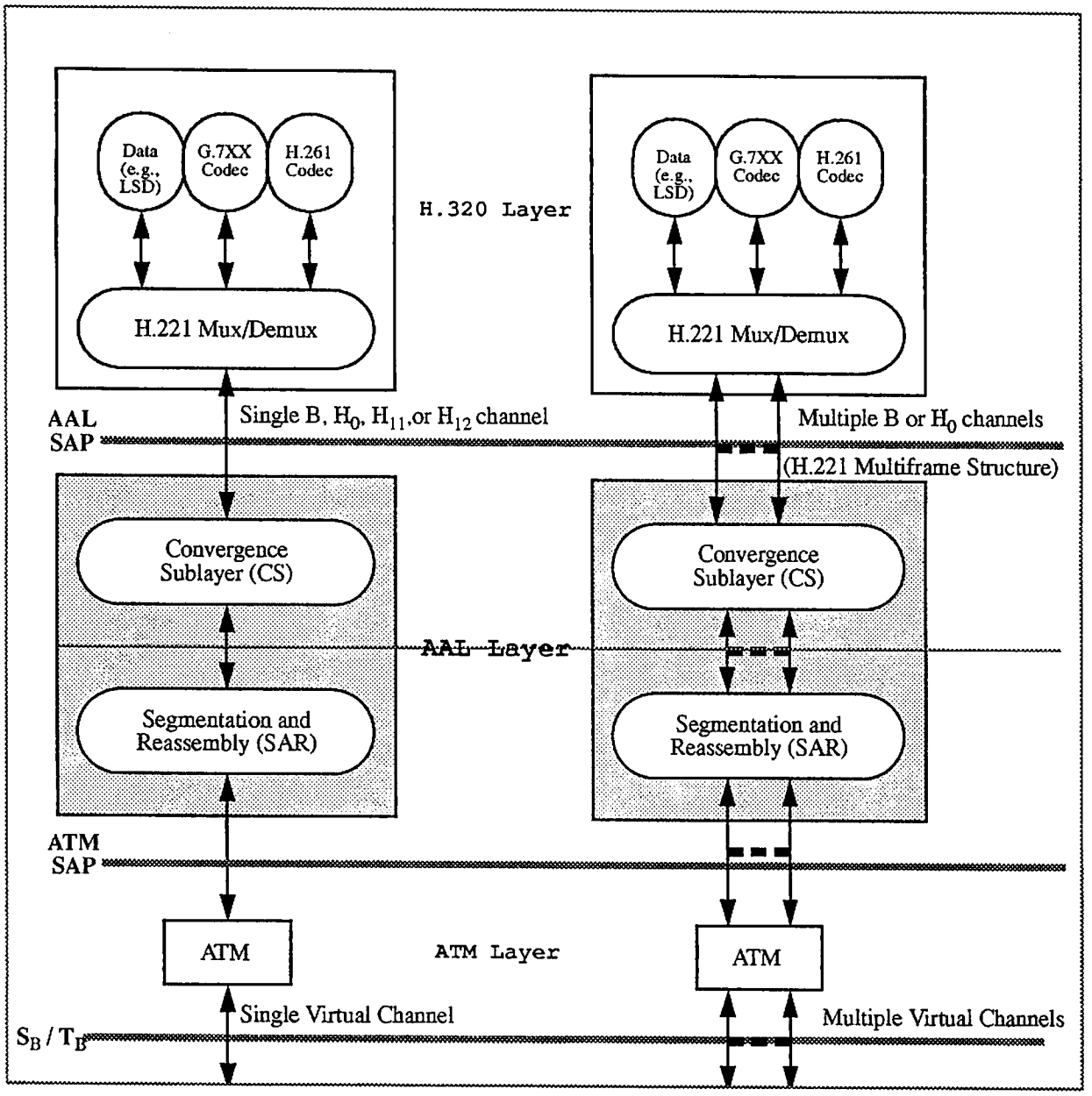

FIGURE 4/H.321: AAL layer interfaces for H.321 terminals with single and multiple virtual channels.

The SAR sublayer receives a 47-byte CS Protocol Data Unit (PDU) from the convergence sublayer, and adds a one byte of SAR header to generate the 48-byte SAR-PDU. The SAR-PDU is passed to the ATM layer across the ATM-SAP. The ATM layer adds the five-byte ATM header and forms the 53-byte ATM cell.

5.6.1 Convergence sublayer functions

The only CS function supported by H.321 terminals is the Structure Data Type (SDT) pointer. It is important to note that although all H.321 terminals are required to support this function, it is not necessary to use the SDT pointer in some cases. For example, when two H.321 terminals of type

B-TE1 (as shown in Figure 1a) are communicating with each other, the SDT pointer might not be needed[1]. In addition, the SDT pointer is never used when the channel bitrate is 64 kb/s[2]. In general, however, the SDT pointer will be required when an H.321 terminal is interworking with an H.320 terminal.

5.6.2 SAR sublayer functions

In addition to mapping between the CS-PDU and SAR-PDU, in H.321 terminals the SAR sublayer provides the following functions:

a. Sequence numbering:

   At the transmitting end, the SAR sublayer receives a sequence number from the CS sublayer for each CS-PDU. This number occupies three bits of the four-bit sequence number (SN) field of the SAR-PDU byte header. At the receiving end, the sequence number value is passed to the CS.

b. CS indication:

   The SAR sublayer indicates the existence of the CS sublayer. In H.321 terminals, when the convergence sublayer SDT function is in use, coding of the CS Indication (CSI) bit and the SDT pointer byte should be done according to Recommendation I.363. The Synchronous Residual Time Stamp (SRTS) function will not be used in H.321 terminals.

   {Editor's note - If the SDT pointer function will not be used in some cases (e.g., during an H.321-H.321 session as explained in footnote 1), then the usage and coding of the CSI bit for these cases should be under study.}

c. Error protection:

   The SAR sublayer protects the SN field (i.e., the 3-bit sequence number value and the CSI bit) using a 4-bit SN Protection (SNP) field. The SNP is divided into a 3-bit CRC code to protect the SN field, and an even parity to protect the resulting seven-bit code (4-bit SN plus 3-bit CRC).

5.7 Call control

Since an H.321 terminal is, in principal, a B-ISDN terminal emulating a N-ISDN service, then a call is established through the procedures defined in § 6 of Recommendation Q.2931[3].

The out-of-band signalling functional unit of an H.321 terminal should use, during the call-connection procedure, the Q.2931 Information Elements (IE's) shown in Table 2. These IE's are part of the SETUP message[4] (Table 3-19/Q.2931) used when initiating a 64 kbit/s based circuit-mode ISDN service call over a broadband ISDN network.

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1. {Editor's note - This is an open issue which is still under study in collaboration with SG11. Eliminating the need for using the SDT pointer in an H.321-H.321 session depends on the possibility that H.321 terminals can identify themselves to each other during call set-up via out-of-band (Q.2931) signalling means.}
2. This includes the commonly used 2x64 kb/s (2B) connections and other multiple B communication modes.
3. That section of Recommendation Q.2931 outlines the requirements for supporting (a) 64 kbit/s based circuit-mode ISDN services in B-ISDN and (b) access signalling interworking between N-ISDN and B-ISDN.
4. Other Q.2931 messages may also use these IE's.

Table 2/H.32Y: Q.2931 Information Elements for H.321 terminals

Q.2931 Information Element	Information Element Field(s)	IE Parameter(s) for H.321 terminals
Narrowband bearer capability (N-BC)	Information transfer capability	• Unrestricted Digital Information (UDI) • Restricted Digital Information (RDI) • 3.1KHz audio • UDI with tone/announcement (UDI-TA)
	Transfer mode	• circuit
	Information transfer rate	• 64 kbit/s • 2x64 kbit/s • 384 kbit/s • 1536 kbit/s • 1920 kbit/s • multirate (64 kbit/s base rate)
	Rate multiplier	• 2 to the maximum number of B channels. (Note 1)
	User information layer 1 protocol	• Recommendation G.711 μ-law • Recommendation G.711 A-law • Recommendations H.221 and H.242 (Note 2)
Broadband bearer capability (B-BC)	Bearer class	• BCOB-A
	Susceptibility to clipping	• Susceptible to clipping
	Call configuration	• point-to-point (Note 3)
Broadband low layer information (B-LLI)	(The support of this information element by H.321 terminals is under study)	

Table 2/H.32Y: Q.2931 Information Elements for H.321 terminals

Q.2931 Information Element	Information Element Field(s)	IE Parameter(s) for H.321 terminals
ATM traffic descriptor	Forward peak cell rate (for CLP 0)	(Variable: depends on the transfer rate)
	Backward peak cell rate (for CLP 0)	
	Forward peak cell rate (for CLP 0+1)	
	Backward peak cell rate (for CLP 0+1)	
AAL parameters	AAL type	• AAL 1
	Subtype identifier	• Circuit Transport
	CBR rate	• 64 kbit/s • nx64 kbit/s
	Multiplier	• 2, 6, 24, or 30 (Note 4)
	Source clock frequency recovery method	• Null (synchronous) • Adaptive Clock Method (Note 5)
	Error correction method	• Null (No error correction is provided) (Note 6)
	Structure data transfer block size	(Note 7)
	Partially filled cells method	• 47
End-to-End transit delay	Cumulative transit delay value	(Note 8)
	Maximum end-to-end transit delay value	
Quality of service (QOS)	(Note 9)	

Table 2/H.32Y: Q.2931 Information Elements for H.321 terminals

Q.2931 Information Element	Information Element Field(s)	IE Parameter(s) for H.321 terminals
Narrowband low layer compatibility (N-LLC) (Note 9)	Information transfer capability	• Unrestricted Digital Information (UDI) • Restricted Digital Information (RDI) • 3.1KHz audio • UDI with tone/announcement (UDI-TA)
	Negotiation indicator	• out-band negotiation not possible • out-band negotiation possible
	Transfer mode	• circuit
	Information transfer rate	• 64 kbit/s • 2x64 kbit/s • 384 kbit/s • 1536 kbit/s • 1920 kbit/s • multirate (64 kbit/s base rate)
	Rate multiplier	• 2 to the maximum number of B channels. (Note 10)
	User information layer 1 protocol	• Recommendation G.711 μ-law • Recommendation G.711 A-law • Recommendations H.221 and H.242 (Note 11)
Narrowband high layer compatibility (N-HLC)	(Note 12)	
OAM traffic descriptor	(Under Study)	

Note 1 - {Editor's note: It is not clear if the "Rate multiplier" field is required or not. If it is not required, then how an nx64 kbit/s rate is specified when *n* is larger than two? How multiples of H_0 rates are specified? Is a separate call setup procedure used for each B or H_0 connection? If that is the case, then why there is a designated entry for the 2x64 kbit/s transfer rate? ***Contributions are requested to clarify this point.***}

Note 2 - {Editor's note: Is it sufficient to use the "Recommendations H.221 and H.242" parameter only? In addition, if an H.320 terminal sets this field to the "Recommendations H.221 and H.242" option, can this information be used by the interworking unit (between the N-ISDN and B-ISDN network) to eliminate the need for including the Structure Data Type pointer in the convergence sublayer of the AAL-1 function? ***Contributions are requested to clarify (a) what option is used by existing H.320 terminals for the "User Information Layer 1 Protocol" field of the Q.931 N-BC information element, and (b) if an interworking unit is required to look at that field.***}

Note 3 - {Editor's note: Should the "point-to-multipoint" option (found in Q.2931) be considered here for certain (e.g., broadcast) applications?}

Note 4 - {Editor's note: Is it possible to use other multiplier values for nx64 kbit/s connections? This question might be related to the last issue raised in Note 1 above. It is possible that H.321 terminals (when communicating among themselves) can take advantage of the broadband network by using a transfer rate of nx64 kb/s through a single virtual channel, when *n* in this case can have any value between 2 and 30.} ***Contributions are requested to clarify the issues identified in Notes 3 and 4.}***

Note 5 - {Editor's note: There are two possible solutions for recovering the source clock in H.321 terminals: (1) If a common clock is available at both ends, then this clock is used to recover timing and synchronize both ends as usually done in a synchronous circuit transport. Therefore, in this case, the Synchronous Residual Time Stamp (SRTS) approach is not needed. (2) When a common clock is not available, then the Adaptive Clock Recovery method is used.}

Note 6 - {Editor's note: During the Experts Group meeting in Singapore (November, 1994), it was decided to eliminate the short interleaver (FEC and cell-loss recovery mechanism) option. It was also decided that the H.261 BCH code provides an appropriate protection against random bit-error events. These conclusions were based on the ATM network performance assumptions outlined in AVC-635. ***Contributions are solicited to verify (or even nullify) these conclusions.***}

Note 7 - {Editor's note: One issue associated with the SDT pointer function is that when an H.320 terminal places a call, how would an interworking unit (IWU), between the N-ISDN and B-ISDN networks, recognize that the incoming call is an H.320 call, and therefore there is no need for the SDT pointer?. This and other issues have been addressed through correspondence documents from Mr. Okubo to Rapporteurs in SG-13 and SG-11.}

Note 8 - {Editor's note: Should H.321 specify transit delay and other QOS parameters for audiovisual services? If there is a need to specify QOS parameters for H.321 terminals, ***contributions are requested to identify and quantify these parameters.***}

Note 9 - {Editor's note: The (optional) N-LLC information element is used for compatibility checking between the two communicating ends. The attributes in here should not be in conflict with the attributes specified in the N-BC information element. Does the interworking unit between N-ISDN and B-ISDN networks look at the N-LLC?}

Note 10 - {Editor's note: See Note 1 above.}

Note 11 - {Editor's note: See Note 2 above. If (a) an H.320 terminal sends an N-LLC IE during call-setup, (b) the terminal sets this field to the "Recommendations H.221 and H.242" option, and (c) the interworking unit actually looks at the N-LLC IE, can this information be used by the interworking unit to eliminate the need for including the Structure Data Pointer in the convergence sublayer of the AAL-1 function? ***Contributions are requested to clarify (a) if H.320 terminals use the N-LLC information element and what option is used for the "User Information Layer 1 Protocol" field of this information element, and (b) if an interworking unit is required to look at that field.***}

Note 12 - {Editor's note: The (optional) N-HLC information element is used for compatibility checking between the two communicating ends.}

6. Terminal equipment

6.1 Environments

6.2 Audio source and arrangement

(See Recommendation H.320)

6.3 Video source and arrangement

(See Recommendation H.320)

6.4 Data and other auxiliary equipment

(See Recommendation H.320)

6.5 Optional enhancements

(Under Study)

6.6 Error resilience

In B-ISDN environments, a communication channel may suffer from occasional bit errors and cell losses. Audio and video source coding/decoding have inherent or built-in error correction or resilience mechanisms such as the BCH FEC code in H.261.

{Editor's note -As explained in Note 7 of Table 2 above, it was decided to eliminate the short interleaver (FEC and cell-loss recovery mechanism) option. It was also decided that the H.261 BCH code provides an appropriate protection against random bit-error events. These conclusions were based on the ATM network performance assumptions outlined in AVC-635. ***Contributions are solicited to verify (or even nullify) these conclusions.***}

7. Intercommunications

7.1 Intercommunication between different terminal types

A common mode of (H.320) operation among H.321 terminals should be determined as described in Recommendation H.320. Moreover, when an H.321 terminal is communicating with another H.321 terminal, there are several possibilities exist regarding the number of virtual channels needed between the two terminals. Both single and multiple VC's scenarios are shown in Figure

5/H.321.

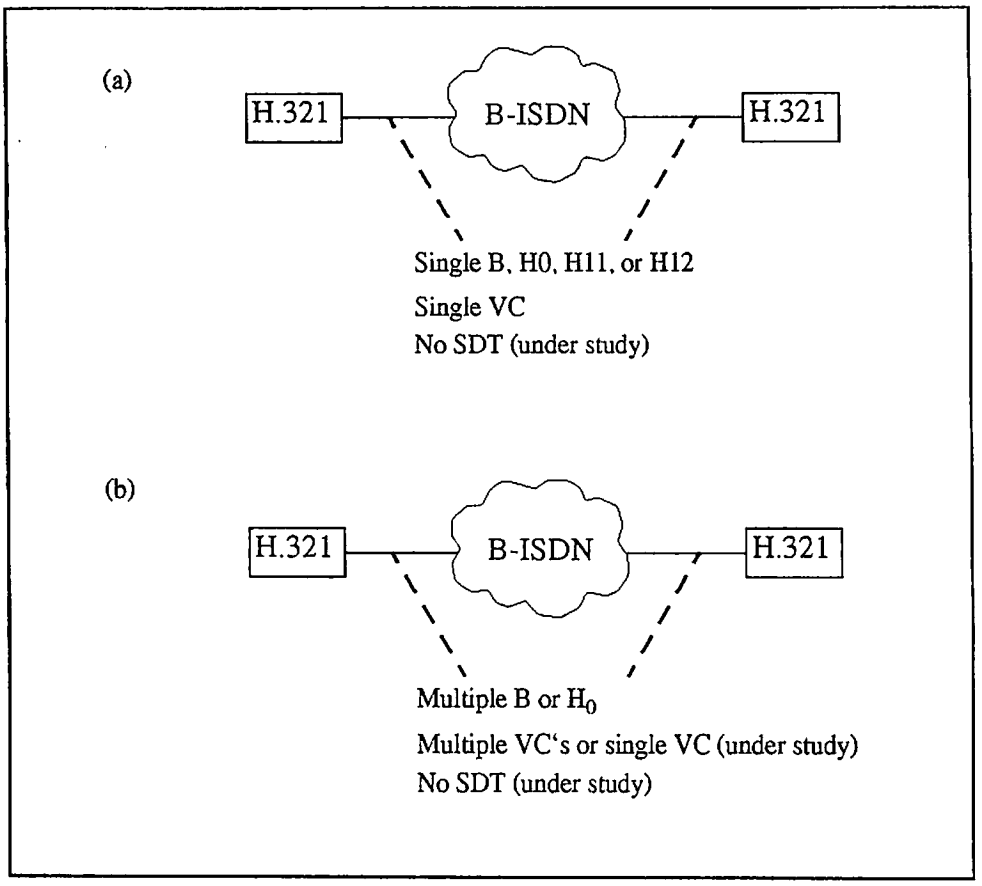

FIGURE 5/H.321: Interworking scenarios between H.321 terminals

7.2 Intercommunication with N-ISDN terminals

H.321 terminals have the capability of interworking with H.320 terminals through the network support of interconnection between B-ISDN and N-ISDN as specified in I.580.

A common mode of (H.320) operation among H.320 and H.321 terminals should be determined as described in Recommendation H.320. Moreover, several mode of communications are possible between H.320 and H.321 terminals, depending on, for example, which terminal initiates the call and the number of channels used. Examples of these communication modes are shown in Figure 6/H.321.

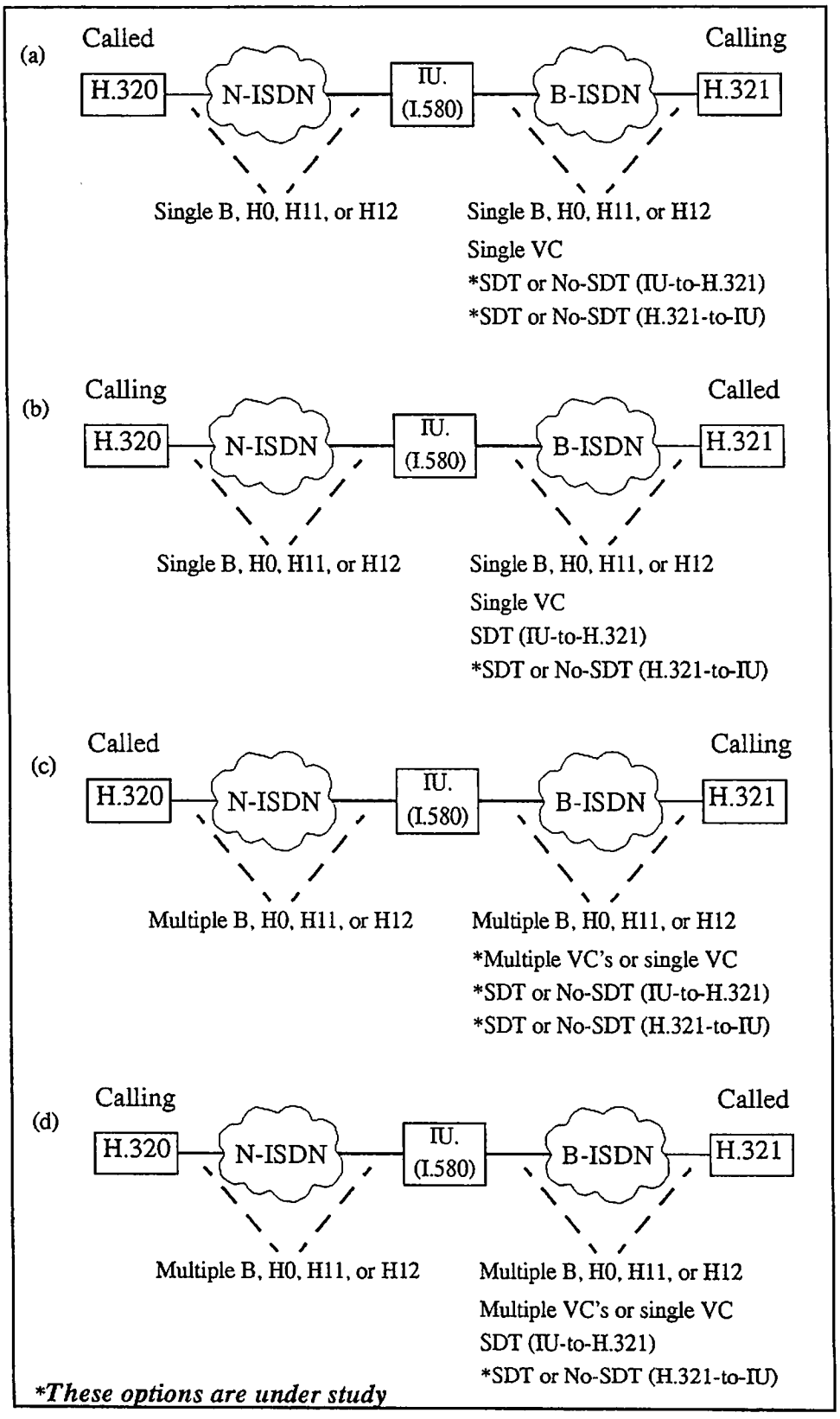

FIGURE 6/H.321: Interworking scenarios among H.320 and H.321 terminals

7.3 Intercommunication with telephony

H.321 terminals shall be able to interwork with telephones accommodated in N-ISDN and PSTN. Its operational mode of communication is 3.1 kHz audio.

{Editor's note - use of signalling elements such as Bearer Capability should be mentioned. There remains a general question of telephone support on B-ISDN.}

7.4 Intercommunication with audiovisual terminals connected to other networks

A common mode of (H.320) operation among H.32Z and H.321 terminals should be determined as described in Recommendation H.320. H.321 terminals will interwork with both H.32Z.1 (H.320 over guaranteed bandwidth LANs) and H.32Z.2 (H.320 over non-guaranteed bandwidth LANs) terminals as shown in Figure 7/H.321.

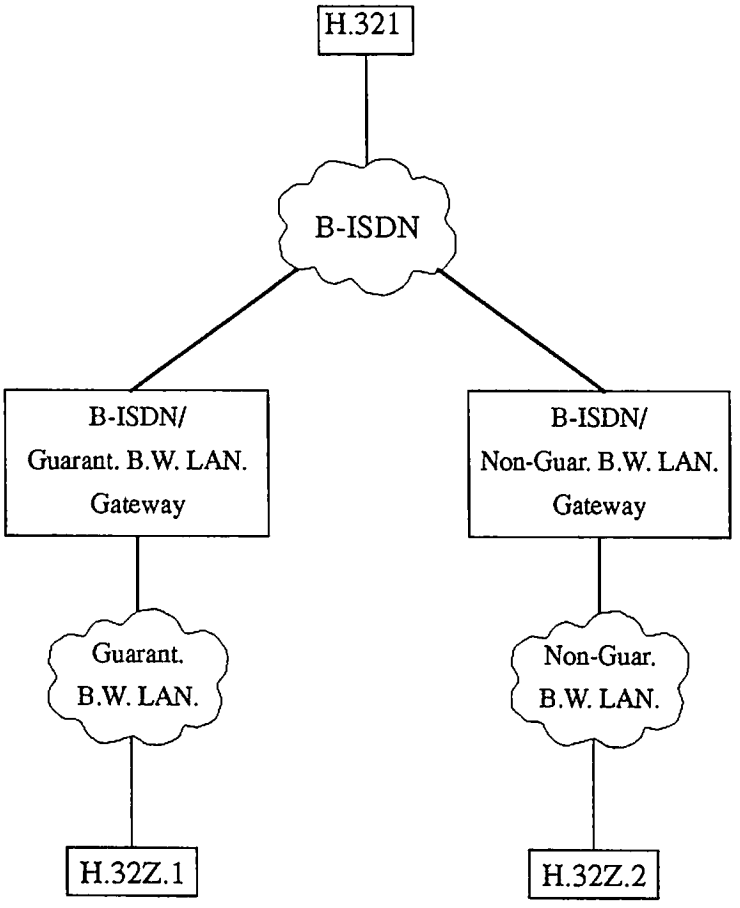

FIGURE 7/H.321: Interworking between H.32Z and H.321 terminals

END