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PART IV

Recommendations Q.101 to Q.118 | flbis

CLAUSES APPLICABLE

TO CCITT STANDARD SYSTEMS

Blanc

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SECTION 1

GENERAL CLAUSES

Recommendation Q.101

1.1 FACILITIES PROVIDED IN INTERNATIONAL SEMI-AUTOMATIC WORKING

1.1.1 The operating methods used in the semi-automatic international service are described in the *Instructions for the International Telephone Service* . These operating methods assume the existence of equipment (operator's positions and automatic switching equipment) involving the following categories of operators:

a) *outgoing* operators;

b) *incoming* operators;

c) *delay* operators;

d) *assistance* operators;

e) *information* | or *special service* | operators.

1.1.2 The *outgoing operator* | ontrols the setting up of calls at the outgoing exchange. (From the operating point of view she is, in general, the controlling operator and is sometimes so referred to in the *Instructions* .)

She must be able to set up calls to any one of the following points in the called country:

a) subscribers;

b) incoming operators at the incoming international exchange;

c) delay operators, especially a particular delay operator at the incoming international exchange;

d) incoming operators at a local manual exchange in the called country;

e) information or special service operators.

The outgoing operator should be able to recall incoming and delay operators on calls set up via these operators, by sending a forward-transfer signal as defined in the relevant system specifications.

1.1.3 The *incoming operator* | t the incoming international exchange is obtained by using a special code 11 signal or a special number. The code 11 signal is a particular combination provided by the signal code. This operator performs the functions of an incoming operator in ordinary manual service for those calls which cannot be routed automatically at the incoming international exchange.

Called alternatively in French ''op´eratrice translatrice'', see *Instructions for the International Telephone Service* (art. 125).

1.1.4 The *delay operator* | s obtained by using a special code 12 signal, or a special number. The code 12 signal is a particular combination provided by the signal code. The delay operator may be:

— any of the operators of this category;

— or a particular operator, or one of those operating a particular group of positions; her position or her group of positions is then indicated by a number which follows the code 12 signal or is indicated by the special number.

With respect to the direction in which a required call is set up, the delay operator may be at the outgoing international exchange and may be called by an operator at the incoming international exchange. From the technical point of view and as far as signalling is concerned, however, the delay operator at the outgoing international exchange called back by an operator at an incoming international exchange must be regarded as being at the incoming end of the international circuit over which she has been called back.

1.1.5 *Notes on incoming and delay operators*

a) Incoming and delay operators must be able to speak the *service language* | used for the route concerned, and hence may have to belong to a

particular language group. A *language (or information) digit* , from 1 to 8, sent on all semi-automatic calls, is used to obtain operators of a particular language group [see Recommendation Q.104]

b) It may be the same operator who acts as an incoming and as a delay operator, and even as an assistance operator. She enters a circuit in any of these capacities in response to the appropriate signal.

c) While an incoming or delay operator is being called, the national ringing tone of the incoming country must be sent back over the international circuit.

1.1.6 The *assistance operator* | t the incoming international exchange enters a semi-automatic circuit on a call already set up, when requested by the outgoing operator, because of language difficulties or, for instance, when she is required to interpret a national tone. Access to an assistance operator at an international transit exchange is not possible.

The assistance operator is called by a forward-transfer signal, sent by the outgoing operator when, for example, she operates a key on the

outgoing position. An assistance operator in a required language group is obtained in conjunction with the forward-transfer signal by the language digit (or information) sent previously during the setting up of the call. Hence the incoming relay set must store the language digit (or information).

The outgoing operator receives no indication to show that the assistance operator is being called, or to show when she answers or withdraws from the circuit, but if necessary the outgoing operator can send the forward-transfer signal several times on the same call.

The assistance operator must be able:

a) to break into the call as a third party (this she would do, for example, when the language spoken in the country of arrival is other than the service language used in that relation, and the operator intervenes as an interpreter);

b) to enter a circuit on one side only after having isolated the other. She does this, in particular, when she translates a verbal announcement or interprets an audible tone returned from the incoming end.

In no circumstances will the assistance operator be able to block the international circuit.

Note — It should be noted that the term ‘‘assistance operator’’ has a very definite meaning in CCITT documents. It stands for an operator who breaks in, as required, as a third party in a circuit already set up. Hence this operator must not be confused with any other operator in the incoming country who may help to *set up* the call in conjunction with the international outgoing operator. Assistance operators may not be available on intraregional circuits.

The language digit may not be used on some intraregional circuits.

1.1.7 The *information or special service operator* | f the country of destination is obtained by using a special number. This operator is responsible for giving details concerning subscriber number and miscellaneous inquiries.

Recommendation Q.102

1.2 FACILITIES PROVIDED IN INTERNATIONAL | AUTOMATIC WORKING

In international automatic working, the calling subscriber can obtain only such subscriber numbers as are made up of the numerical digits appearing on his dial or push-button set. Hence, he cannot obtain operators reached by code 11 or code 12 signal, or an assistance operator reached by a forward-transfer signal. In principle, he should not obtain access to incoming, delay or information operators reached by special numbers.

He can have direct dialling access to manual exchanges in the incoming country only subject to certain conditions (these conditions are defined in Recommendation Q.28, § 2, and in Recommendation Q.120, § 1.8, and are applicable to all CCITT standard systems).

It is pointless to send a language digit (or information) over an international circuit since the calling subscriber does not have to obtain operators speaking a particular language at the incoming international exchange. On automatic calls, a discriminating digit (or discriminating information) replaces the language digit (or information) sent on semi-automatic calls. This:

— enables the equipment in the outgoing international exchange to make a distinction between semi-automatic and automatic calls as is required when drawing up international accounts, as described in § 2 of Recommendation E.260;

— enables, therefore, incoming equipment to serve both automatic and semi-automatic service;

— in Systems No. 4, 6, 7 and R2 informs the equipment in the international incoming exchange that it has not to rely on an end-of-pulsing signal (see Recommendation Q.106);

— enables the equipment in the incoming international exchange to prevent automatic calls from having access to certain destinations (special services, for example).

Recommendation Q.103

1.3 NUMBERING USED

1.3.1 *International prefix*

The international prefix (see definition 1 in Recommendation Q.10) which gives subscribers access to the international automatic network is used only in automatic working and is not used in semi-automatic working.

The international prefix is not included in the numerical signals sent out from the international outgoing exchange.

1.3.2 *Country code*

For information operators, see Recommendation E.115.
The country code may not be used on some intraregional calls.

Information about country codes will be found under § 8.2 in Recommendation Q.11. In the international outgoing exchange, the country code is used:

BN1 supprim´e pour MEP

a) in automatic working for the purpose of giving access to outgoing circuits;

b) in semi-automatic working it is required to give outgoing operators in the outgoing international exchange access to the circuit by means of selectors.

The country code is sent on the international circuit or signalling channel:

— in the case of transit calls;

— in terminal and transit calls to a demand assignment system.

1.4 LANGUAGE DIGIT OR DISCRIMINATING DIGIT

1.4.1 *Language digit (or language information)*

1.4.1.1 The language digit defined under § 1.1.5 above indicates the *service language* | to be used between operators in the international service, that is to say, the language to be spoken in the incoming international exchange by the incoming, delay and assistance operators when they come on the circuit. The language digit (or information) must be sent on *all* semi-automatic calls.

1.4.1.2 The digit (or indicator) to be used to select the appropriate language is as follows:

1 = French

2 = English

3 = German

4 = Russian

5 = Spanish

6 ?04 available to Administrations for selecting a particular language

7 ?05 provided by mutual agreement (in System No. 5, however,

8 ⌋ digit 7 is used on calls requiring access to test equipment)

9 = reserve (see § 1.4.2.2 below)

1.4.1.3 The language digit (or information) is either:

— sent by the operator to the outgoing equipment; in this case the operator must send it immediately before the national (significant) number of the called subscriber; or

— sent automatically by the outgoing equipment.

1.4.2 *Discriminating digit (or discriminating information)*

1.4.2.1 In all automatic calls, the position in the sequence of numerical signals occupied by the discriminating digit (or information) is that occupied by the language digit (or information) in semi-automatic calls (see Recommendations Q.102 and Q.107).

1.4.2.2 The digit 9 (or its equivalent) in the list of language digits (or calling party's categories) has been kept in reserve for use as extra discriminating information if required. Such use should be for a call with special characteristics, but the digit 9 (or the equivalent information) must not be used merely to take the place of the digit 0 (or its equivalent) in an automatic call

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See definition in Recommendation Q.10.

For example, it might be thought useful to have an additional discriminating digit (or information) when a distinction has to be made between:

a) automatic calls, and

b) semi-automatic calls set up in the outgoing country directly by ordinary operators, in national exchanges and not by international operators in the international exchange, and arriving by the same group of national circuits as calls mentioned in a).

1.4.2.3 Combination 13 in the signal code of System No. 4 and System R2 and its equivalent in Systems No. 6 and No. 7, as well as combination 7 in the signal code of System No. 5 serve as a discriminating digit (or information) on calls to automatic testing equipment.

Such a distinction might be necessary because:

— in international accounts, calls mentioned in b) are dealt with as semi-automatic calls and are not to be metered by the international equipment.

— for signalling, calls mentioned in b) are not accompanied by an end-of-pulsing signal.

On Signalling System No. 5 the discriminating digit 9 may be used to indicate a data call by bilateral agreement.

1.4.2.4 In Signalling Systems No. 6 and 7, the equivalent of the combinations 11 and 12 may be used as a discriminating digit (or calling party's indicator) on calls originated by a subscriber with priority (combination 11) or on data calls (combination 12).

1.4.2.5 On all automatic calls the discriminating digit must be sent over the international circuit or signalling channel by the country of origin of the call, and this country has to arrange for the automatic insertion of the discriminating digit (or information).

Recommendation Q.105

1.5 NATIONAL (SIGNIFICANT) NUMBER .PS 10

See definition in Recommendation Q.10.

1.5.1 In automatic working, the subscriber sends the called subscriber's national (significant) number by means of a dial, push-button set, or automatic dialling device.

1.5.2 In semi-automatic working, the operator sends the national (significant) number of the called subscriber by means of a keyset for example.

1.5.3 The outgoing equipment must be designed to cater for a sufficient number of digits in the national (significant) number as specified in Recommendation Q.11, §§ 2.2 and 3.

Recommendation Q.106

1.6 THE SENDING-FINISHED SIGNAL

In semi-automatic working, when the international outgoing operator has finished keying or dialling, she operates a special button on her keyboard or a key so that, after the number, a local signal which is called a *sending-finished* signal is sent to the outgoing equipment to show that there are no more digits to follow. In automatic working, subscribers cannot show when they have finished dialling the number, and so this signal does not apply.

Note — In semi-automatic working, local sending of the sending-finished signal will cause an *end-of-pulsing* signal to be sent on the international circuit or signalling channel. This has the same function and shows the incoming equipment that there are no more digits to be received. In some cases also in automatic working, when the outgoing equipment decides that there are no more digits to follow, an end-of-pulsing signal is sent on the international circuit or signalling channel, for example in the ST condition of System No. 5 (see Recommendation Q.152).

In System R2 the sending of end-of-pulsing signal **BN1 supprim´e pour MEP**

(code 15) may not occur if a *number-received* indication has already been received.

Recommendation Q.107

STANDARD SENDING SEQUENCE OF FORWARD ADDRESS INFORMATION

(Geneva, 1980; modified at Melbourne, 1988)

A distinction is made in this Recommendation between the information to be sent by the telephone user for different types of calls and the corresponding information to be sent by the international signalling equipment.

With regard to the latter, the sequence of forward address information signals is dealt with in detail. The detailed exchange of other signalling information is covered by the procedures described in the specifications of the CCITT signalling systems concerned.

1 Information to be sent by the telephone user

The normal sequence of address information required for the set-up of an international call and to be sent by the user, i.e. the calling subscriber or operator, is as shown in Table 1/Q.107. This sequence does not depend on the CCITT signalling system used in the international network. Here five different types of call, from *a)* to *e)* are covered.

H.T. [T1.107]

TABLE 1/Q.107

Standard sequence of the address information to be sent by the telephone user

Type Address information sent by the user }	Call to:	{
a) 1. International prefix | ua) 2. Country code | ub) 3. National (significant) number | uc) }	A subscriber (automatic)	{
b) A subscriber (semi-automatic) } 1. Country code | ub), | ud) 2. National (significant) number | uc) 3. Sending-finished }	{ {	
c) Any incoming or delay operator's position (semi-automatic) } 1. Country code | ub), | ud) 2. Extra digit designating the incoming international exchange | ue) 3. Code 11 or code 12 | uf) 4. Sending-finished }	{ {	
d) An particular delay operator, or one of those operating a particular group of delay operator's positions (semi-automatic) } 1. Country code | ub), | ud) 2. Extra digit designating the incoming international exchange | ue) 3. Code 12 | uf) 4. Number of a particular position or a group of positions 5. Sending-finished }	{ {	
e) An information operator or a special service operator }	{ 1. Special numbers	

a) The recommended international prefix is 00, see Recommendation Q.11 *bis* , § 4.1.

b) The country code consists of one these digit combinations: I 1, I 1 I 2, I 1 I 2 I 3.

c) The national (significant) number consists of the subscriber number and the trunk code: N 1, N 2, N 3, . | | It does not contain the national (trunk) prefix (the preferred national prefix is 0 — see Recommendation Q.11 | fIbis § 4.5.2). The subscriber using the international automatic telephone network should be informed in an appropriate manner that the national prefix after the country code must not be sent.

d) If, in the case of semi-automatic calls, the language digit L = 1, 2, 3, . | | is not sent automatically by the outgoing signalling equipment, it has to be sent by the operator to the outgoing equipment. In this case, the operator must send the L digit immediately following the country code.

e) The extra digit (N 1) designating the incoming international exchange is used in cases where more than one incoming international exchange can be reached in the country of destination. (It is recognized that the existing design of some equipment does not permit the insertion of the extra digit.)

fD) See Recommendation Q.101.

Table 1/Q.107 [T1.107], p.1

2 Sequence of forward address information to be sent by the outgoing international signalling equipment

The information to be sent in the forward direction by the outgoing international signalling equipment in order to set up telephone connections differs from the information to be sent by the telephone user. The content and the sequence of forward address information is furthermore dependent on the signalling systems used in the international network. In the following, a distinction is made between common channel and channel associated signalling systems.

2.1 *Common channel signalling systems*

In the case of common channel Signalling Systems No. 6 and No. 7, the first signal to be sent to an (international) signalling data link relating to the set up of a telephone connection is the initial address message. According to the definitions in Recommendations Q.254 [1], Q.722 [2] and Q.762 [7], the initial address message normally contains, among others, the following forward address information:

a) nature-of-address indicator indicating that the

— international number,

— national (significant) number, or

— subscriber number is included;

b) nature-of-circuit indicator indicating that

— a satellite circuit is included

— no satellite circuit is included;

c) echo-suppressor indicator indicating that

— an outgoing half-echo suppressor is included

— no outgoing half-echo suppressor is included;

d) calling-party's-category indicator including, among others,

— a language digit, L

— the discriminating digit D;

e) address signals

— country code

— national (significant) numbers

— code 11

— code 12

— end-of-pulsing (ST) signal or code 15.

As the initial address message of Signalling Systems No. 6 and No. 7 carries at least the information mentioned above, it is not necessary to describe here in detail the sequence of the forward address information to be sent by the outgoing international signalling equipment; reference is made to Recommendations Q.258 [3], Q.723 [6] and Q.763 [8], instead.

Nevertheless, the following additional comments are made:

a) In cases where the international call is routed

— from an originating international exchange (CT) to an international transit CT, or

— from one international transit CT to another international transit CT

(i.e. for international transit calls) the appropriate nature-of-address indicator (international number — Signalling System No. 7) or country code indicator (country code included — Signalling System No. 6) will be used together with the country code.

b) If a terminal international link is selected; i.e. in cases where the call is routed

— from an originating CT direct to a destination CT, or

— from a transit CT to a destination CT

the nature-of-address indicator [national (significant) number: Signalling System No. 7] or the country code indicator (country code not included: Signalling System No. 6) will be used. In this case, no country code has to be sent.

In both cases a) and b) described above, further routing information will be included in the initial address message. For further details, see Recommendations Q.258 [3], Q.723 [6] and Q.763 [8].

2.2 *Channel associated signalling systems*

For channel associated signalling systems, it is important to determine the first interregister signal and the sequence of forward address information. This matter is dealt with in the following, taking into account various types of calls and Signalling Systems No. 4, No. 5, R1 and R2.

With the exception of the seizing signals in Signalling System No. 4, no line signals are dealt with.

2.2.1 *The first signals to be sent on international links*

Table 2/Q.107 shows the first type of signal to be sent on four different types of international links in the case where channel associated signalling systems are used.

H.T. [T2.107]

TABLE 2/Q.107

First signal to be sent on international links

Type	International link		{
	from Orginating country	to Destination country	{
a) Terminal-call indicator or discriminating or language digit }			
b)	Originating country	Transit country	Transit-call indicator
c)	Transit country	Transit country	Transit-call indicator
d) Terminal-call indicator or discriminating or language digit }	Transit country	Destination country	{

Table 2/Q.107 [T2.107], p.2

The terminal-call indicator is a type of signal indicating that an international terminal link *a)* or *d)* is involved and that no country code

has to be sent to the incoming CT. In the case of Signalling System No. 4, the terminal-call indicator is represented by the terminal seizing signal — a forward line signal. For the other channel associated signalling systems, interregister signals are used. The discriminating digit D and the language digit L (both are also called the characteristic digit Z) must be in accordance with Recommendation Q.104.

The transit-call indicator is a type of signal indicating that an international transit link *b)* or *c)* is involved and that the country code will be included in the signalling sequence. In the case of Signalling System No. 4, the transit-call indicator is represented by the transit seizing signal — a forward line signal. For the other channel associated signalling systems, interregister signals are used.

2.2.2 *Sequence of forward address information for automatic and semi-automatic calls to a subscriber*

The forward address information to be sent by the outgoing international signalling equipment differs from the information sent by the telephone user as described in § 1.

Details covering the different channel associated CCITT signalling systems are shown in Table 3/Q.107.

2.2.3 *Sequence of forward address information for calls to any incoming or delay operator's position*

Table 4/Q.107 shows in detail the standard sequence of forward address information for calls to any incoming or delay operator's position to be sent by the outgoing international signalling equipment. A distinction is made between international transit and terminal calls as well as between different channel associated CCITT signalling systems.

H.T. [T3.107]

TABLE 3/Q.107

Sequence of forward address information for automatic and semi-automatic calls to a subscriber to be sent by the outgoing international signalling equipment

{ Channel associated CCITT signalling system }	No. 4	No. 5	R2	R1 | ua)
Transit-call indicator Echo-suppressor indicator — I-12 or I-14 or I-11 | uc) }	Transit seizing | ub) — d) — —	KP 2 {	—	

{
Nature-of-circuit indicator
}
I-13 or I-14 | ue)
}
	—
	—
	—
		—	{	

Country code I 1, I 1 I 2, I 1 I 2 I 3 | uf) }	{ — — — — — — — — —			

{
Calling-party's-category indicator
}
D = 0 or L = 1, 2, 3, . | |
}
	{
	—
	—			

{
National (significant) number
}
	N 1 N 2 N 3 . | |	—		

Sending-finished Terminal-call indicator	Code 15 Terminal seizing | ub)	ST KP 1	Code 15 KP h)	—

{
Calling-party's-category indicator
}
D = 0 or L = 1, 2, 3 . | | | ug)
}
	{
	—
	—			

Echo-suppressor indicator	— d)	—	1-14 | ue)	—

{
Nature-of-circuit indicator
}
1-13 or 1-14 | ue)
}
	—
	—
	—
		—	{	

National (significant) number	N 1 N 2 N 3 . | |			
Sending-finished	Code 15	ST	Code 15	—

a) Signalling system R1 is not used for international transit calls.

b) For Signalling System No.4, the transit and the terminal-call indicators are represented by line signals. For the other signalling systems, no line signals are shown.

c) The use of signal I-11 in international working is subject to bilateral agreements.

d) Code 14 can be used for echo-suppressor control to bilateral or multilateral agreements.

e) These signals are sent on request.

f) See Recommendation Q.101.

g) For Signalling System R2, the L digit is also used as terminal-call indicator.

h) The KP signal is only used to prepare the incoming signalling equipment for the reception of the subsequent interregister signals; see also footnote a) above.

MONTAGE: Sending sequence International terminal call International transit call

Tableau 3/Q.107 [T3.107] p.3

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H.T. [T4.107]

TABLE 4/Q.107

Sequence of forward address information for calls to any incoming or delay operators' position

{ Channel associated CCITT signalling system }	No. 4	No. 5	R2	R1 | ua)
Transit-call indicator Echo-suppressor indicator — I-12 or I-14 or I-11 | uc) }	Transit seizing | ub) — d) — —	KP 2 {	—	

{
Nature-of-circuit indicator
}
I-13 or I-14 | ue)
}
	—
	—
	—
		—	{	

Country code	I 1, I 1 I 2, I 1 I 2 I 3	—		
Language digit	L = 1, 2, 3, . | |	—		

{
Extra digit designating the incoming exchange
}
	N 1	—		

{
Access to operator's position
}
Code 11 or code 12 | uf
)
}
	{
	—			

Sending-finished Terminal-call indicator Terminal seizing | ub) }	Code 15 { KP 1	ST KP h)	Code 15	—
Language digit L = 1, 2, 3, . | | | ug) }	{ —			
Echo-suppressor indicator	— d)	—	1-14 | ue)	—

{
Nature-of-circuit indicator
}
1-13 or 1-14 | ue)
}
	—
	—
		—	{	

{
Extra digit designating the incoming exchange
}
	N 1	—		

{
Access to operator's position
}
Code 11 or code 12 | uf
)
}
	{
	e.g. 121 or 1150			

Sending-finished	Code 15	ST	Code 15	ST

a) Signalling System R1 is not used for international transit calls.

b) For Signalling System No.4, the transit and the terminal-call indicators are represented by line signals. For the other signalling systems, no line signals are shown.

c) The use of signal I-11 in international working is subject to bilateral agreements.

d) Code 14 can be used for echo-suppressor control subject to bilateral or multilateral agreements.

e) These signals are sent on request.

f) See Recommendation Q.101.

g) For Signalling System R2, The L digit is also used as terminal-call indicator.

h) The KP signal is only used to prepare the incoming signalling equipment for the reception of the subsequent interregister signals; see also Note a).

MONTAGE: Sending sequence International terminal call International transit call

Tableau 4/Q.107 [T4.107] p.4

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2.2.4 *Sequence of forward address information for calls to a particular delay operator*

The standard sequence of forward address information for calls to a particular delay operator or one of those operating a particular group of delay operator's position is shown in detail in Table 5/Q.107. Again a distinction is made between international transit and terminal calls as well as between different channel associated CCITT signalling systems.

The footnotes relating to Table 4/Q.107 are also valid for Table 5/Q.107.

3 Standard sending sequence of forward address information in the case of calls to testing and measuring devices

International calls to testing and measuring devices are terminal calls. Therefore, the outgoing signalling equipment will not send the country code. In Signalling System No. 4, the terminal-call indicator is a line signal.

Table 6/Q.107 contains the standard sending sequence and forward address information in the case of calls to testing and measuring devices to be sent by the outgoing signalling equipment for Signalling Systems No. 4, No. 5, No. 6, No. 7, R1 and R2.

Recommendation O.11 [4] contains the detailed specifications for CCITT manual maintenance access lines. Recommendation O.22 [5] contains the detailed specifications for the CCITT ATME No. 2. Further information with regard to calls to testing and measuring devices can be found in the detailed specifications of the relevant CCITT signalling systems.

In the case of the common channel Signalling Systems No. 6 and No.7, all information will be carried by means of an initial address message in which the message indicators will be set to their appropriate values as specified in Recommendations Q.258 [3], Q.723 [6] and Q.763 [8].

In Table 7/Q.107 the access codes required to reach the testing and measuring devices in the exchange of destination are given for CCITT Signalling Systems No. 4, No. 5, No. 6, No. 7 and R2.

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H.T. [T5.107]

TABLE 5/Q.107

Sequence of forward address for calls to a particular delay operator's position

{ Channel associated CCITT signalling system }	No. 4	No. 5	R2	R1 | ua)
Transit-call indicator Echo-suppressor indicator — I-12 or I-14 or I-11 | uc) }	Transit seizing | ub) — d) —	KP 2 {	—	

{
Nature-of-circuit indicator
}
I-13 or I-14 | ue)
}
	—
	—
		—	{	

Country code	I 1, I 1 I 2, I 1 I 2 I 3	—		
Language digit	L = 1, 2, 3, . | |	—		

{
Extra digit designating the incoming CT
}
	N 1	—		

{
Access to operator's position
}
	Code 12	—		

{
Number of a particular position
}
	x 1 (x 2 x 3 . | |)	—		

Sending-finished Terminal-call indicator	Code 15 Terminal seizing | ub)	ST KP 1	Code 15 KP g)	—
Language digit L = 1, 2, 3, . | | | uf) }	{ —			
Echo-suppressor indicator	— d)	—	1-14 | ue)	—

{
Nature-of-circuit indicator
}
1-13 or 1-14 | ue)
}
	—
	—
		—	{	

{
Extra digit designating the incoming CT
}
	N 1	—		

{
Access to operator's position
}
	Code 12	e.g. 1150		

{
Number of a particular position
}
	x 1 (x 2 x 3 . | |)	e.g. 11x 1 x 2		

Sending-finished	Code 15	ST	Code 15	ST

a) Signalling System R1 is not used for international transit calls.

b) For Signlling System No.4, the transit and the terminal-call indicators are represented by line signals. For the other signalling systems, no line signals are shown.

c) The use of signal I-11 in international working is subject to bilateral agreements.

d) Code 14 can be used for echo-suppressor control subject to bilateral or multilateral agreements.

e) These signals are sent on request.

f) For Signalling System R2, the L digit is also used as terminal-call indicator.

g) The KP signal is only used to prepare the incoming signalling equipment for the reception of the subsequent interregister signals; see also Note a).

MONTAGE: Sending sequence International terminal call International transit call

Tableau 5/Q.107 [T5.107] p.5

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H.T. [T6.107]

TABLE 6/Q.107

Sending sequence of forward address information in the case of calls to testing and measuring devices

CCITT signalling system	No. 4	No. 5	No. 6	No. 7	R2

Terminal-call indicator
Together with other message indicators
}
{
Calling party's category indicator
}
	Terminal seizing
	
	KP
	
	D=code | 3
		KP 1
		
		D | |
			{
			
			Test call
				Test call	D | code 13 | ua)

Test-call indicator	Code 12	Code 12	—	—	Code 13

{
Access code for a particular testing or measuring device
}
Digits to be agreed upon (minimum three)
}
	Digit 0 plus 2 digits x, y	Digit 0 plus 2 digits x, y	16 combi- nations	2 digits x, y	2 digits x, y

Sending-finished	Code 15	ST	ST	ST	Code 15

a) For signalling System R2, the D digit is also used as terminal-call indicator.

MONTAGE: Sending sequence

Tableau 6/Q.107 [T6.107] p.6

H.T. [T7.107]

TABLE 7/Q.107

Access codes for a particular testing or measuring device

CCITT signalling system	Access codes				
	No. 4	No. 5	R2	No. 6	No. 7

{
Multiple address capability for transmission access test line
}
	6 21-29	**6** 21-29	**6** 21-29	6 7 8	**6** 21-29

ATME 2 Type a	61	61	61	1	61
ATME 2 Type b	62	62	62	2	62
ATME 2 Type c	63	63	—	—	63
Quiet termination	64	64	64	3	64
Echo suppressor test	65	65	65	4	65
Loop around	66	66	66	5	66
Echo canceller test	67	67	67	9	67
Loop back test line	68	68	68	10	68
Simplified test Good/no good transmission Test	— 00	— —	90 00	— 	—
Continuity check	—	—	—	0	00

Tableau 7/Q.107 [T7.107] p.7

References

[1] CCITT Recommendation *Telephone signals* , Vol. VI, Fascicle VI.3, Rec. Q.254.

[2] CCITT Recommendation *General function of telephone messages and signals* , Vol. VI, Fascicle VI.8, Rec. Q.722.

[3] CCITT Recommendation *Telephone signals* , Vol. VI, Fascicle VI.3, Rec. Q.258.

[4] CCITT Recommendation *Specifications for manual maintenance access lines* , Vol. IV, Fascicle IV.4, Rec. O.11.

[5] CCITT Recommendation *CCITT automatic transmission measuring and signalling testing equipment (ATME No. 2)* , Vol. IV, Fascicle IV.4, Rec. O.22.

[6] CCITT Recommendations, *Formats and codes* , Vol. VI, Fascicle VI.8, Rec. Q.723.

[7] CCITT Recommendations, *General function of messages and signals* , Vol VI, Fascicle VI.8, Rec. Q.762.

[8] CCITT Recommendations, *Formats and codes* , Vol. VI, Fascicle VI.8, Rec. Q.763.

Recommendation Q.107 | fIbis

ANALYSIS OF FORWARD ADDRESS INFORMATION FOR ROUTING

(Geneva, 1980; modified at Melbourne, 1980)

1 General

This Recommendation covers the analysis of forward address information for the routing of circuits using Signalling Systems No. 4, No. 5, No. 6, No. 7 and R2.

For Signalling System R1, Recommendation Q.324 [1] indicates that in the application of Signalling System R1 to intra-regional networks, the routing plan of that network shall apply. The routing plan is such that analysis is limited to a maximum of six digits.

Signalling Systems No. 4, No. 5, No. 6, No. 7 and R2 as specified are suitable for international application (see also Recommendation Q.7) and Recommendations Q.12 and Q.13 on routing are applicable. Similarly, for international traffic the combinations of digits to be sent must be in accordance with Recommendations Q.10, Q.11 | fIbis and Q.101 to Q.107.

Based on the forward address information received (see Recommendation Q.107), routing is performed at the outgoing international exchange and at the following (transit) exchanges. For this purpose, an analysis of some of the information received is required. Recommendation Q.107 specifies the standard sequences of forward address information for each of the signalling systems mentioned above.

2 Digit analysis at the outgoing international exchange

The ISDN numbering plan is based on an extension of the existing numbering plans applicable to national and international public telephone networks. In fact, ISDN services may be provided under the existing numbering plan for the international telephone service (the E.163 subset of E.164). However, some Administrations may choose to allow for full E.164 numbers (maximun 15 digits). Therefore, the associated change which motivates an increase in the maximum number of digits which must be analysed in the outgoing international exchange to determine routing should be fully supported.

More specifically, according to E.164, this maximum should be equal to 6 digits, the language digit (L) or the discriminating digit (D) not being included. Some examples of the information required to determine routing at an international exchange are given in the following:

I_1 Z $N_1N_2N_3N_4N_5$

or I_1 I_2Z $N_1N_2N_3N_4$

or I_1 I_2I_3Z $N_1N_2N_3$

where

I_1, I_2, I_3 = digits of the country code

Z = characteristic digit, i.e. discriminating digit (D) or language digit (L), and

N_1, . | | N_n = digits of the national (significant) number.

In cases where the country code is shared by different countries, up to 7 digits may have to be analysed for routing and accounting purposes. In the implementation of new international exchanges, this should be taken into account.

In general, the whole amount of forward address information relating to international calls is stored at the outgoing international exchange.

Some examples of the information required to determine the routing at an international exchange are given in the following:

In the cases of common channel Signalling Systems No. 6 and No. 7, the information content of the D or L digit will be conveyed by the calling-party's-category indicator.

I_1 Z $N_1N_2N_3$

or I_1 I_2Z N_1N_2

or I_1 I_2I_3Z N_1N_2

where

I_1, I_2, I_3 = digits of the country code

Z = characteristic digit, i.e. discriminating digit (D) or language digit (L), and

N_1, . | | N_n = digits of the national (significant) number.

The maximum number of digits which has to be analysed in the outgoing international exchange to determine the routing is 5, the language digit (L) or the discriminating digit (D) not being included. In cases where the country code is shared by different countries, up to 7 digits may have to be analysed for routing and accounting purposes. In the implementation of new international exchanges, this should be taken into account.

In semi-automatic working, in the case where the language digit is not sent by the operator, and in automatic working, it is necessary to determine (in the outgoing international exchange) the position where the language or discriminating digit must be inserted automatically (for channel associated signalling systems immediately after the country code). This position is determined by an analysis of the first or the first two digits of the country code. A three-digit country code can also be detected by an analysis of the first two digits.

It is recognized that the existing design of some equipment may not permit the reception of the extra digit N_1. In this situation, agreement will be required between the relevant countries concerned that the extra digit N_1would not be sent to a particular incoming international exchange.

In the case of countries with more than one incoming international exchange where semi-automatic calls to code 11 or code 12 operators require a digit analysis beyond the country code for routing in the outgoing international exchange, N_1may be used as the extra digit designating the incoming international exchange. For direct relations between the outgoing exchange and the incoming exchanges, sending of the digit $N_1$to the incoming international exchanges is not required

3 Digit analysis at the international transit exchange

Signalling equipment for transit exchanges must be designed for the transfer of all information necessary for setting up calls including access to operators' positions.

In an international transit exchange, analysis of some of the digits is required to determine the routing to the desired international incoming exchange or to another international transit exchange. The maximum number of digits which has to be analysed at the international transit exchange to determine the routing is 5, the language (L) or the discriminating digit (D) not being included (see also § 2). In cases where the country code is shared by different countries, up to 7 digits may have to be analysed for routing and accounting purposes. In the implementation of new international exchanges, this should be taken into account.

The transit exchange decides how many of the received digits it needs for this analysis.

In an international transit exchange, an analysis, effective on the first or the first two digits of the country code, determines the number of digits in the country code. For channel associated signalling systems, the position of the language or the discriminating digit is therefore determined which, in the sequence of forward address information, follows immediately the country code.

Since in the case of common channel Signalling Systems No. 6 and No. 7 the initial address message contains all digits required for routing the call, selection of the outgoing circuit can start as soon as this message has been received. In addition to the digit information, other routing information is contained in the initial address message, e.g. country code or nature-of-address indicator, nature-of-circuit indicator, calling-party's-category indicator, and echo-suppressor indicator, some or all of which must be analysed as described in the detailed specifications.

Normally, it will not be necessary for a transit exchange using Signalling System No. 6 or No. 7 to analyse digits in more than the initial address message. Subsequent address messages can be forwarded to the next international exchange without analysis as soon as the outgoing circuit is determined.

In the case of Signalling System No. 6, however, a subsequent address message (SAM) must always be analysed for sequence reasonableness before being forwarded to the next international exchange.

In the case of incoming Signalling System No. 4, the transit exchange must ensure that it does not request signal code 15 in order to avoid premature release of the outgoing register, e.g. by evaluating the signal code 11 or code 12.

4 Examples of the digit analysis in an international transit exchange

Possible cases for digit analysis by an international transit exchange are shown in the following examples (the letters given to the international exchanges correspond to Figure 1/Q.107 | fIbis and the letters given to the digits correspond to the examples given in § 2 above). It should be noted that in some cases analysis of fewer digits than those indicated in the following examples may be sufficient.

Figure 1/Q.107 | is, p.8

4.1 *Example 1*

In example 1, transit traffic via C in one country is routed to one of the two exchanges M or R in another country according to the first digit(s) of the national (significant) number.

In the cases of common channel Signalling Systems No. 6 and No. 7, the information content of the D or L digit will be conveyed by the calling-party's-category indicator.

a) Automatic and semi-automatic calls with normal national numbers

Example: $I_1 I_2 Z\ N_1 N_2$

b) Semi-automatic calls to code 11 or code 12 operators in the case where only one incoming international exchange (M or R) is equipped to receive calls to operators' positions

Examples: $I_1\ I_2\ L\ C_{1\backslash d1}$ or $I_1 I_2 L\ C_{1\backslash d2}$

In the case of countries with more than one incoming international exchange where code 11 or code 12 traffic requires for routing in the transit exchange a digit analysis beyond the country code, N_1 may be used as the extra digit designating the incoming international exchange

Examples: $I_1\ I_2\ L\ N_1\ C_{1\backslash d1}$ or $I_1\ I_2\ L\ N_1 C_{1\backslash d2}$

analysed analysed

4.2 *Example 2*

In example 2, transit traffic via C in one country is routed to G or S in another country. Automatic traffic with the presence of discriminating digit (D) is routed to G or S according to the first digit of the national significant number, while all semi-automatic traffic with the presence of language digit (L) is routed to S for assistance operator use regardless of digits following L.

Examples: $I_1\ I_2$ D or $I_1\ I_2 L$

analysed $I_1\ I_2$ D or analysed

5 Example of digit analysis for incoming terminal traffic

Terminal traffic incoming to an international exchange C in a country and which is to be routed to code 11 or code 12 operators in another international exchange A in the same country according to the extra digit N_1.

Examples: $L\ 1\ C_{1\backslash d1}\ C_{1\backslash d5}$ or $L\ 1\ C_{1\backslash d2}$ X X $C_{1\backslash d5}$

analysed analysed

6 Cross-border traffic between adjacent countries

If for cross-border traffic between adjacent countries access to operators' positions is not provided, it may be decided by bilateral agreement to exclude the transfer of the language or the discriminating digit. In this case, the first digit sent will be the first of the national (significant) number. In addition, one or more of the first digits of the national (significant) number may be omitted, depending on the routing requirements at the incoming exchange.

In the cases of common channel Signalling Systems No. 6 and No. 7, the information content of the D or L digit will be conveyed by the calling-party's-category indicator. Code 15 may be considered as equivalent to ST in all CCITT signalling systems.

For cross-border traffic between adjacent countries, the number of digits that must be analysed will be determined by bilateral agreement. This may involve more digits than for normal international traffic.

Reference

[1] CCITT Recommendation *Analysis of address information for routing* , Vol. VI, Fascicle VI.4, Rec. Q.324.

1.8 ONE-WAY OR BOTH-WAY OPERATION OF INTERNATIONAL CIRCUITS

1.8.1 *One-way operation*

In order to have as simple as possible equipment in international exchanges and to avoid double seizures, System No. 4 has been designed in 1949-1954 for one-way operation of international circuits in semi-automatic and automatic working.

1.8.2 *Both-way operation*

1.8.2.1 These advantages of one-way operation naturally hold good in the case of long international (interconti nental) circuits. However, for these circuits the following considerations have been determining factors in providing both-way circuit operation:

a) When a group of circuits is composed of a small number of circuits, the increase in efficiency due to both-way operation is obviously very important. Moreover, long international (intercontinental) circuits are very costly. Finally, the increase in the cost of terminal equipment which results from both-way operation is small compared with the considerable economic advantage derived from this mode of operation.

b) The two ends of a long international (intercontinental) group of circuits may belong to two time zones which are very far apart and, depending on the difference in time, this is likely to result in important and variable differences between the traffic in the two directions.

1.8.2.2 All circuits in System No. 5 and the speech circuits in Systems No. 6 and 7 should be equipped to work in both-way operation. Nevertheless, the both-way method of operation would be applied only if it offered a considerable economic advantage. Hence in the case of large

groups (for example, more than 40 circuits in each direction), the possibility of maintaining one-way operation might be considered, because of the extra reliability of this type of operation. If, in circumstances necessitating the use of large groups, there are great differences between the busy hours at each end, it would be advisable, if it were desired to maintain one-way operation, to arrange that the circuits be used successively in one or the other direction according to the time of day. This availability of the circuits for routing traffic from country A to country B or vice versa would be arranged by a convenient method.

In certain cases another solution is worthy of consideration. This consists of setting up three groups of circuits, two operated one-way and the third both-way, it being understood that the latter would be used as an overflow route for calls which could not be routed on the first two groups.

1.8.2.3 Attention is drawn to the conditions which should be introduced to avoid double seizing and false blocking on both-way international circuits. In addition, attention is drawn to the fact that in semi-automatic working, as in automatic working, access to the circuits at both ends should be automatic.

In semi-automatic operation, in the event of double seizing, automatic selection of a new circuit should be preferred to the operator’s setting up the call again, so that the operator does not become aware of the double seizing. In automatic operation, automatic selection of a new circuit should naturally be the rule.

The necessary arrangements have been made in the specifications of the systems concerning simultaneous seizing in both-way operation.

1.8.2.4 The digital circuits in System R2 and the circuits in System R1 may be equipped to work in both-way operation.

Recommendation Q.109

1.9 TRANSMISSION OF THE ANSWER SIGNAL IN INTERNATIONAL | EXCHANGES

For the reasons given in Recommendation Q.27, it is necessary to reduce to a minimum the delays resulting from:

— the conversion of the national answer signal into the international answer signal and vice versa; and

— the transmission of the international answer signal over the international part of the connection,

these delays being additional to any delays due to conversions and repetitions of the answer signal within the national systems of the incoming and outgoing countries.

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SECTION 2

TRANSMISSION CLAUSES FOR SIGNALLING

A. Signalling on PCM links

Recommendation Q.110

2.0 GENERAL ASPECTS OF THE UTILIZATION OF STANDARDIZED CCITT SIGNALLING SYSTEMS ON PCM LINKS

2.0.1 *Signalling Systems No. 4 and No. 5*

Signalling Systems No. 4 and No. 5 are in-band signalling systems. It is not planned to specify modified versions of these systems for application to PCM transmission systems.

Should it be required to use one of these signalling systems on circuits routed partly or wholly via PCM transmission systems it is recommended that the standard in-band signalling arrangements for both line and interregister signals be used. The circuits should be connected on a 4-wire basis to appropriate analogue inputs and outputs of the PCM transmission system.

When used at analogue exchanges the circuits should be connected on a 4-wire basis to appropriate analogue inputs and outputs of a PCM transmission system conforming to Recommendations G.732 [1] or G.733 [2].

At digital exchanges, circuits should be connected to PCM interfaces conforming to Recommendation Q.503.

2.0.2 *Signalling System No. 6*

For the transmission of signalling information over digital systems a digital version of Signalling System No. 6 has been developed and is specified in Recommendations Q.251 and Q.295.

Alternatively, the analogue version of System No. 6, as also specified in Recommendations Q.251 to Q.295 may be used without modifications by replacing the analogue voice-frequency channel of the signalling data link by PCM voice-frequency channels. In this case, the connection of the modem to the PCM transmission channel should be made on a 4-wire basis to the analogue input and the analogue output.

2.0.3 *Signalling System No. 7*

Signalling System No. 7 has been developed for the use in integrated digital networks. It is optimized for 64 kbit/s PCM transmission channels.

In addition, it can be used on analogue transmission channels with lower bit rates.

2.0.4 *Signalling System R1*

Signalling System R1, as specified in Part I of Fascicle VI.4, may be used without modification on PCM voice-frequency channels by direct connection of the circuits to appropriate analogue inputs and outputs of the PCM transmission system.

An alternative method of transmitting the line signals via a PCM system as specified in Recommendation G.733 has been developed as the digital version of System R1. Details are given in Recommendations Q.314 to Q.316. The multifrequency interregister signals are applied in-band via the analogue input of the speech circuit.

At digital exchanges, circuits should be connected to PCM interfaces conforming to Recommendation Q.503.

2.0.5 *Signalling System R2*

The analogue version of System R2 line signalling cannot be transmitted via an analogue input of a PCM system since these line signals are sent out-band using a 3825 Hz signalling channel. The digital version of System R2 line signalling specified in Recommendations Q.421-Q.424 has been developed for use with PCM systems specified in Recommendation G.732 [1]. The multi-frequency inter-register signals are applied in-band via the input of the speech circuit. At digital exchanges, circuits should be connected to PCM interfaces conforming to Recommendation Q.503.

References

[1] CCITT Recommendation *Characteristics of primary PCM multiplex equipment operating at 2048 kbit/s* , Vol. III, Fascicle III.3, Rec. G.732.

[2] CCITT Recommendation *Characteristics of primary PCM multiplex equipment operating at 1544 kbit/s* , Vol. III, Fascicle III.3, Rec. G.733.

B. Clauses common to signal receivers (and senders) for Signalling Systems No. 4, No. 5, R1 and R2

Recommendation Q.112

2.1 SIGNAL LEVELS AND SIGNAL RECEIVER SENSITIVITY

2.1.1 *Standardized transmitted power*

The values of the standardized transmitted power for the different line and interregister signals are defined in the relevant parts of the specifications for the CCITT Systems No. 4, No. 5, R1 and R2.

Note — The level of leak current which might be transmitted to line, for example when static modulators are used for signal transmission, should be considerably below signal level, as specified.

2.1.2 *Variations of the absolute power level of received signals*

The standardized absolute power level of the signalling current to be transmitted is fixed at the maximum value compatible with circuit transmission requirements and the extreme values of absolute power level, between which received signalling currents may lie, depend on three factors:

1) the overall loss and the variation with time of this loss of the international circuit (link-by-link signalling) or of the chain of international circuits (end-to-end signalling) at 800 Hz;

2) the variation with frequency of the overall loss of these circuits, in relation to the nominal value at 800 Hz;

For Signalling Systems No. 6 and No. 7, see Fascicles VI.3 and VI.7 respectively.

3) the tolerance on the transmitted absolute power level in relation to the nominal value.

The operate level range of the signal receivers about a nominal value should take account of these three factors. In System No. 4, the operate range (± | dB) is appropriate for end-to-end signalling. The maximum number of circuits in the end-to-end signalling situation is normally three but more may be possible depending upon the actual conditions. In System No. 5 the operate range, (± | dB) for line signals and for register signals is appropriate for each circuit in link-by-link signalling. For the other CCITT systems see the relevant parts of their specifications.

2.1.3 *Maximum sensitivity of the signal receiver*

It is desirable to limit the maximum sensitivity of the signal receiver, particularly on account of crosstalk between the GO and RETURN paths of a 4-wire circuit, leak currents, etc.

Recommendation Q.113

2.2 CONNECTION OF SIGNAL RECEIVERS IN THE CIRCUIT

2.2.1 The line signal receivers are permanently connected to the 4-wire side of the circuit. The register signal receivers in System No. 5 are connected to the 4-wire side of the circuit when the register is associated with the circuit for the setting up of the call; the same is valid (in the international exchanges) for the register signal receivers in Systems R1 and R2.

2.2.2 An in-band line signal receiver should be protected against disturbing currents (voice currents or possibly noise), coming from the the near end of the circuit, by a buffer amplifier or other arrangement. The arrangement used should introduce an appropriate supplementary attenuation in such a manner that, at the point where the line signal receiver is connected, these disturbing currents are of such a level that they cannot:

— operate the line signal receiver;

— interfere with the reception of signals by operating the guard circuit of the line signal receiver.

The additional attenuation introduced should in consequence take account of:

a) the relative level *n* at the point where the signal receiver is connected (this relative level is obtained by assuming a zero relative level at the distant origin of the circuit);

b) the minimum permissibe signal level at the input to the signal receiver, for example:

—18 + *n* dBm in the case of System No. 4 (see Recommendation Q.123 § 3.2.1),

—16 + *n* dBm in the case of System No. 5 (see Recommendation Q.144 § 2.4.1);

c) the maximum permissible level for disturbing currents (voice currents and switching noise) coming from the near end of the circuit. The maximum level of voice current might be assumed to be, for example, +10 dBm0 in the direction *opposite* to that of the signals. The nature of the switching noises depends on the national systems used;

d) any attenuation (terminating set and possibly pads) between the point where the signal receiver is connected and the point where the near-end disturbing currents are considered;

e) a safety margin to give an appreciable reduction of the level of disturbing currents coming from the near end [as defined in c)] compared to the minimum level of the signal as defined in b).

2.2.3 When a register-signal receiver is connected to the circuit, the exchange side of the circuit is disconnected and hence the receiver is not subject to near-end disturbances.

2.2.4 The Recommendations of Volume III concerning international circuits must still be met after the connection of a signal sender and a signal receiver and of the switching equipment. In consequence, it is necessary to fix the limits of input and output impedance, insertion loss, attenuation distortion, non-linear distortion, balance, and crosstalk of line signal senders and receivers; an example of specification clauses concerning these conditions is given in Recommendation Q.114.

2.3 TYPICAL TRANSMISSION REQUIREMENTS FOR SIGNAL SENDERS AND RECEIVERS

2.3.1 In-band line signal receivers (including the buffer amplifier or equivalent device), in §§ 2.3.2 to 2.3.7 below, apply only in the case where the signal receiver is a 4-terminal device (‘‘quadripole’’) and where the nominal circuit impedance is 600 ohms.

2.3.2 *Input and output impedance*

The nominal value of the input and output impedances of the signal receiver is 600 ohms.

Z_E and Z_S, which are respectively the measured values of the input and output impedance of the signal receiver, should meet the following condition throughout the 300 to 3400 Hz frequency band:

$$\left| \frac{\text{f IZ}_{\text{E}} - 600}{fIZ_{\text{E}} + 600} \right| \quad 0.35 \text{ and}$$

$$\left| \frac{\text{f IZ}_{\text{S}} - 600}{fIZ_{\text{S}} + 600} \right| \quad 0.35.$$

In making these measurements the free terminals should be looped by a resistance of 600 ohms and the voltage applied must not overload the equipment.

2.3.3 *Attenuation*

At 800 Hz, the insertion loss of the signal receiver, measured with a generator and a receiver of internal resistance of 600 ohms, must be between the limits:

$$A \pm 0.5 \text{ decibel}\times$$

The value *A* is to be determined from the level diagram of the circuit according to the point of the circuit at which the signal receiver should be connected.

The measurement is made with a 1 mW generator having an internal impedance equal to a pure resistance of 600 ohms and having an e.m.f. of 2×0.775 volt (so-called ‘‘standard generator’’). The e.m.f. of the generator will be adjusted to take into account the relative level of the point of the circuit at which the signal receiver is connected.

If *n* is the relative level at the signal receiver input, the e.m.f. of the generator will therefore be:

1.55 | (mu | 0

$$\frac{fIn}{0}$$

volts,
if *n* is expressed in decibels.

2.3.4 *Attenuation distortion*

The variation in insertion loss of the signal receiver in the 300-3400 Hz frequency band, measured under the conditions of § 2.3.3 above, should not exceed the limits shown in Figure 1/Q.114.

As in certain cases Systems No. 5, and R1 may be applied to circuits in transmission systems with a channel spacing of less than 4 kHz, the 300 Hz lower limit shown above may be replaced by 200 Hz for System No. 5.

2.3.5 *Nonlinear distortion*

The curve representing the variation (as a function of power) of the output level of the signal receiver, with reference to the nominal value of the output level, should be within the limits shown in Figure 2/Q.114 over the relevant frequency range.

2.3.6 *Balance*

The input and output of the signal receiver should have a high degree of balance to earth, the admittance of each terminal to earth being very low.

The same clause should apply to the signal sender.

Figure 1/Q.114 p.9

Figure 2/Q.114 p.10

2.3.7 *Crosstalk between adjacent signal receivers*

The crosstalk ratio between two adjacent signal receivers should not be less than 74 dB in the relevant frequency band.

2.3.8 During the register signalling period no speech transmission takes place. It is not essential therefore for the register signalling equipment of systems having separate equipment for that purpose to take account of §§ 2.3.2 to 2.3.7 above but it is desirable to adopt appropriate clauses for efficient signalling performance.

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SECTION 3

CONTROL OF ECHO SUPPRESSORS

Recommendation Q.115

CONTROL OF ECHO SUPPRESSORS AND ECHO CANCELLERS BY INTERNATIONAL SWITCHING CENTRES

3.1 *General*

In order to achieve transmission objectives on long automatic and semi-automatic telephone connections, it is necessary to take into account the effects of echo. A general discussion of echo considerations is given in Recommendation Q.42 which is an extract of Recommendation G.131. The characteristics of terminal half-echo control devices are given in Recommendations G.161 [1] and G.164 [2]. The characteristics of echo cancellers are given in Recommendation G.165 [3].

In order to achieve optimum echo control for each call, it is necessary to control both types of echo control devices.

This can be carried out at switching centres only if sufficient information is available to coordinate an overall control action.

Logical means to obtain pertinent information and the switching considerations governing its practicable use are detailed below. Control based on the transfer of signals between switching centres is given particular attention. Self-contained control action such as tone disablement of echo suppressors and echo cancellers for data transmission is not within the scope of this Section.

In the cases to be discussed, control methods will be applied at international exchanges (CTs), but it is recognized that in some countries covering large geographic areas it may be appropriate to extend the control methods into national networks.

The actions described in §§ 3.5 to 3.8 about the analysis of information and the decision to be taken in an outgoing transit or incoming international exchange are summarized in the SDL flowchart of the Annex A.

Annex A does not cover the handling of echo control devices in the case of different bearer services and CCITT Signalling System No. 7.

3.2 *Terminology*

a) Subsequent discussion of control measures will refer to the standard terminal half-echo suppressor specified in Recommendation G.164 [2] and the echo cancellers specified in Recommendation G.165 [3]. The terms echo suppressor and echo canceller will be used to denote these devices. The term echo control device will comprise both, echo suppressors and echo cancellers.

b) Two means of introducing echo control devices are considered as acceptable, these are, the use of permanently associated echo control devices and the use of echo control devices inserted from a common pool of echo control devices.

c) With respect to control of permanently associated echo control devices control actions are said to enable or disable.

d) With respect to echo control devices provided from pools, control actions are concerned with inserting or not inserting.

e) The signals assigned in Systems R2, No. 6 and No. 7 (and reserved in System No. 4) for echo control equipment control are in most cases a means to guide subsequent exchanges in taking necessary action with respect to possible introduction of an incoming echo control device. Thus the descriptive phrases associated with the various signalling systems, as given below, convey comparable meaning in the control plan.

Systems No. 4 and R2: incoming half-echo suppressor (half-echo canceller) required;

Systems No. 6 and No. 7: outgoing half-echo suppressor (half-echo canceller) included in the connection.

f) A secondary signalling function related to echo control provides for the possibility that echo control device may not be available at an originating CT. In this case responsibility for both outgoing and incoming echo control device may be delegated by signal.

g) A long circuit is considered as one which, if used by itself, would require echo control.

h) A short circuit is considered as one which, if used by itself, would not require echo control.

3.3 *Compatibility of echo control devices and signalling equipment*

3.3.1 Arrangements should be incorporated in the switching equipment to prevent echo suppressor and echo canceller action from disturbing simultaneous forward and backward signalling via the speech paths.

For this case typical arrangements are:

i) locating the echo control device on the switching side of the signalling equipment;

ii) inhibiting the action of echo control device located on the line side of the signalling equipment by means of an appropriate condition extended from the signalling equipment to the echo control device while signalling is in progress.

Note 1 — The standard half-echo suppressor (Recommendations G.161 [1] and G.164 [2]) if located on the line side of line signalling equipment may adversely affect signalling. This difficulty is possible because with the new standard half-echo suppressor normal operation will at times cause 6 dB additional loss to appear in the path to a line signalling receiver. Operating margins are correspondingly reduced. For example, with signalling receivers for System No. 5 as specified in

Recommendation Q.112, signalling reliability could be impaired. Accordingly, adequate operating margins should be assured or the echo suppressor should not be located on the line side of line signalling receivers. With regard to inter-register signalling which requires simultaneous transmission in both directions, similar considerations call for disabling the echo suppressors while inter-register signalling is in progress in order to prevent the 6 dB loss.

Note 2 — Echo cancellers will not introduce any fixed loss during in-band signalling. But they can cause a problem during the continuity check used in CCITT Signalling Systems No. 6 (Recommendation Q.271) and No. 7 (Recommendation Q.724), or with compelled signals having the same frequency(ies) on both directions of transmission in Signalling System No. 5 (Recommendation Q.112) where the received signal is processed through the existing echo path model and produces an interfering signal in the return path.

Note 3 — Some echo control devices are capable of internally providing either signalling bypass or an appropriate internal function which permits transparent operation to in-band signalling or other in-band tones.

3.3.2 Arrangements should be incorporated in the Systems No. 6 and No. 7 equipment to prevent echo suppressor action from disturbing the procedure for making the continuity check of the speech path. Echo suppressor and echo cancellers must be permanently disabled, if a circuit is used for common channel signalling.

3.4 *Operation without signals*

In Signalling Systems No. 5 and R1, signals are not available for echo control information. In System No. 4 a signal may be applied only if multilateral or bilateral agreements authorize its use. Accordingly, the recommended control plan relies on means other than signals in cases where it has not been found practicable to provide signals. In the case of System No. 5, the normal field of application to long circuits typically indicates the presence of echo control device. In the case of System R1, regional control procedures not requiring signals are applicable.

3.5 *Analysis of information at an outgoing international exchange*

The outgoing international exchange, hereafter designated ''A'', must make a decision with respect to its echo control requirements at the time an outgoing circuit is selected. Unless echo control devices are not available, one or more of the following items of information should influence this decision:

i) country code of destination and possibly some additional address digits;

ii) information about the actual routing of the call;

iii) nature of outgoing international circuit at A (e.g. satellite circuit);

iv) nature of incoming national circuit at A;

v) signals received over the incoming national circuit at A;

vi) requested bearer service (see Recommendation I.231 [4]).

With respect to iii) and iv), the characteristic of primary interest is propagation time. Two general categories, long and short, are the basis of control action. See §§ 3.2 g) and h) above, for definition of terminology.

3.6 *Decision to be taken at the outgoing international exchange*

If the factors i) to vi) in § 3.5 above indicate that there is no need to provide echo control devices on a particular connection, the outgoing exchange should act accordingly and advise subsequent exchanges by signal or other appropriate means, of its decision.

If the information available indicates that the connection to be established will require echo control and if it is known that an outgoing echo control device is not already provided in the national network, then the outgoing exchange should provide for the outgoing echo control device. The outgoing exchange should also, if signals are available, indicate by signal to subsequent exchanges as appropriate what action it has taken.

In the event that an outgoing exchange is unable to provide an outgoing echo control device when a need is known, it may call for cooperative action. (Signal I-11 in System R2 is specifically assigned to make possible a cooperative transfer of responsibility for echo control device control from an originating CT to a transit CT. The signal outgoing half-echo suppressor not included could be used with Systems No. 6 and No. 7, but such an application would in effect assume that a modern exchange found sufficient reason to displace an outgoing echo control device from its preferred location.)

3.7 *Decision to be taken at an international transit exchange*

The decision at an international transit exchange depends on an assessment of switching and signalling information available after the transit CT has selected an outgoing circuit. Information similar to that listed in 3.5 i) to vi) above is of interest.

a) When the first transit CT knows that an outgoing echo control device has not yet been provided closer to the call source by a signal of CCITT Systems No. 6, 7 and R2, or by bilateral agreements for specific exceptions, the transit CT should consider the outgoing circuit selected, the ultimate call destination and such other information as indicated above. If a connection requiring echo control may result, an outgoing echo control device should be enabled or inserted at the first transit CT.

b) When the transit CT concerned knows that an outgoing echo control device is located closer to the call source, the question to be decided is the location of the incoming echo control device. The incoming echo device is located at the transit CT only when a location nearer to the called party is not practicable. Specifically, an exception may result when the transit CT selects a short terminal circuit equipped with CCITT Signalling Systems No. 4, 5, or R1. In this case, an incoming echo control device should be

enabled or inserted at the transit CT.

c) It follows from the above that in every case where an international transit centre interconnects two circuits and knows that echo control device will be provided at a preceding location and also at a more distant location, the transit centre should disable or not insert its own echo control device. (Full echo control device is not covered in the control plan and should not be affected by the procedures described in this Section.)

d) It is, of course, commonly the case that an outgoing echo control device has not been introduced at the outgoing exchange because none is required. When the transit exchange has reason to know of such a situation, it should not introduce an echo control device and should advise the subsequent exchange when possible that an incoming echo control device is not required (or equivalently, that an outgoing echo control device has not been introduced).

e) In the case of a routing where both an incoming and outgoing echo control device has already been inserted at earlier points, the transit exchange should advise the subsequent exchange, where possible, that an incoming half echo control device is not required.

3.8 *Decision to be taken at the incoming international exchange*

Short circuits equipped with CCITT Systems No. 5, R1 and No. 4 (unless bilateral agreements are reached), provide no signals at the incoming CT for selective use of echo control devices. As a result, in the absence of separate circuit groups on the same route or other alternatives, the economic choice is to omit echo devices. In the case of a call that has passed through a transit exchange en route to the incoming exchange, the requirement for an incoming echo control device should then be met at the preceding CT as covered in § 3.7 b) above.

With CCITT Systems No. 6, 7, R2 and 4 (assuming multilateral or bilateral agreement) selective use of echo control devices on short terminal links is a basic option. Therefore, the terminal CT acts in accordance with the control signal received. When an outgoing echo control device has been included at a preceding CT, the incoming CT should enable or insert an incoming echo control device.

When no echo control device has yet appeared elsewhere in the connection, none should be enabled or inserted at the incoming CT.

3.9 *Other considerations*

It is recognized that when echo control devices are inserted from pools, there is a small probability that no echo control device will be available when needed. In this case an (equipment) congestion signal should be given to the calling subscriber.

Nothing in this Recommendation should be construed as discouraging control measures which may supplement the plan described and lead to improved results in specific situations. For example, regional procedures which introduce loss to control echo may be arranged to satisfy both regional and international needs on a selective basis. In addition for multiple ISC in one country the procedure of Annex B may be applied. It is recognized that possibilities for echo control have not been exhausted. If switching and signalling equipment have a changed role in the application of future procedures, this Recommendation will be subject to revision.

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ANNEX A
(to Recommendation Q.115)

Call processing logic — Echo suppressor control

Figure CCITT-50660, p.11

ANNEX B
(to Recommendation Q.115)

Echo suppressor control on inter-ISC circuits

within a single country

In the case where an international transit call is connected through multiple ISCs in a single country in tandem, the following problem may arise with the control of echo suppressors.

Referring to Figure B-1/Q.115, which shows such a connection with two possible outgoing international circuits, one echo suppressed (Exchange B), and one unsuppressed (Exchange C). Exchange E does not have echo suppressors in a pool. Exchange D does not know whether or not the outgoing circuit from Exchange E is provided with echo suppressors. It is not therefore able to control the half echo suppressor HESd, since there may be an incoming half echo suppressor later in the connection.

In order to overcome this problem, a backward signal can be used from Exchange E, which informs Exchange D of the provision of echo suppressors on the outgoing international circuit.

Two methods are currently proposed by Administrations to provide these backward indications, these are detailed below:

i) A backward signal to Exchange D indicating the presence or absence of echo suppressors on the outgoing international circuit is generated by Exchange E as soon as the outgoing circuit has been selected. If a call failure situation subsequently arises and a repeat attempt is made then a new outgoing international circuit is chosen, and a further signal is passed back to Exchange D indicating the presence or absence of echo suppressors on this new circuit. HESd is then enabled, or disabled according to the last backward echo suppressor indicator received from Exchange E.

ii) In this case HESd is initially disabled, and remains so unless a signal is received from Exchange E indicating the absence of echo suppressor on the outgoing circuit. Exchange E only transmits such a signal if the outgoing international circuit has no echo suppressor provided, and will delay transmission of the signal until the address complete signal (or equivalent) is ready to be sent.

Figure B-1/Q.115, p.13

References

[1] CCITT Recommendation *Echo suppressors suitable for circuits having either short or long propagation times* , Volume III of Orange Book, Recommendtion G.161.

[2] CCITT Recommendation *Echo suppressors* , Volume III, Recommendation G.164.

[3] CCITT Recommendation *Echo cancellers* , Volume III, Recommendation G.165.

[4] CCITT Recommendation *Circuit-mode bearer services categories* , Volume III, Recommendation I.231.

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SECTION 4

ABNORMAL CONDITIONS

Recommendation Q.116

4.1 INDICATION GIVEN TO THE OUTGOING OPERATOR OR CALLING SUBSCRIBER IN CASE OF AN ABNORMAL CONDITION

In general, when an abnormal condition occurs in the setting up of a call, the outgoing operator in semi-automatic operation and the calling

subscriber in automatic operation should receive an indication to show that it is necessary to make a new attempt to set up the call or to take other appropriate action.

The tables in the specifications of the signalling systems give details of the signals that are received at the outgoing exchange when abnormal conditions occur in setting up a call. Each Administration will decide how these signals are to be translated into appropriate indications for outgoing operators or calling subscribers.

Recommendation Q.117

4.2 ALARMS FOR TECHNICAL STAFF AND ARRANGEMENTS IN CASE OF FAULTS

4.2.1 In general, when an abnormal condition is recognized as being possibly due to a fault, an alarm must be given to indicate this condition and, if possible, any other necessary operation must be carried out to avoid circuits being put out of service unnecessarily and to facilitate fault tracing.

4.2.2 There will be the usual alarm and fault indication arrangements for such items as blown fuses, disconnected heat coils, faulty signalling equipment, failures of power supplies, failures of common control equipment, etc., as provided under the specifications of each Administration.

4.2.3 The occupation of each item of equipment such as line circuit equipment, link circuit, operators' calling equipment, selectors, registers, etc., can be indicated by the lighting of a lamp near to the equipment concerned, or by other suitable means, as may be available, e.g. in exchanges with stored-programme control.

4.2.4 It can be arranged for the progress of a call to be followed, in particular the sending or reception of digits or successive numerical signals. In this respect, each Administration will decide the arrangements it desires to install, taking account of the practice which it normally follows in this matter.

4.3 SPECIAL RELEASE ARRANGEMENTS

4.3.1 *Answer signal not received by an outgoing exchange after receiving a number-received signal or number-received information (Systems No. 4 and R2) or after receiving an address complete signal (Systems No. 6 and No. 7) or after transmitting the ST signal (System No. 5)*

It is recommended that arrangements should be made either in the national network of the outgoing country or at the outgoing international exchange, for the connection to be released if an answer signal is not received within a delay period of 2 to 4 minutes as soon as it is known, or can be assumed, that the called subscriber's line has been reached.

If an Administration adopts a shorter delay period for this forced release condition, there will be a risk that the international connection will be released prematurely on calls not returning an answer signal. If the maximum delay of 4 minutes is exceeded, it will of course involve an unnecessary occupation of international circuits.

4.3.2 *Delay in clearing by the calling subscriber in automatic service* | arrangements made in the outgoing country)

In automatic working, arrangements must be made to clear the international connection and stop the charging if, between 1 and 2 minutes after receipt of the clear-back signal , the calling subscriber has not cleared. Clearing of the international connection should preferably be controlled from the point where the charging of the calling subscriber is carried out.

Such timed supervision may also be applied in semi-automatic service.

During the establishment of a connection to a PABX extension it is not appropriate to send a clear-back signal. However, if a PABX returns a clear back condition, the duration must be less than 10 seconds, so that it would not uninentionally clear the connection, especially on calls from networks with short time-out.

4.3.3 *Clear-forward signal not received by the incoming exchange after sending a clear-back signal*

The incoming circuits at the incoming international exchange should include an arrangement for releasing the national part of the connection if, after sending a clear-back signal, a clear-forward signal is not received within 2 to 3 minutes (provided that a similar arrangement is not already made in the national network of the incoming country). This arrangement avoids indefinite blocking of the national circuits of the country of destination or of the subscriber's line in the case of interruptions of the line or equipment faults.

Since the call may be a semi-automatic call not including the time-out of § 4.3.2 at the outgoing end, the expiry of the 2 to 3 minute time-out should not cause any alarm or blocking actions on the international circuit.

4.4 INDICATION OF CONGESTION CONDITIONS | fR AT TRANSIT EXCHANGES

In the case of congestion at a transit exchange, the following conditions apply:

In the North American network the corresponding time-out is 10 to 32 seconds.
For call where the charging is applied to called party

(e.g., free phone service) the time-out may be reduced. The value to be chosen is for further study.
These release arrangements may not be used within some regional networks.

4.4.1 The busy-flash signal or an equivalent signal shall be returned to indicate that there is equipment congestion in the exchange or that no free outgoing circuit is available. This signal shall be returned within the periods specified.

In semi-automatic and in automatic working, the receipt of this signal by the international exchange will cause the clear-forward signal to be sent so as to release the international connection and will give a suitable indication to the calling subscriber or operator, unless an automatic repeat attempt is made.

PART V

SUPPLEMENTS TO THE SERIES Q RECOMMENDATIONS

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Supplement No. 1

REPORT ON THE ENERGY TRANSMITTED

BY CONTROL SIGNALS AND TONES

(For this Supplement, see Supplement No. 1 in Volume VI-4 of the *Green Book*)

Supplement No. 2

CHARACTERISTICS OF SPEECH INTERPOLATION SYSTEMS

AFFECTING SIGNALLING

1 CELTIC system

1.1 *General*

The first generation CELTIC system (concentrator exploiting the idle time of circuits) has been in operation since 1977. A second generation system, to come into operation in 1983, is now being developed (1980).

CELTIC is a fully digital system (see Figure 1).

Connection and service messages can be routed on a CELTIC signalling circuit between terminals A and B.

Figure 1, p.14

1.2 *Summary description of CELTIC*

The incoming PCM streams are synchronized and then multiplexed (possibly with a jump or doubling of the PCM frame, if the clocks of the incoming PCM streams are not synchronous).

The signal is then sent to a speeh detector unit and to a delay line (see Figure 2).

Figure 2, p.15

1.2.1 *Delay line*

The delay line is used to offset delay due to the decision time of the speech detector, the answering time of the computer (search for an

available channel and its assignment to an active circuit) and the processing time taken by the CELTIC signalling unit to set up the connecting message. The delay line is the same for all circuits (adjustable from 0 to 32 ms). Its nominal value is *32 ms* .

This delay line may be cancelled circuit by circuit.

1.2.2 *Speech detector*

— In the CELTIC 1G system, the speech detector has two hangover times:

Short hangover: 50 ms (speech duration less than 50 ms)

Long hangover: 180 ms (speech duration more than 50 ms).

— In the CELTIC 2G system, there will be only one hangover of 120 ms. The speech detector will be adapted to noise in a range between —40 and —55 dBm0.

The decision time of the speech detector varies according to the nature of the signal (between approximately 2 and 12 ms). The decision criteria are constituted mainly by the amplitude of the signal, but also by the presence of sibilants in the speech.

The speech detector takes into account the speech level in the receiving channel: a positive decision is given only if the level of the sample of transmitted speech is higher than the level in the receiving channel.

In the CELTIC 2G system, the speech detector is backed up by a *signalling detector* : when a signalling frequency is recognized, this detector suppresses the return channel protection and where necessary the delay line and disables the echo suppressors which may be integrated in CELTIC. This signalling detector reacts quickly and is adapted to the signalling pulses in the band (signal shape criterion).

The speech detector is associated with a *2100 Hz* tone detector (data transmission).

Tone detection suppresses *return channel protection* , effects *circuit-channel locking* | nd suppresses *the delay line of the circuit concerned* .

1.2.3 *Processing of TS-16 bits*

CELTIC contains a device for taking out the significant bits of the TS 16 (a, b, c) in the transmitting direction and reinserting them in the receiving direction.

This device has two functions:

— transmitting direction: it detects changes in the state of the significant bits of the TS 16 and informs the computer.

— receiving direction: it can modify one or more bits of the TS 16 according to information provided by the computer (command to block junctor or to disable echo suppressor).

1.2.4 *Echo suppressor*

An echo suppressor multiplexed on 240 circuits is provided with CELTIC, if desired (an inexpensive addition).

In this case, the echo suppressor should be disabled on a telephone signalling phased circuit (one of the purposes of the above mentioned signalling detector).

Note — The 32 ms delay introduced by CELTIC in any case necessitates the use of echo suppressors on all circuits.

1.3 *Links between CELTIC and the transit centre*

There are four types of link:

— speech links,

— signalling links,

— links for circuit blocking command,

— links for echo protection disabling command, where necessary.

The number and nature of the links depend on the operational conditions of CELTIC:

— nature of transit centre,

— signalling system (CCITT Nos. 4, 5 and 6, R1 or R2),

— position of CELTIC in relation to the transit centre,

— position of echo suppressors in relation to signalling sets.

Circuit blocking is requested circuit by circuit or for 30 circuits common to the same PCM, in case of alarm, in case of gradual stopping of the CELTIC or in case of dynamic load control.

1.4 *Operation of CELTIC with different types of signalling*

1.4.1 *Signalling System No. 4*

The 32 ms delay introduced by CELTIC necessitates the use of echo suppressors, which must be disabled if they are below the signalling sets in the signalling sequence (echo suppressors integrated in CELTIC). Pulse bridging would lead to a prohibitive hang-over time.

Adoption of a *fixed hangover time of 120 ms* for the speech detector will lead to a lower concentration rate, by preventing the CELTIC from operating in ‘‘freeze-out’’, in order to limit the number of unsuccessful calls.

1.4.2 *Signalling System No. 5*

A hangover of 120 ms is suitable for this type of signalling. The signalling detector disables echo protection where necessary.

1.4.3 *Signalling System No. 6*

The echo suppressors are disabled during the continuity test. No particular problems.

1.4.4 *Signalling System R2*

In the digital version, line signalling is transmitted by 2 bits of the TS 16:

The CELTIC 2G system examines these bits and transmits through the CELTIC signalling channel to the other end *any change in the state of these bits* , circuit by circuit.

The echo suppressors and the action of the delay line are disabled during the register signalling sequence (action of signalling detector).

1.4.5 *Conclusion*

The presence of delay lines | mplies systematic provision of echo suppressors. A single hangover time of about 120 ms in the speech detector will suffice, with a limitation for System No. 4, which requires a lower freeze-out rate.

2 DSI characteristics

The INTELSAT 120 Mbit/s time division multiple access (TDMA) system incorporates the use of digital speech interpolation (DSI). The TDMA/DSI system will be used with Intelsat V and post-Intelsat V satellites operating in 80-MHz hemisphere and zone beam transponders and will provide high quality service in accordance with CCIR Recommendation 522 [1].

The DSI system increases the capacity of the TDMA system by interleaving speech bursts from different terrestrial channels on the same satellite channel. Inputs to the DSI module are digitally encoded in

accordance with Recommendation G.711 [2] using encoding referred to as ''A-law'' with alternate digit inversion.

The system is transparent to in-band Signalling System No. 5 and the speech detector hangover time is such as to avoid disconnection of the link between successive signalling packets.

Competitive clipping (of speech bursts) lasting more than 50 ms occurs on less than 2% of the voice spurts. This is made possible in part by appropriating (or stealing) the least significant bit (8th bit) of satellite channels to create overload channels when all normal satellite channels are in use.

A complete description of the INTELSAT TDMA/DSI system may be found in the INTELSAT document BG-42-65 [3].

3 TASI characteristics affecting signalling

3.1 During a normal telephone conversation each party usually speaks for only about 40% of the time (speech activity), 60% of his channel time being idle. TASI (Time Assignment Speech Interpolation) is an equipment which rapidly switches channels to talkers on a time-shared basis to make use

of the otherwise idle channel time and thus permits a greater number of simultaneous calls than would otherwise be possible with the available channels in the cable.

TASI interpolates to associate an interchange circuit with a transmission channel when speech is detected on a circuit at one end and is required to be transmitted, over a channel, to the same circuit at the other end. Depending upon the need, circuit/channel association ceases, and the channel is made available to other circuits when the cessation of a burst of speech is detected.

When speech begins and a channel is available, but not yet associated, a time (the initial clip) elapses before detection of the speech (or signal) by the TASI speech detector and circuit/channel association at each end. Should the TASI system be heavily loaded, a channel may not be immediately available. In this situation a time (extended clip) in addition to the initial clip elapses before circuit/channel association.

To reduce the number of times clipping occurs, the TASI speech detector is given a hangover, maintaining circuit/channel association, to

bridge the shorter gaps in speech, and thus reduce the interpolation. This feature permits the transmission of a sequence of short-pulse short-gap signals without signal clipping.

As signals must be detected by the TASI speech detector before transmission over the TASI system and as the total clip (initial clip + extended clip) reduces the duration of the received signal, TASI affects signalling.

3.2 There are three TASI systems in service. TASI-A and TASI-B make use of analogue — time division switching matrices while TASI-E uses a digital, time division matrix. Circuits can be connected directly from a digital switch to the TASI-E in digital format. A primary multiplex per Recommendation G.733 [4] must be placed between an analogue switch and the TASI-E to provide the conversion to PCM digital format. If the outgoing transmission channels are analogue, a primary multiplex per Recommendation G.733 must be placed between the TASI-E equipment and the analogue channels. TASI-E is designed to work with Signalling System No. 5

using the standard in-band line signalling, and of course with System Nos. 6 and 7 circuits. The continuous energy Signalling System R1 line signalling on each circuit is detected by the TASI-E terminal and then sent to the distant TASI-E terminal over the internal data links.

Clipping has been reduced in TASI-E by putting 50 ms fixed delay in each direction in the circuits so that processing and circuit/channel connections can be made while the inband signals are still in the delay circuits. The initial clip is thus eliminated and the extended clip reduced by about 20 ms.

3.3 The characteristics of TASI affecting signalling may be summarized as follows: TASI-A, TASI-B and TASI-E have similar characteristics except where noted:

3.3.1 TASI-A speech detector sensitivity; —40 dBm0.

TASI-B speech detector sensitivity: usually —36 dBm0 although it does change to —28 dBm0 if input level remains higher than —20 dBm0 in excess of 200 milliseconds. The TASI-E speech detector is made up of the basic

speech detector, which adapts to the average speech level and background noise, and signalling-by-pass circuits which detect the presence of moderate level MF frequencies and provide extended hangover time to bridge the gaps between pulses.

3.3.2 To minimize speech activity on the RETURN channel due to reflection from the GO channel. The TASI speech detector on the RETURN channel is reduced in sensitivity in the presence of speech on the GO channel. This also applies to signalling. Thus in situations where simultaneous forward and backward signalling is required, the level of the backward signalling must be such as to take account of a reduction in the sensitivity of the speech detector at the end receiving the forward signal. TASI-A sensitivity may be reduced to as little as —25 dBm0. TASI-B sensitivity to —28 dBm0. In TASI-E the basic speech detector has echo protection but the signalling-by-pass circuits do not, thus allowing simultaneous signalling in both directions.

3.3.3 Nominal duration of speech detector hangover for a single burst:

TASI-A

a) 50 ms for input signals of 50 ms or less;

b) 240 ms for input signals greater than 50 ms;

TASI-B

c) 10 ms plus burst length for burst lengths up to 40 ms;

d) 180 ms for burst lengths greater than 40 ms.

TASI-E

e) 128 ms for input signals greater than —19 dBm0;

f) 88 ms for input signals between —19 and —25 dBm0;

g) 16 ms for input signals less than —25 dBm0.

3.3.4 Nominal duration of clip of a signal (including the 5 ms response time of the TASI-A or TASI-B speech detector):

a) initial clip: 18 ms;

b) total clip when TASI-A or TASI-B is heavily loaded and a free channel is not immediately available, expressed as a probability that a signal will be clipped for a certain time or longer: see Table 1.

H.T. [T1.2]

TABLE 1

Total clip	{		
	1	2	3
125 ms	1/100 |	1/20	1/10
250 ms	1/700 |	1/140	1/60
500 ms	1/15 | 00	1/5000	1/1500

Table 1 [T1.2], p.16

A total clip of 500 ms was assumed for the System No. 5 design, and the duration (850 ± 200 ms) of the forward-transfer pulse line signal concerned includes a 500-ms TASI prefix for TASI circuit/channel association.

3.3.5 For multiple pulses of short duration, a maximum duration of gaps between short-pulse signals has been determined to maintain continuous operation of the speech detector and thus continuous circuit/channel association. For TASI-A the maximum allowable duration of the gaps is twice the pulse duration over the pulse range 10 to 60 ms and over the operate level range of the speech detector.

This assumes prior energizing of the speech detector to give the 240 ms hangover [see § 3.3.3 |) above] before the short-pulse short-gap signalling is applied.

Since TASI-A is more critical than either TASI-B or TASI-E in this respect, a short pulse signalling system designed to work properly over TASI-A circuits will also work properly over TASI-B or TASI-E circuits. For TASI-B prior energizing of the speech detector will give 180 ms hangover initially. The hangover for successive pulses will depend on the length of the pulse as given in §§ 3.3.3 |) and d). The hangover for TASI-E will depends on the level of the signal which energized the speech detector and will be up to 128 ms for the range of signalling frequency levels as shown in §§ 3.3.3 |) to g).

The register short-pulse short-gap multifrequency signalling adopted for the System No. 5 takes advantage of this continued speech detector operation and is transmitted without a TASI prefix, reliance being placed on the circuit/channel association due to the seizing signal.

References

[1] CCIR Recommendation *Allowable bit error rates at the output of the hyperthetical reference circuit for systems in the fixed satellite service using pulse-code modulation for telephony* , Vol. IV, Rec. 522, ITU, Geneva, 1978.

[2] CCITT Recommendation *Pulse code modulation (PCM) of voice frequencies* , Vol. III, Fascicle III.3, Rec. G.711.

[3] INTELSAT document, No. BG-42-65.

[4] CCITT Recommendation *Characteristics of primary PCM multiplex equipment operating at 1544 kbit/s* , Vol. III, Fascicle III.3, Rec. G.733.

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Supplement No. 3

H.T. [1T1.3]
INFORMATION RECEIVED ON NATIONAL VOICE-FREQUENCY

SIGNALLING SYSTEMS

Country Tolerance at the generator terminal (Hz) } Frequency variation possible at the entry to the international circuit (Hz) } Absolute level of the power of signals at the point of zero relative level (decibels) }	Frequency (Hz) { Spliting time (milliseconds) {	{			
Algeria 15 then 35 with attenuated 18 dB }	2000 —5	± |	± | 2	{	
Saudi Arabia	3825	± |	± |	—	—5
Argentina	3825	± |	± | 0	—	—5
Australia	600-750 separate	± |	± | 5	160-210	0
Austria	2280	± |	± | 5	30	—6
Bahamas —8 and after attenuation —20 }	2600	± |	± | 0	35 maximum	{
Bangladesh	3825	± |	—	28-55	—
Belgium —5, and —20, after attenuation }	3825	± |	± |	30	{
Benin	700-1700 separete 200	± | 0	± | 0	50	—6
Botswana	3825	± |	± | 0	25	—5
Brazil	3825	± |	± |	30 maximum	—5
Brunei 3825 1380-1500 1620-1740 1860-1980 1140-1020 900-780 660-540 } In agreement with Recommendations Q.414, Q.415, Q.452, Q.454 }	{ ± | ± |	± | ± | 0	— —	{	
Burundi	3825	± |	± | 5	—	—6
Cameroun —5 and after attenuation —20 }	3825	± |	± | 5	—	{
Canada —8 and after attenuation —20 }	2600	± |	± | 0	30 maximum	{
Chile	3825	± |	± | 0	—	—18 or -
China	2600	± |	—	30-50	—8

Tableau Suppl. n° 3, [1T1.3], p.17

H.T. [2T1.3]

Country Tolerance at the generator terminal (Hz) } Frequency variation possible at the entry to the international circuit (Hz) } Absolute level of the power of signals at the point of zero relative level (decibels) }	Frequency (Hz) { Spliting time (milliseconds) {	{			
Cyprus	3825	± |	± |	—	—6 —
Colombia	3825	± |	± |	40 ± 10	—20
Comoros	3825	± |	—	—	—20
Congo	3825	± |	—	20	—20
Korea (Rep. of)	3825	± | 0	± | 0	—	—15
Costa Rica	3825	± |	± | 0	—	—20
Cuba	3825	± |	± | 5	25	—5
Denmark	3000 3825	± | ± |	± | 0 ± |	30 à 50 —	—8 —
Dominican (Rep.)	2600	—	—	—	—
Egypt	3825	± |	± | 0	20-50	—6 —18
United Arab Emirates 3825 700, 900, 1100, 1300, 1500, 1700, 2400, 2600 } Regist. sign. | (em7 Line sign. | (em9 }	{ ± | ± |	± | 5	30-50	{	
Ecuador	3825	± |	± |	40 | (+- | 0	—20
Spain	2500	± |	± | 5	10	—6
United States of America —8 and after attenuation —20 }	2600	± |	± | 0	30 maximum	{
Fiji	3825	± |	—	—	—20
Finland	3825	± |	± |	30-50	—18 —
France	2280	± |	± |	35	—6
Gabon —8 and —20 after attenuation }	3825	± |	± | 5	15	{
Ghana	3825	± |	—	—	—5

Tableau Suppl. n° 3, [2T1.3], p.18

H.T. [3T1.3]

Country Tolerance at the generator terminal (Hz) } Frequency variation possible at the entry to the international circuit (Hz) } Absolute level of the power of signals at the point of zero relative level (decibels) }	Frequency (Hz) { Spliting time (milliseconds) {	{			
Guatemala	3825	± |	± |	—	—20
Guinea-Bissau	3800	± |	—	15	—6
Hungary	2100 or 2280 3825	± | ± |	± | 5 ± | 5	25 25	—6 —6
India 25 filter loss at 2400 Hz 50 dBm }	2400 —10	± |	± | 0	{	
Indonesia	3825	± |	± | 5	30	—8 ±
Iran	3825	± |	± |	35	—5 ±
Iraq	3825	± |	—	—	—18
Ireland	3825	± |	—	—	—20
Israel	3850 550-1980	± | ± |	± | ± | 0	—	—5 —11.
Italy 2040-2400 separate and compound }	{ ± |	± | 5	35	—9	
Jamaica —8 and after attenuation —20 }	2600	± |	± | 5	35 maximum	{
Jordan	3825	± |	—	10	—18 —
Kenya —6 and after attenuation —20 }	3825	± |	—	—	{
Lesotho	3825	± |	± | 0	—	—5
Liberia	3825	± |	—	—	—6
Luxembourg	3825	± |	± |	35-40	—5
Madagascar	2280	± |	± |	35	—6
Malta	3825 3825	± | 0 ± |	— —	— —	—18 —
Morocco	2280	± |	± | 0	25-35	—6

Tableau Suppl. n° 3, [3T1.3], p.19

H.T. [4T1.3]

Country Tolerance at the generator terminal (Hz) } Frequency variation possible at the entry to the international circuit (Hz) } Absolute level of the power of signals at the point of zero relative level (decibels) }	Frequency (Hz) {			
Mexico —6 —8 and after attenuation —20 }	2400 2600	± | ± |	± | 5 ± | 5	35 20
Mozambique —5 and after attenuation —20 }	3825	± |	± |	40 maximu
New Zealand	600-750 2280 3825	± | ± | ± |	± | ± | ± |	140 maximum 35 m
Oman —6 and after attenuation —18 }	3825	± |	—	10
Uganda	2040-2400	± |	—	30-40
Pakistan	3825	± |	—	—
Panama	3825	± |	± | 0	90
Paraguay	3825	± |	—	—
Peru 3825 1380-1500 1620-1740 1860 1140-1020 900-780 660 } In agreement with Recommendations Q.414 | 1] Q.415 | 2] Q.452 | 3] Q.454 | 4] }	{ ± | ± | ± |	± | ± | ± | 0	— — —	{
Philippines 2600(*) 3825 (*) This frequency will not be used in the future } —8, —20 —14 and after attenuation +9 }	{ ± | ± |	± | 0 ± | 5	40 ± 10 20	{
Poland ± | ± | ± | 0 ± | } ± | ± | ± | 0 ± | 0	2280 3825 500/20 2100 {	{		

} —6 —5 —3 —6 }	— — — —	{		
Portugal 3825 1380-1500 1620-1740 1860-1920 1140-1020 900-780 } ± | 5 In agreement with Recommendations Q.451 and Q.455 } —18 In agreement with Recommendations Q.454 and Q.455 }	{ ± | ± | ± | 0 30-50	{ {		
Syria	3825	± |	—	50

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H.T. [5T1.3]

Country Tolerance at the generator terminal (Hz) } Frequency variation possible at the entry to the international circuit (Hz) } Absolute level of the power of signals at the point of zero relative level (decibels) }	Frequency (Hz) { Spliting time (milliseconds)	{ {		
Dem. People's Rep. of Korea	2600 3825 2100	± | ± |	± | 5	35
Romania	3825 or 2280	± |	—	—
United Kingdom	2280	± |	—	20-35
Rwanda —16 ± | et —7 ± | .5 }	3825	± |	Between ± | and ± | 0	30-50
Sao Tome and Principe	2600 2400	± | 0	—	20
South Africa (Rep.)	3825 2280	± | ± |	— —	— 35 maxin
Sweden	2400	± |	± | 1	35-40
Switzerland	3000	± |	± |	40
Surinam 1380-1500 1620-1740 1860-1980 1140-1020 900-780 660-540 } In agreement with Recommendations Q.452 to Q.454 }	3825 {	± | .8	± | 0	— {
Swaziland —6 and —20 —5 and —18 }	3825	± | .5	—	—
Tanzania —6 and after attenuation —20 }	3825	± |	—	—
Czechoslavakia	2280	± |	± | 5	150 then 130 v
Thailand	3825	± |	± |	30-50

Togo
{
3825
1380-1500
1620-1740
1860-1920
}
In agreement with Recommendations Q.414 Q.415
}
 	
1140-1020
900-780
	
	+ | + | + | + |
	
	{
		
		± | 0
			
			40-50
				
				{

660-540 }	+ | + | + |	± | 0	40-50	Q.452 Q.
Tunisia	2400	± |	± | 5	40 maxin

Tableau Suppl. n° 3 [5T1.3], p.21

H.T. [6T1.3]

Country Tolerance at the generator terminal (Hz) } Frequency variation possible at the entry to the international circuit (Hz) } Absolute level of the power of signals at the point of zero relative level (decibels) }	Frequency (Hz) { Spliting time (milliseconds) {	{ {			
USSR 1200-1600 separate and compound } 40 maximum before reply, 150 | (+- | 0 after reply }	{ ± | —9 | 2600	 ± | 5 ± |	{ ± | 5	 50-75	 —9.5
Uruguay	3825	± |	± | 0	20	—18 |
Venezuela	3825	± |	± |	—	—6 | —18 |
Viet Nam	3825	± |	± | 5	—	—6 |
Yugoslavia	2280 3825	± | ± |	— —	— —	—6 | —5 |
Zambia	3825	± |	± |	30-50	—20 |

Tableau Suppl. n° 3 [6T1.3], p.22

References

[1] CCITT Recommendation *Signal sender* , Vol. VI, Fascicle VI.4, Rec. Q.414.

[2] CCITT Recommendation *Signal receiver* , Vol. VI, Fascicle VI.4, Rec. Q.415.

[3] CCITT Recommendation *Requirements relating to transmission conditions* , Vol. VI, Fascicle VI.4, Rec. Q.452.

[4] CCITT Recommendation *The sending part of the multifrequency signalling equipment* , Vol. VI, Fascicle VI.4, Rec. Q.454.

Supplement No. 4

VARIOUS TONES USED IN NATIONAL NETWORKS

(For this Supplement, see Supplement No. 2 of Fascicle II.2)

Supplement No. 5

NORTH AMERICAN PRECISE AUDIBLE TONE PLAN

(For this Supplement, see Supplement No. 3 of Fascicle II.2)

Supplement No. 6

TREATMENT OF CALLS CONSIDERED AS ‘‘TERMINATING ABNORMALLY’’

(For this Supplement, see Supplement No. 4 of Fascicle II.2)

Supplement No. 7

MEASUREMENTS OF IMPULSIVE NOISE IN A 4-WIRE TELEPHONE EXCHANGE

(For this Supplement, see Supplement No. 7 in Volume VI-4 of the
Green Book)

Supplement No. 8

SIGNALLING FOR DEMAND ASSIGNMENT SATELLITE SYSTEMS

(For this Supplement, see Supplement No. 8 in Volume VI-4 of the
Green Book)

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