INTERNATIONAL TELECOMMUNICATION UNION

ITU-T Q.115

TELECOMMUNICATION
STANDARDIZATION SECTOR
OF ITU

(03/93)

GENERAL RECOMMENDATIONS ON TELEPHONE SWITCHING AND SIGNALLING

CLAUSES APPLICABLE TO ITU-T STANDARD SYSTEMS

CONTROL OF ECHO SUPPRESSORS – CONTROL OF ECHO SUPPRESSORS AND ECHO CANCELLERS

ITU-T Recommendation Q.115

(Previously "CCITT Recommendation")

FOREWORD

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

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

ITU-T Recommendation Q.115 was revised by the ITU-T Study Group XI (1988-1993) and was approved by the WTSC (Helsinki, March 1-12, 1993).

NOTES

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 Similarly, in this reform process, the CCIR and the IFRB have been replaced by the Radiocommunication Sector.

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

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

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CONROL OF ECHO SUPPRESSORS – CONTROL OF ECHO SUPPRESSORS AND ECHO CANCELLERS

(New Delhi, 1960; modified at Geneva 1968 and Helsinki, 1993)

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 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 clause.

The target to be reached by the use of echo control device control actions in signalling systems is:

- to optimize the location of provision/insertion of echo control devices (ECD). The ECD should be as near to the echo source (hybrid or terminal equipment) as possible. This is of special importance for echo cancellers as they can only provide a limited round trip delay value [3];
- to provide information about the insertion/provision of ECD in the connection in forward and in backward direction;
- to negotiate the place of insertion/provision of ECD for a given connection. This negotiation could be used in forward and in backward direction, depending on the capabilities of the signalling system(s) used.

In the cases to be discussed, control methods will be applied at international exchanges but it is recognized that it may be appropriate to extend the control methods into national networks.

The extension of control methods may be appropriate:

a) in some countries covering large geographic areas;

b) in the case of countries having echo control in the national network.

The echo control procedures may be extended to the national network. This allows that not all echo control devices must be inserted in the international exchange.

The delay time counter procedures require the addition of transmission delay values, beginning at the origin of a call and ending at the destination of it. These values could only be representative, if the whole or at least most of the delay of the connection is considered.

If the configuration of a call is changed after the call set up (e.g. a new leg is added to a conference call), the exchange having knowledge about this change is responsible to initiate the echo control devices for this new configuration (see Annex C).

2 Use of different signalling systems for one connection with respect to echo control

The actions described in 6 to 9 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 Annex A.

Annex A does not cover the handling of ECDs in the case of different connection types and does not cover Signalling System No. 7 TUP and ISUP.

The following connection types are used in the echo control procedures:

– 3.1 kHz audio or speech; and

– 64 kbit/s unrestricted.

The handling of ECDs in the case of different connection types is described in clause 11, the control of ECD if Signalling System No. 7 ISUP is described in clause 12.

Annex A covers the situation if different signalling systems are used for one connection, and no ISUP or TUP link is included in the connection.

If the whole connection is controlled by ISUP, clause 12 applies.

If different signalling systems including ISUP are used for one connection, the following configurations may occur:

a) The ISUP link(s) is/are the first link(s) of the connection:

   All informations concerning echo control are available in the interworking exchange. This information is used for the decisions necessary concerning echo control.

b) The ISUP link(s) is/are intermediate link(s) of the connection:

   All informations concerning echo control are available in the interworking exchange. This information is used for the decisions necessary concerning echo control.

c) The ISUP link(s) is/are the last link(s) of the connection:

   The ISUP procedures for echo control could be applied on the ISUP link(s) if necessary.

3 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 ECD will comprise both, echo suppressors and echo cancellers.

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

c) With respect to control of permanently associated ECDs, 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. An inserted ECD is controlled to enable or disable it.

e) With respect to ECD provided from pools, reservation of ECD is not used. The concept of reservation of ECD in pools was included in earlier Recommendations.

f) Comparable signals assigned in Signalling Systems R2, No. 6 and No. 7 TUP and ISUP (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.

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

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

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

j) *A long connection* – A connection that requires echo control.

A long connection may consist of several circuits in tandem. These circuits may or may not be long circuits, but their total propagation delay is such that echo control is required.

If not detected at call set-up time, the total propagation delay is calculated during call set-up based on information carried in signalling (see 12.2).

k) *Incoming half echo control device (IHECD)* – A device cancelling the echo returned from the destination network with reference to the direction in which the call is set up.

Outgoing half echo control device (OHECD) – A device cancelling the echo returned from the network of origin with reference to the direction in which the call is set up.

4 Compatibility of echo control devices and in-band signalling systems

4.1 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 ECD on the switching side of the signalling equipment;

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

NOTES

1 The standard half-echo suppressor (see 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.

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 Signalling Systems No. 6 (see Recommendation Q.271) and No. 7 (see Recommendations Q.724 and Q.764), or with compelled signals having the same frequency(ies) on both directions of transmission in Signalling System No. 5 (see Recommendation Q.112) where the received signal is processed through the existing echo path model and produces an interfering signal in the return path.

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.

4.2 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 suppressors and echo cancellers must be permanently disabled, if a circuit is used as a signalling channel for common channel signalling.

If circuits controlled by Signalling System No. 7 are used to provide for different connection types, ECDs have to be enabled before the path is switched through to the subscribers, if the ECDs are needed for a connection.

5 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 devices. In the case of System R1, regional control procedures not requiring signals are applicable.

6 Analysis of information at an outgoing exchange

The outgoing exchange must make a decision with respect to its echo control requirements at the time an outgoing circuit is selected or, in the case of ISUP 92, with the respect to the requirements that may appear between call set up and call release. Unless echo control devices are not available, one or more of the following items of information should influence this decision:

i) address information indicating the destination (e.g. country code, area code);

ii) information about the actual routing of the call;

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

iv) nature of incoming circuit;

v) signals received over the incoming circuit ;

vi) connection type requested (see clause 11).

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 clause 3 h) and i) above, for definition of terminology.

7 Decision to be taken at the outgoing exchange

If the factors i) to vi) in 6 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 international 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 ECD 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 ECD control from an outgoing gateway exchange to a transit exchange.)

8 Decision to be taken at a transit exchange

The decision at transit exchange depends on an assessment of switching and signalling information available after the transit exchange has selected an outgoing circuit. Information similar to that listed in clause 6 i) to vi) above is of interest.

a) When the first transit exchange knows that an outgoing ECD has not yet been provided closer to the call source by a signal of Systems No. 6, 7 and R2, or by bilateral agreements for specific exceptions, the transit exchange 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 ECD should be enabled or inserted at the first transit exchange.

   The round trip delay of ECD should be considered if an outgoing echo control device is included in a transit exchange. If the round trip delay is too long, the ECD has to be inserted closer to the origin of the call.

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

   The round trip delay of the ECD should be considered, if an incoming ECD is included in a transit exchange. If the round trip delay is too long, the ECD has to be inserted closer to the destination of the call.

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

d) It is, of course, commonly the case that an outgoing ECD 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 ECD and should advise the subsequent exchange when possible that an incoming ECD is not required (or equivalently, that an outgoing ECD has not been introduced).

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

f) The provision of tandem ECD for transit calls may be considered provided it does not result in degradation of the call. (See Annex B.)

9 Decision to be taken at the incoming exchange

Short circuits equipped with Systems No. 5, R1 and No. 4 (unless bilateral agreements are reached), provide no signals at the incoming gateway exchange for selective use of ECDs. As a result, in the absence of separate circuit groups on the same route or other alternatives, the economic choice is to omit echo control 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 ECD should then be met at the preceding exchange as covered in clause 8 b) above.

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

When no ECD has yet appeared elsewhere in the connection, none should be enabled or inserted at the incoming gateway exchange.

10 Unavailability of echo control devices

It is recognized that when ECDs are inserted from pools, there is a small probability that no ECD will be available when needed. In this case, the echo control may be done by another exchange. If this is not possible, no special action is taken.

10.1 Association of echo control device to circuits

The most common configuration for location of echo control devices is that the outgoing half echo control device and the incoming half echo control device are located at different exchanges, e.g. at each end of an international circuit.

In some cases, especially in national networks, a configuration may occur when both, outgoing and incoming half echo control devices are inserted in the same exchange.

Decisions on locating half echo control devices should take into consideration that there are limitations to how large delays actual echo control devices are able to handle, e.g. 48 or 64 ms round trip delays.

Echo control devices which are inserted into a connection should preferably be inserted in the proper sequence. This means the incoming half echo control device should be placed after the outgoing half echo control device, seen in the direction of call set up. This principle should preferably also apply when the outgoing and incoming half echo control devices for some reason are located in the same exchange.

11 Handling of ECDs in the case of different connection types

The ISDN UP is used to control connections for different connection types. It is also used to control PSTN connections.

Different bearer capabilities are needed to provide the different services. If the same circuits are used to provide the different basic services, ECDs have to be inserted/enabled depending on the requested service.

The decision to insert/enable an ECD should be based on the analysis of the requested connection type (carried through the TMR in ISDN UP or digital connectivity request in TUP).

If the TMR is speech or 3.1 kHz audio, an ECD should be inserted/enabled for this connection at the appropriate exchanges.

If the TMR is 64 kbit/s unrestricted or if digital connectivity is requested in TUP, no ECD is inserted. If the ECD is permanently associated, these ECDs have to be disabled and provide bit transparency.

When a call involves changing to different connection types during call set up, a transition from 64 kbit/s unrestricted to 3.1 kHz audio or speech should result in inserting/enabling ECD and their reverse transition in releasing/disabling ECDs.

This applies in the case when the network supports changing of connection types.

The succeeding change of connection types during every phase of the call is for futher study.

11.1 PLMN to PSTN or ISDN interworking

Information about echo control is given in Recommendation G.173.

12 Control of ECD if Signalling System No. 7 ISUP is used

12.1 Analysis of additional information provided by ISUP

In addition to the items of information which are subject to the analysis for echo control mentioned in clause 6, ISUP provides some more capabilities for echo control:

i) propagation delay counter, call history information;

ii) signals received in forward and backward messages:

- OHCD required
- IHCD required
- OHCD included
- OHCD not included
- IHCD included
- IHCD not included

These additional capabilities are required to ensure proper echo control for all ISDN basic and supplementary services. Examples for the use of the ISUP echo control procedures are given in Annex C.

12.2 Propagation delay counter, call history information

The ISUP 92 provides procedures to determine the total propagation delay for a connection in order to have better means to evaluate need for echo control on the connection concerned.

The propagation delay information is accumulated during call set up in the forward direction. The result is sent in the backward direction as Call History Information before the active phase of the call.

The accumulated result represents (if possible) the propagation delay of the whole connection.

The originating exchange has the possibility to start accumulating the propagation delay with a value > 0. The originating exchange may set the propagation delay counter to a fixed value stored in the exchange or include a propagation delay value received from another network.

The destination exchange has the possibility to increment the propagation delay value received in the forward signalling information to add the propagation delay of the network behind the destination- (or gateway-) exchange to the propagation delay value sent back to the originating exchange.

The originating exchange is the first exchange supporting the propagation delay procedure and the appropriate echo control procedures.

The increment of the propagation delay counter is 1 ms, the maximum delay value is $2^{16} \times 1$ ms.

The propagation delay counter is accumulated for every link in the connection for every call, if possible.

The propagation delay may not be used for the decision by all exchanges to include echo control devices into a connection.

As not all exchanges support the propagation delay counting, other criteria have to be used for echo control.

The call history information is normally returned from the destination exchange and is the result of the accumulated propagation delay. Where interworking is encountered during call set up, the last exchange supporting propagation delay counting will return the accumulated propagation delay as call history information to the originating exchange. If the interworking exchange has propagation delay knowledge of the succeeding part of the connection, it will be added to the propagation delay accumulated and returned in the call history information. The call history information can be used at a later time of the call.

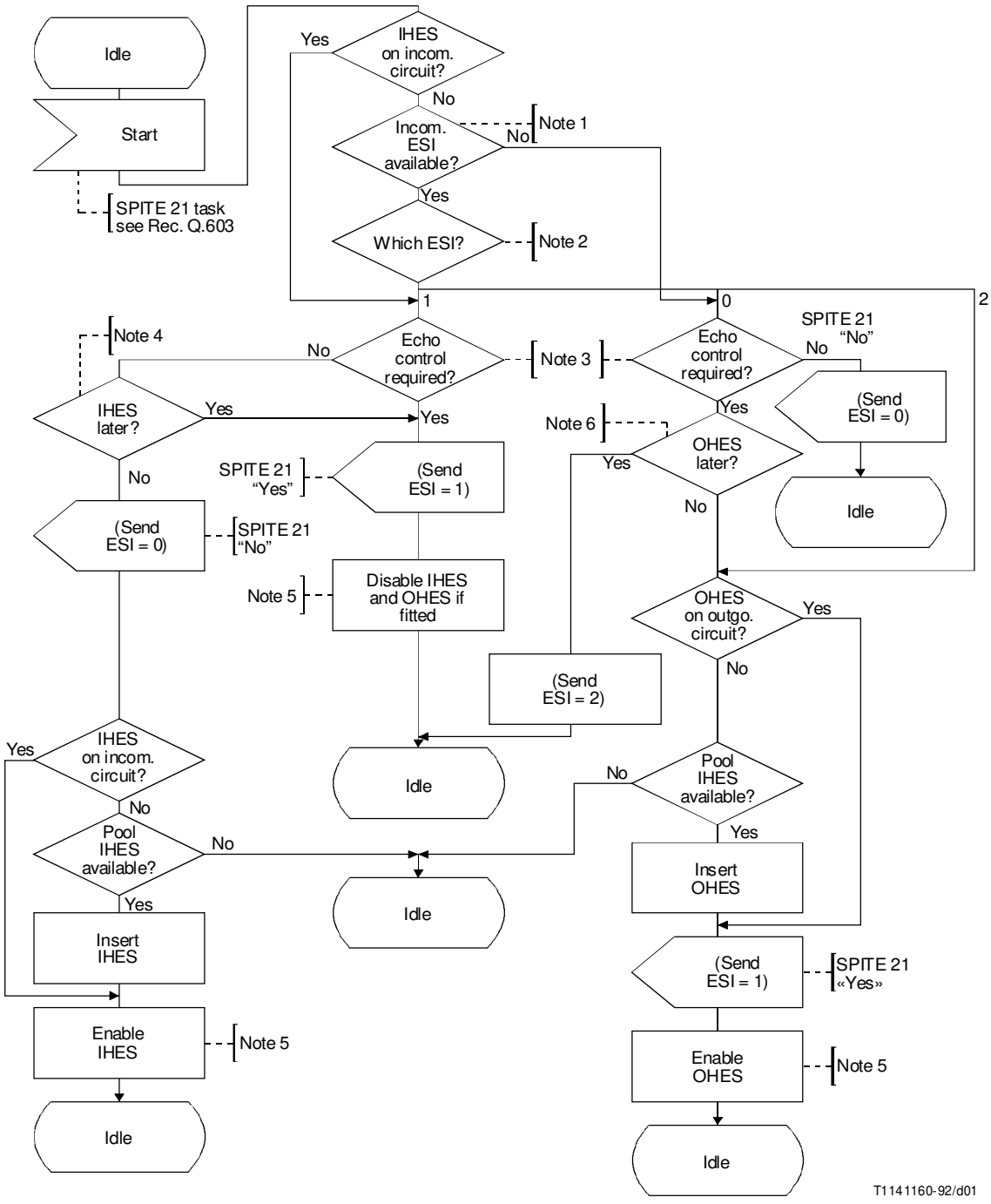
13 Other considerations

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.

Annex A

Call processing logic – Echo suppressor control

(This annex forms an integral part of this Recommendation)



ESI	Echo suppression indicator
IHES	Incoming half echo suppressor
OHES	Outgoing half echo suppressor
SPITE 21	Incoming half echo suppressor to be included at distant end? See Recommendation Q.603.

FIGURE A.1/Q.115

NOTES relating to Figure A.1/Q.115:

1 "Yes", where incoming signalling system provides echo suppressor indicators (ESI). For terminal R2 calls ESI is only available on request using A14. Signal A14 should only be returned where an IHES can be inserted.

2 ESI = 0, OHES not included, IHES not required.
ESI = 1, OHES included, IHES required.
ESI = 2, OHES not included, OHED required.

3 Analysis of digits indicates a long connection which requires or already has echo suppressors; or route analysis indicates that permanent echo suppressors are fitted.

4 IHES should be connected as close to called subscribers as possible. This decision relates to the capability of the next or a later exchange to connect echo suppressors from a pool.

5 During the "register activated" phase all echo suppressors should be disables. Enable or disable actions refer to the period after register deactivation, except for System R2 where it refers to the period after the reception of the answer signal.

6 This exchange cannot connect OHES, but by bilateral agreement is to be connected at next exchange. The indicador ESI = 2 is only used in Signalling System R2 and can only be used between the outgoing R2 international exchange and the first transit exchange.

Annex B

Echo suppressor control on inter-ISC circuits within a single country

(This annex forms an integral part of this Recommendation)

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, 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.

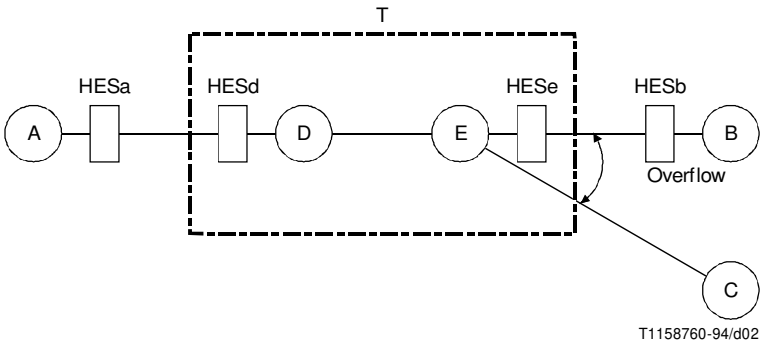


FIGURE B.1/Q.115

Echo control on multiple ISCs in a country

Annex C

Echo control for ISDN basic and supplementary services

(This annex forms an integral part of this Recommendation)

This annex gives some general guidelines on the application of echo control for (ISDN) supplementary services, namely the Call Diversion, Add-on Conference and Meet Me Conference supplementary services.

C.1 Call diversion services

C.1.1 General

It is assumed that each leg of a diverted call is set up using ECD – and propagation delay procedures in Signalling System No. 7, ISDN User Part 92.

C.1.2 Use of the echo control procedures

The call is set up using the echo control procedures as described in Recommendation Q.764.

If there are links in the connection with a long delay, echo control devices will be included as described for the basic call.

In addition, the delay time counter value is passed to the next link of the diverted connection, to determine when the propagation delay of the whole connection exceeds the threshold above which echo control is needed.

This could lead to the situation, that more than two ECDs are inserted in the whole connection. By use of the echo control procedures of ISDN UP 92, it is achieved to disable all ECD not necessary for this connection. For this purpose, it is necessary to provide a possibility of echo control after the call set up.

C.2 Multi-party services

NOTE – See also Recommendation G.172 for the handling of echo in conference bridges.

C.2.1 General

The exchange where the conference bridge is located should have the capability to invoke echo control.

Each leg of the multi-party call should be set up using ECD – and propagation delay procedures in Signalling System No. 7, ISDN User Part 92.

If a leg is set up with another signalling system, proper echo control cannot be guaranteed.

The following procedures assume that echo control procedures and propagation delay of ISUP 92 are supported.

The exchange should have the capability of storing propagation delay information until call release. This must be done for all legs included in the conference.

Echo control is invoked in the case that the total propagation delay for two legs in the conference is above a value T_{max}.

T_{max} is determined:

- either by the maximum recommended value given in Recommendation G.131 for connections not needing echo control; or
- in case the exchange (or conference equipment) has echo control devices, the threshold value T_{max} is determined according to the maximum value of the echo delay the device can handle.

C.2.2 Criteria to initiate echo control procedures

Upon adding a new call to the multi-party call, the received propagation delay value related to this leg shall be added to each of the other legs to decide whether echo control applies for the legs concerned.

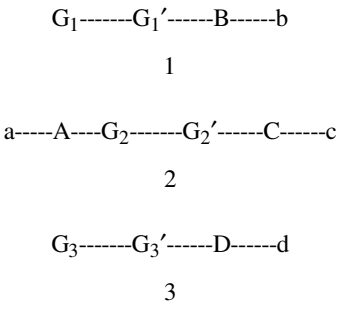
If echo control is necessary, the exchange will initiate echo control procedures according to Recommendation Q.764 for each of the legs concerned.

In the case the exchange or the conference equipment itself has echo control equipment with sufficient capacity, invocation of echo control procedures may not be necessary (see C.2.1 above).

In the case it is known that echo control is already invoked on one leg of the connection, the echo control procedures will be initiated once more for that leg.

C.2.3 Conference Call, Add-on, and Three-Party Service

The conference bridge is supposed to be located in the originating local exchange A:



Example: Connections 1 and 2 may not alone require echo control. The total propagation delay for the two connections requires echo control. One half echo control device will then be inserted on each of the connections 1 and 2. IHES or OHES will be used depending on the direction of the call set up with reference to the conference bridge. No echo control is applied on connection 3.

The echo control equipment may, in principle, be located in any of the exchanges:

a) either in the conference bridge equipment itself;

b) or in the exchange where the conference bridge is located;

c) or in any of their gateway exchanges G_x or $G_{x'}$ normally being equipped with echo control devices anyway;

d) or in any of the exchanges involved in the set up of the multi-party call.

Case a) [or b)] is to be considered as the most recommended solution, as invocation of echo control procedures are only necessary in the cases where the echo control devices have insufficient capability to control echo with long delays (see C.2.2).

C.2.4 Conference Call, Meet Me

The conference bridge is supposed to be located in the exchange D, being any type of exchange.

a-----A-----G_1-----G_1'-----D

1

b-----B-----G_2-----G_2'-----D

2

c-----C-----G_3-----G_3'-----D

3

The requirements with regard to the conference bridge equipment, handling of propagation delay information and invocation of echo control procedures are the same as for the Conference Call, Add-on and Three-Party Service.

References

[1] CCITT Recommendation *Echo suppressors suitable for circuits having either short or long propagation times*, Rec. G.161.

[2] CCITT Recommendation *Echo Suppressors*, Rec. G.164.

[3] CCITT Recommendation *Echo Cancellers*, Rec. G.165.

[4] CCITT Recommendation *Bearer services supported by an ISDN*, Rec. I.231.