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SPECIFICATIONS OF SIGNALLING SYSTEM No. 6

SIGNALLING PROCEDURES

NORMAL CALL SET - UP

ITU-T Recommendation Q.261

(Extract from the *Blue Book*)

NOTES

1 ITU-T Recommendation Q.261 was published in Fascicle VI.3 of the *Blue Book*. This file is an extract from the *Blue Book*. While the presentation and layout of the text might be slightly different from the *Blue Book* version, the contents of the file are identical to the *Blue Book* version and copyright conditions remain unchanged (see below).

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

4.1 NORMAL CALL SET-UP

4.1.1 *Initial address message*

An initial address message which is sent as the first message of a call set-up generally includes all of the information required by the next international exchange to route the call. The seizing function is implicit in the reception of this initial address message. The format of the initial address message is given in Recommendation Q.258.

The initial address message (IAM) will contain the following signalling information:

a) country-code indicator,

b) nature-of-circuit indicator,

c) echo-suppressor indicator,

d) calling-party's category,

e) address signals.

The *country-code indicator* provides information as to whether or not a country code is included in the address signals. It is necessary in System No. 6 as the country code is not sent to the incoming international exchange. This indicator must be translated to the appropriate signal for transmission over succeeding circuits using other signalling systems. Interworking with other systems is specified in the parts of the *Yellow Book* covering those systems.

The *nature-of-circuit indicator* provides information as to whether or not this circuit or any preceding circuit in the connection has traversed a high-altitude satellite, and makes it possible for an international transit exchange to ensure that a second high-altitude circuit is included only in known exceptional circumstances.

The *echo-suppressor indicator* provides information as to whether or not a standard outgoing half-echo suppressor (Recommendation G.161) has been included in the forward direction at a preceding international exchange. Receipt of this signal marked **1** indicates that a standard incoming half-echo suppressor should be included in the backward direction at the last four-wire exchange in the connection. Exceptionally, it is possible for the echo suppressors to be inserted at a point other than the last four-wire exchange on the basis of this signal.

The use of an echo suppressor at an international transit exchange must be by agreement and only in those connections which have been analyzed and where it has been found that the transmission requirements are fulfilled.

Recommendation Q.115 covers the arrangements for control of echo suppressors.

The *calling-party's-category indicator* is used to indicate the type of caller originating the call, e.g. ordinary caller, operator or data caller and may indicate that a special routing is required. The *language and discriminating information* is included in the calling-party's category. It will be necessary to translate the language digit received from an operator in semi-automatic working or a discriminating digit received from a preceding link to the appropriate calling-party's-category code. The language or discriminating information must be translated from the calling-party's-category indicator to the appropriate digit for transmission over a circuit using System No. 4 or System No. 5 in a succeeding link.

The *sending sequence of address information* will be the country code (not sent to an incoming international exchange) followed by the national (significant) number. For calls to code 11 and code 12, refer to Recommendation Q.107.

All digits required for routing the call through the international network will be sent in the *initial address message.* On calls with a country code in the address (except in the case of calls to special operators), the initial address message will contain a minimum of four digits and should contain as many as are available. All digits of the address may be included. In a terminal link, the initial address may contain one digit. Thus, the initial address message could consist of as few as three signal units (one digit) or as many as six signal units. Although 15 digits and ST could be

included in a six-unit message, the international numbering plan allows only 12 digits.

Selection of the outgoing national circuit normally can start at the incoming international exchange on receipt of the initial address message and signalling can proceed on the first national link.

Note - When interworking towards another signalling system with fewer facilities, it will be necessary to discard some of the signals, e.g. nature-of-circuit indicator and echo-suppressor indicator.

When no echo suppressor or nature-of-circuit indication is received from a preceding circuit using a signalling system with fewer facilities, the indicators will be considered as received *no* unless positive knowledge is available.

4.1.2 *Subsequent address messages*

The remaining digits, if any, of the address may be sent individually in one-unit messages or in groups in multi-unit messages. Efficiency can be gained by grouping together as many digits as possible. However, to prevent an increase in post-dialling delay in those cases where overlap operation with subscribers' dialling is used, it may be desirable to send the last few digits individually. The number of signal units used in a subsequent address message may be from one to four. If the outgoing circuit from an international transit exchange **is** equipped with System No. 5, any digits received in overlap must be grouped for *en bloc* sending.

Subsequent address messages can be sent on to the national network as they are received. Appropriate measures (e.g. by withholding the last digit(s) of the national number) must be taken at the last common channel exchange, to prevent ringing the called subscriber or alerting the operator until the continuity of the speech circuits served by the common channels has been verified.

The *sequence of address messages* may be disturbed in the event that one or more messages have been retransmitted because of an error. To prevent the assembly of digits in an incorrect sequence, the last System No. 6 or common channel exchange must examine the sequence number included in each address message and reassemble the digits if necessary. In some instances, intermediate common channel exchanges must also resequence address messages; refer to Recommendation Q.262, § 4.2.1.

4.1.3 *End-of-pulsing (ST) signal*

The ST signal is always sent in the following situations:

a) semi-automatic calls,

b) test calls, and

c) when the ST is received from a preceding circuit.

In automatic working, this signal will be sent whenever the outgoing international exchange is in a position to know, by digit analysis, that the final digit has been sent. Digit analysis may consist of an examination of the country code and counting of the maximum (or fixed) number of digits of the national number. In other cases, the ST signal is not sent and the end-of-address information is determined by the receipt of one of the address- complete signals from the incoming international exchange.

4.1.4 *Continuity check of the speech path*

The continuity check is described in § 5. The use of the loop method of continuity checking requires that any echo suppressors in the check loop be disabled. Each System No. 6 exchange must disable any echo suppressor in that exchange, which is required to be active for the speech connection, for the period of attachment of the *continuity-check loop* or *transceiver.*

Each System No. 6 exchange will connect the transceiver to the outgoing speech circuit when the initial address message is sent [see Recommendation Q.271, § 5.7.2, a)].

The first System No. 6 exchange will send forward the *continuity signal* after completion of the following conditions:

- the continuity check performed on the outgoing circuit is completed,

- the speech path across the exchange has been checked and found correct (Recommendation Q.271, § 5.2), and
- if the preceding link is a common link, receipt of a continuity signal from the preceding exchange.

Succeeding intermediate System No. 6 exchanges will send forward the continuity signal after the completion of the three following conditions:

- a continuity signal is received from the preceding link,
- the speech path across the exchange has been checked and found correct (Recommendation Q.271, § 5.2), and
- the continuity check performed on the outgoing circuit is completed.

The speech path may be switched through at an international exchange and the transceiver disconnected after the continuity check of the circuit has been successfully completed. However, the switching through of the speech path should be delayed until the residual check tone has propagated through the return path of the speech circuit. This determination may be made by timing, or by using the check-tone receiver to test for the removal of the check-tone or other appropriate means.

On receipt of the continuity signal in the following international exchange, the continuity-check loop will be removed. Also, any digits of the national number which were withheld may be released (see § 4.1.2 above).

At the System No. 6 exchange, on failure of the outgoing circuit to satisfy the continuity check:

- the continuity-check transceiver will be removed and an automatic repeat attempt will be made on another circuit,
- the outgoing terminal of the faulty circuit will be removed from service,
- a blocking signal will be sent to the following exchange, and
- after receipt of the blocking-acknowledgement signal, a clear-forward release-guard sequence will take place.

A *repeat of the continuity check* of the speech path will be made on the failed outgoing circuit within 1 to 10 seconds of receipt of the release-guard signal.

The second continuity check will be initiated by the System No. 6 exchange detecting the failure, using the test call procedure specified in Recommendation Q.295, § 9.1.1. The address information shall contain the code **0 0 0 0** to notify the incoming exchange that the test call is not to be switched through.

If the repeated check passes on this test call, the speech circuit will be unblocked and returned to service. If the check fails, the maintenance staff will be alerted that a failure has occurred and the circuit has been blocked. The check may be repeated at intervals of 1-3 minutes using the test call procedure. The repeated continuity check procedure will be finished and the circuit unblocked and returned to service when continuity is detected. Each repeated continuity check test call will be terminated using the clear-forward release-guard sequence.

The repeated continuity check test cycle may at any time be inhibited, either manually or automatically, in order to prevent its use in an inappropriate situation.

According to transmission maintenance requirements, System No. 6 should provide for:

a) a print-out each time a second continuity check is started. In such cases, the circuit involved should be identified;

b) a print-out each time a continuity check results in a warning being given to maintenance personnel.

Continuity check by means of the test call procedure may be performed at any time as required under the control of the maintenance staff. In these circumstances, although the test call is always terminated by the clear-forward signal, the blocking and unblocking signals are sent only at the discretion of the maintenance staff.

The second continuity check is not performed in the case of check failure in test calls (see Recommendation Q.295, § 9.1.1).

Since a continuity check failure can be caused by a faulty transceiver, precautions should be taken to ensure a low probability of selecting a faulty one for both the initial continuity check and the second check, e.g. by ensuring the selection of a different transceiver for each of the checks.

4.1.5 *Address-complete signals*

The address-complete signals should be originated either in or as close as possible to the called-party's-exchange since they imply that no further electrical called-party's-line-condition signals or congestion signals (see, however, § 4.1.7 below) will be sent. An address-complete signal will not be sent until the continuity signal has been received and the cross-office check made, if applicable.

If the succeeding network does not provide electrical called-party's-line-condition signals, the last No. 6 exchange shall originate and send an address-complete signal when the end of address signalling has been determined:

a) by receipt of an end-of-pulsing (ST) signal;

b) by receipt of the maximum number of digits used in the national numbering plan;

c) by analysis of the national (significant) number to indicate that a sufficient number of digits has been received to route the call to the called party;

d) by receipt of an end-of-selection signal from the succeeding network (e.g. number received signal in System No. 4); or

e) exceptionally, if the succeeding network uses overlap pulsing and number analysis is not possible, by observing that 4 to 10 (for new equipment 4 to 6) seconds have elapsed since the last digit was received, and that no fresh information has been received; in such circumstances, transmission to the national network of the last digit received must be prevented until the end of the waiting period which causes an address-complete signal to be sent over the international circuit. In this way, it is ensured that no national answer signal can arrive before an address-complete signal has been sent.

If the succeeding circuit in a connection utilizes System No. 5, the last System No. 6 exchange shall originate and send an address-complete signal whenever the conditions for sending the end-of-pulsing (ST) signal over the No. 5 circuit have been met as specified in Recommendation Q.152.

When the last System No. 6 (common channel) exchange receives an address-complete or equivalent signal, it will release routing and address information from memory and transmit the address-complete signal over the preceding link after receipt of the continuity signal.

If in normal operation delay in the receipt of an address-complete or equivalent signal from the succeeding network is expected, the last common channel exchange will originate and send an address-complete signal 15 to 20 seconds after receiving the latest address message. This time-out condition is an upper limit considering the clauses of 4.8.5.1 a) of Recommendation Q.268 (20 to 30 seconds for outgoing international exchanges in abnormal release conditions).

An intermediate System No. 6 exchange which receives an address-complete signal will release routing and address information from memory and transmit the signal over the preceding link.

On receipt of an address-complete signal, the first System No. 6 exchange will release registers and through-connect the speech path of the interconnected circuit, release address and routing information from memory and transmit the same or an equivalent signal over the preceding link.

When interworking from System No. 4 to System No. 6, the number-received signal will be sent over the System No. 4 link on receipt of the end-of-pulsing signal (ST) from the System No. 4 link or an address-complete signal from the System No. 6 link. However, the number-received signal will also be sent on failure to receive one of those signals within 4 to 6 seconds after reception of the latest digit.

Unless the exchange originating an address-complete signal has the ability to determine that a called number is a coin-box or a no charge number, the address-complete charge signal will be sent.

After an address-complete signal, only the following signals relating to the call may be, sent:

a) in normal operation, one of the answer signals, clear-back or release-guard signals;

b) call-failure signal (§ 4.8.3 below), message-refusal signal (§ 4.6.2.3 below); or

c) when interworking with Systems No. 4 and No. 5, one of the congestion signals derived from busy-flash signals (§ 4.1.7 below).

Any further information about the called-party's line condition or congestion will be transmitted to the calling subscriber or operator as audible tones or announcements.

The appropriate address-complete, subscriber-free signal is sent as an alternative to the address-complete signals given above when it is known that the called subscriber's line is free (not busy). It must be originated in the called subscriber's exchange, and therefore cannot be followed by the busy-flash signal. The procedures for handling the address-complete, subscriber-free signals are the same as for the other address-complete signals when generated in the called subscriber's exchange.

4.1.6 *Address-incomplete signal*

The address-incomplete signal is sent whenever it can be determined that the proper number of digits has not been received. This determination can be made at once if the end-of-pulsing (ST) signal is received or by receipt of an address-incomplete signal (or equivalent) from the national network. When overlap working is used, and the end-of-pulsing (ST) signal has not been received, the address-incomplete signal will be sent by the last common channel exchange 15 to 20 seconds after receipt of the latest digit.

If the incoming international exchange has already generated and sent an address-complete signal as described in § 4.1.5 above, and address-incomplete signal received from the succeeding network will be suppressed and the suitable tone or announcement sent.

Each System No. 6 exchange on receipt of the address-incomplete signal will send the signal to the preceding System No. 6 (common channel) exchange, if any, clear forward the connection, and remove the record of the call from memory. The first common channel exchange will send the appropriate tone or announcement, if any, for the national network concerned to the calling party.

4.1.7 *Congestion signals*

The three types of congestion signals are defined in Recommendation Q.254, §§ 2.1.12 to 2.1.14. The congestion signals may be sent without waiting for the completion of the continuity-check sequence. Reception of a congestion signal at any System No. 6 exchange will cause the clear-forward signal to be sent and cause either:

a) re-routing of the call or an automatic repeat attempt to be made (§ 4.4 below); or

b) the appropriate attempt signal or the appropriate audible tone or announcement to be sent to the preceding international exchange or to the national network.

Because receipt of congestion signal CGC by an outgoing international exchange may initiate repeat attempt or re-routing, it is possible to transmit congestion signal NNC from international exchanges where repeat attempt or re-routing may be expected to be useless.

If a busy-flash signal is received from a succeeding international link which uses another signalling system, it shall be coded as a circuit-group-congestion signal on System No. 6. Any of the congestion signals from System No. 6 - i.e. switching equipment, circuit group, national network - will be converted to a busy-flash signal for transmission over a preceding link using System No. 4 or System No. 5.

If a signal equivalent to a busy-flash signal is received by an incoming international exchange from a national network, it should be coded as a national-network-congestion signal to be transmitted on System No. 6.

4.1.8 *Called-party's-line-condition signals*

The following signals will be sent when the appropriate electrical signals are received at the incoming

international exchange from the national networks:

- subscriber-busy signal (electrical),
- line-out-of-service signal,
- unallocated-number signal,
- send-special-information tone signal.

These signals will be sent without waiting for the completion of the continuity check.

On receipt of one of these signals, the first common channel exchange (or the outgoing international exchange) will clear forward the connection and cause an appropriate indication to be given to the originating subscriber or operator.

Each System No. 6 exchange on receipt of a subscriber-busy, line-out-of-service, unallocated-number or send-special-information tone signal can clear forward the connection. Preceding links using System No. 4 or System No. 5 will be able to transmit only the busy-flash signal. This signal shall be returned when a subscriber busy signal is received. For the other three signals named above, a special information tone shall be applied when interworking with System No. 4 or System No. 5.

4.1.9 *Answer signals*

The signals answer, charge and answer, no charge are sent as received from the national network or from the succeeding international link.

The answer, no charge signal shall be used when:

a) an answer, no charge signal is received from a succeeding link; or

b) an answer signal is received and an address-complete, no charge or equivalent signal has been sent to a preceding link.

The answer, no charge signal will be translated to a normal answer signal when the preceding signalling system does not include a no-charge signal, either address-complete, no charge, answer, no charge or equivalent.

The signals answer, charge and answer, no charge are used only as a result of the first off-hook signal from the called party and are priority signals.

4.1.10 *Clear-back signals*

A clear-back signal is sent when the called party clears before a clear-forward signal has been received. A clear-back signal must not disconnect the speech path at a System No. 6 international exchange. The requirements for the release of a connection in the event that a clear-forward signal is not received are given in Recommendation Q.118.

4.1.11 *Reanswer and clear-back sequences*

Subsequent off-hook, on-hook signals from the called party, such as will result from switch-hook flashing, will cause the following sequence of signals to be sent:

Clear-back No. 1

Reanswer No. 1

Clear-back No. 2

Reanswer No. 2

Clear-back No. 3

Reanswer No. 3

Clear-back No. 1

etc.

In contrast to the answer signal, the reanswer signal has no special priority. The sequence numbering of the clear-back and reanswer signals makes it possible for the First System No. 6 exchange to reassemble the sequence in proper order in the event that the original sequence is disturbed as a result of retransmission of one or more of the signals. It is necessary, however, that a flashing sequence be retransmitted to the operator (or the preceding link) and that the final condition of the circuit represents the final position of the called party's switch hook. A reanswer signal is transmitted as an answer signal over a preceding link using System No. 4 or System No. 5.

4.1.12 *Forward-transfer signal*

The forward-transfer signal may be sent in semi-automatic working in either of the following two cases:

a) following a call switched automatically to a subscriber, or following a call established via a special operator, the controlling operator wishes to call in an assistance operator. On receipt of the forward-transfer signal at the incoming international exchange, an assistance operator is called in;

b) following a call via code 1 1 or code 12, the controlling operator wishes to recall the incoming operator at the incoming international exchange. Receipt of the forward-transfer signal at the incoming international exchange recalls the incoming operator on calls completed via the operator positions at the exchange.

4.1.13 *Clear-forward and release-guard sequence*

The clear-forward signal is overriding and all international exchanges must be in a position to respond by releasing the circuit and sending a release-guard signal at any time during the progress of a call and even if the circuit is in the idle condition. The clear-forward signal is sent only after all equipment has been released, information concerning the call has been released from memory and the circuit is available for a new incoming call. Receipt of a clear-forward signal will cause all associated equipment to be returned to the idle condition and all information concerning the call to be released from memory. If sent while a circuit is blocked, however, it will *not* result in unblocking the circuit concerned (see Recommendation Q.266, § 4.6.1).

The release-guard signal is sent in response to the clear-forward signal, but not until the circuit is available for a new call. The fact that the circuit is blocked will not delay the transmission of the release-guard signal.

4.1.14 *Diagrams showing signal sequence*

The normal call set-up sequences are shown diagrammatically in Annex A to these Specifications.