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SERIES U: TELEGRAPH SWITCHING

Radiotelex interworking

DETAILED REQUIREMENTS TO BE MET IN INTERFACING THE INTERNATIONAL TELEX NETWORK WITH MARITIME SATELLITE SYSTEMS

Reedition of CCITT Recommendation U.61 published in the Blue Book, Fascicle VII.2 (1988)

NOTES

1 CCITT Recommendation U.61 was published in Fascicle VII.2 of the *Blue Book*. This file is an extract from the *Blue Book*. While the presentation and layout of the text might be slightly different from the *Blue Book* version, the contents of the file are identical to the *Blue Book* version and copyright conditions remain unchanged (see below).

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

Recommendation U.61

DETAILED REQUIREMENTS TO BE MET IN INTERFACING THE INTERNATIONAL TELEX NETWORK WITH MARITIME SATELLITE SYSTEMS

(Geneva, 1980; amended at Malaga-Torremolinos, 1984)

The CCITT,

considering

(a) that fully automatic working between subscribers in the international telex service and subscribers to a radiotelex service provided by a maritime satellite system is technically possible;

(b) Recommendation U.60, which gives the general requirements to be met in interfacing the international telex network with maritime satellite systems,

unanimously recommends

1 Maritime satellite systems should be capable of detecting the head-on collision condition at the coast earth station between a ship earth station request for call and a terrestrially originated call for that particular ship earth station and should:

- permit the ship-originated call to be connected to the international telex network; and
- terminate the call from the international telex network with an appropriate telex service signal (**OCC**) and a clear (Recommendation F.60 [1]).

2 Should the head-on collision condition occur in the connections in the terrestrial network between the coast earth station and the telex exchange, then the normal procedures in accordance with the appropriate Series U Recommendations (U.12, § 3.3, U.11, § 2, U.1 § 12.2) should prevail.

3 A call-connected signal or a telex service signal and clear shall be returned as soon as possible after the receipt of the end-of-selection character at the coast earth station for shore-originated calls. The signal return delay shall not exceed 35 seconds.

Note – For type C signalling (Recommendation U.11) the end-of-selection (EOS) character is combination No. 26 (+) in International Telegraph Alphabet No. 2. For type D signalling (Recommendation U.12) the EOS is character No. 11 in the Control Signalling Code (CSC). For signalling to Recommendation U.1, this signal shall be combination No. 26 (+) in International Telegraph Alphabet No. 2.

4 The maritime satellite system returns to the subscriber in the terrestrial network the service signal **DER** (Recommendation F.60 [1]), followed by a clearing signal when the maritime satellite system detects:

- that the ship's station (teleprinter, control logic, radio equipment) is faulty;
- failure of the answer-back from the ship's teleprinter.

5 At the termination of the call the requirements of the clearing and clear-confirmation signals shall apply to and from the international network (Recommendations U.1, U.11, U.12); the maritime satellite system may use different timings in the directions to and from the ship. It is preferred that the total times for such signal exchanges should have a minimum time addition to that quoted for the international network.

Note – Automatic calling equipment and subscribers in the international telex network may attempt, under certain conditions, to place a follow-on call to the same ship. Under conditions of long clear and clear-confirmation cycle times, such calls will not be successful.

6 In the first generation INMARSAT system, telex characters are transmitted in synchronous channels using 6-unit frames. A telex character is thus sent as one start element followed by the five information elements of International Telegraph Alphabet No. 2. Speed differences between the on-board teleprinter and the satellite circuit are compensated for by occasionally inserting six elements of Z polarity, i.e., whenever a frame is to be sent on the synchronous channel and there is no complete telex character available. When the characters are retransmitted into the telex network, a stop element nominally 1.5 units long is added. Therefore, a period of Z polarity equal to the duration of a telex character may occasionally appear in the data stream.

6.1 The design of the equipment interfacing the international network should preferably ensure the following:

6.1.1 When type C signalling is employed to connect into the international network, either:

- the class-of-traffic and selection signals should all be transmitted into the international network at cadence speed without any periods of Z polarity between the 7 1/2-unit characters; or
- the class-of-traffic signal, the class-of-traffic-check signal, the 2 or 3 digits of the destination code of the called network and the first two digits of the called station should be transmitted as a complete block at cadence speed without any periods of Z polarity between the 7 1/2-unit characters. The remaining selection signals for the called number and the EOS signal (+) may be transmitted with periods of Z polarity, providing that the signals are not delayed by more than 4 seconds.

6.1.2 When type D signalling is employed to connect into the international network, the class-of-traffic signal(s) or network selection signals and selection signals should be transmitted as a complete block at cadence speed without periods of Z polarity between the Control Signalling Code (CSC) characters.

6.1.3 If these options cannot be exercised, then the provisions of Recommendation U.11, § 13, Recommendation U.12, § 3.6 or Recommendation U.1, § 6.6 shall apply.

6.2 When operation to automatic terminals, store-and-forward units, etc., is required, it should be noted that periods of Z polarity may occur within an answerback and text during transmission at cadence speed. (See also Recommendation R.59.)

A method for avoiding periods of Z polarity within an answerback signal is described in Appendix II.

7 Since, for automatic calls in the international telex service, there are no arrangements for call priorities such as are envisaged for maritime satellite systems and since it is a principle that a telex call should not be broken down without transmitting a service signal to the affected terminals, maritime satellite systems should, on exercising the maritime priority:

a) attempt to set up the priority call by cutting down a call that is in the process of being set up, i.e. the call-connected signal was not yet transmitted to the international network before cutting down an established call;

b) when a call in the process of being set up is cut down, transmit a service signal (**NC**) followed by a clear to the international network;

c) where it is unavoidable that an established call be cut down, clear the call using the standard international clearing procedure.

Note – Special signals could be used within the maritime satellite system to reduce the setting-up times of priority calls within that system. Such signals are not required to be related to the time scale of the cut-down of calls from or to the international network.

8 When the international network is used to permit an authorized telex terminal to access a coast earth station for the purpose of making a group call to ships, then such a service can be provided technically:

a) *when the originating network cannot apply selective barring to their subscribers*, providing that the coast earth station authenticates the calling terrestrial telex station by the transmission of the WRU signal and checks the status of the characters received from the calling terminal's answerback;

It should be noted that the WRU should be transmitted after the call-connected signal and the coast earth station's answerback has been transmitted to the calling terminal;

b) *when the originating telex network can apply selective barring to its subscribers*, providing that the telex selection received by the coast earth station is of the format:

$$D_1D_2D_3X_1X_2X_3 \ldots X_k \text{ EOS}$$

where $D_1D_2D_3$ is the appropriate telex destination code assigned to the Maritime Satellite Service in accordance with Recommendation F.69 [2], and $X_1X_2X_3 \ldots X_k$ is the telex number at the coast earth station defining the particular group call request, which, in association with the calling terminal, may be used to identify the appropriate listing of ships to receive the group call. The character X_1 in combination with the Recommendation F.69 [2] code indicates to the international network that a maritime group call is being made. The character X_1 shall be the character 0 (zero). (See also Recommendation F.120.)

c) *when type D systems exist in the connection to the calling telex terminal*. In that case the "calling line identification" procedures of that system may be used during the setting-up phase of the connection to the coast earth station to authenticate the calling terminal's identity instead of the use of the WRU and answerback. Where the calling link identification is not available in the terrestrial network the Control Signalling Code (CSC) No. 12 will be received. Under these circumstances the WRU/answerback sequence should be used as detailed in § 7, a).

When the request for a maritime group call, from the international network, is rejected due to lack of authorization, the international network should be cleared with a service signal (**NA**) followed by a clearing signal.

Note – Group calls may also be set up via a store-and-forward unit associated with the coast earth station. This unit should be accessed by subscribers or other store-and-forward units in accordance with the relevant Series F and U Recommendations. The authentication of the calling telex subscriber should be done by the store-and-forward unit.

9 The composition of ship terminal's answerback codes should conform to Recommendation F.130 [3].

10 Appendix I gives the characteristics and timings for INMARSAT telex circuits. The example given is based on the implementation at the United States coast earth stations.

APPENDIX I

(to Recommendation U.61)

Signalling characteristics and timing of the INMARSAT telex service

I.1 *Introduction*

This Appendix describes the characteristics and time sequences of the international telex service operated over the INMARSAT maritime satellite communication system via the USA coast earth station.

I.2 *Ship Earth Station (SES) originated telex call*

Figure I-1/U.61 shows the signalling sequence for a telex call originated from an SES terminal in the INMARSAT system. Figure I-2/U.61 illustrates the telex signalling and timing sequence. The following is a general description of the sequence of events in establishing a telex call from an SES to a gateway switch.

I.2.1 To initiate a call, the SES sends a telex request message in the out-of-band request channel. The addressed coast earth station (CES) receiving the valid request message will send back an out-of-band assignment message on its normal TDM channel to the network coordination station (NCS). The NCS will repeat the assignment message on the common TDM channel to which the SES is listening.

I.2.2 Upon receipt of a valid out-of-band assignment message from the CES via the NCS, the SES tunes to the normal TDM and can then access its assigned channel. The SES will normally achieve carrier and bit timing synchronization within 0.58 s after receipt of the assignment message. This time includes assignment message decoding, carrier recovery and clock recovery. Transmission will normally start upon frame synchronization, which occurs in less than 5.25 s.

Therefore, the normal SES response time will be less than 5.8 s as seen at the SES or 6.6 s as seen at the coast earth station. The time that the assignment message remains active in the coast earth station is in addition to this 6.6 s, allowing enough time for the SES to start transmitting.

I.2.3 The coast earth station, which is continually transmitting a polarity, makes the transition A to Z polarity indicating call confirmation within one character (150 ms, not counting framing delays) after the assignment message is formatted. In cases of heavy traffic, the assignment message may be delayed in queue until after the transition has occurred, i.e. it is possible for the A to Z transition to be received by the SES before the assignment message.

I.2.4 The initial SES transmission is in the A polarity state. When Z polarity is received from the coast earth station, the SES changes its transmission from A to Z polarity. In the case when the A to Z polarity transition on the coast earth station to SES link reaches the terminal before the assignment message, the SES inserts no more than two characters of A polarity in the initial burst.

I.2.5 Once the coast earth station has received the SES's A to Z polarity transition, call processing is started between the coast earth station and the gateway switch. The coast earth station presents the Z polarity to the gateway switch and the gateway responds with a call confirmation within 150 ms. Within 3 s after the call confirmation, the gateway returns a call connected signal. The coast earth station then connects the gateway switch to the SES. The gateway then sends its

header and a WRU to the SES. The SES will send its answerback in response to the WRU from the gateway switch. The SES's answerback is passed through the CES to the gateway switch. Upon verification of the answerback by the gateway switch, it will send a "**GA+**" (Go Ahead) and the SES can then send selection digits to the gateway switch.

I.2.6 After this connection, the coast earth station does not respond to any data on the line until it detects clearing.

I.2.7 The gateway switch, upon receipt of the selection sequence from the SES, proceeds to process the call to the desired terrestrial subscriber. As the INMARSAT system interfaces with various gateway switches, the signalling sequences proceed according to the protocol between the particular gateway switch and the terrestrial network.

Note – The signalling sequences shown between the gateway switch and the terrestrial network in Figure I-1/U.61 illustrates one method of signalling which can be employed.

I.3 *Terrestrial originated telex call*

I.3.1 Figures I-3/U.61 and I-4/U.61 illustrate the telex signalling and timing sequences for a telex call originated in a terrestrial network to an SES via the INMARSAT system. As the signalling sequences between the terrestrial networks and each gateway switch are not identical, that portion of the signalling sequences in Figure I-3/U.61 is for illustrative purposes only and no attempt is made to describe all the possible sequences.

I.3.2 The following paragraphs provide a description of the sequence of events which occur between a gateway switch and an SES for a telex call originated from the terrestrial network.

I.3.2.1 Upon receipt of the selection digits from the terrestrial network, the gateway switch starts the signalling sequence by sending a call request signal on an idle circuit to the coast earth station. Upon receipt, the coast earth station returns both a call confirmation and proceed-to-select signal within the proper intervals as shown in Figure I-4/U.61. The gateway switch can then proceed to send the selection digits to the coast earth station.

I.3.2.2 The coast earth station checks the validity of the selection digits and if correct, sends an out-of-band assignment message via the NCS to the SES requested. When the assignment message has been transmitted, the signalling proceeds in the same manner as a call from an SES to a coast earth station described in § 2. Once the coast earth station has received the satellite call connect from the SES, it sends a call connected signal to the gateway switch and cuts through the circuit between the SES and the gateway switch. From this point, the coast earth station is essentially transparent to all data on the line until it detects a clearing signal.

I.3.2.3 The gateway then sends a WRU to the SES. The SES responds to the gateway's WRU with its answerback. The gateway switch, upon receipt of the SES's answerback, sends its header to the SES and the SES's answerback to the terrestrial network and the call is now in progress.

I.4 *Telex clearing sequence*

I.4.1 The coast earth station recognizes a clearing signal as an A polarity condition of 400 to 1000 ms from either the gateway switch or an SES. After recognition of the clearing signal, the coast earth station will disconnect the circuit and send a clear confirmation signal in both directions.

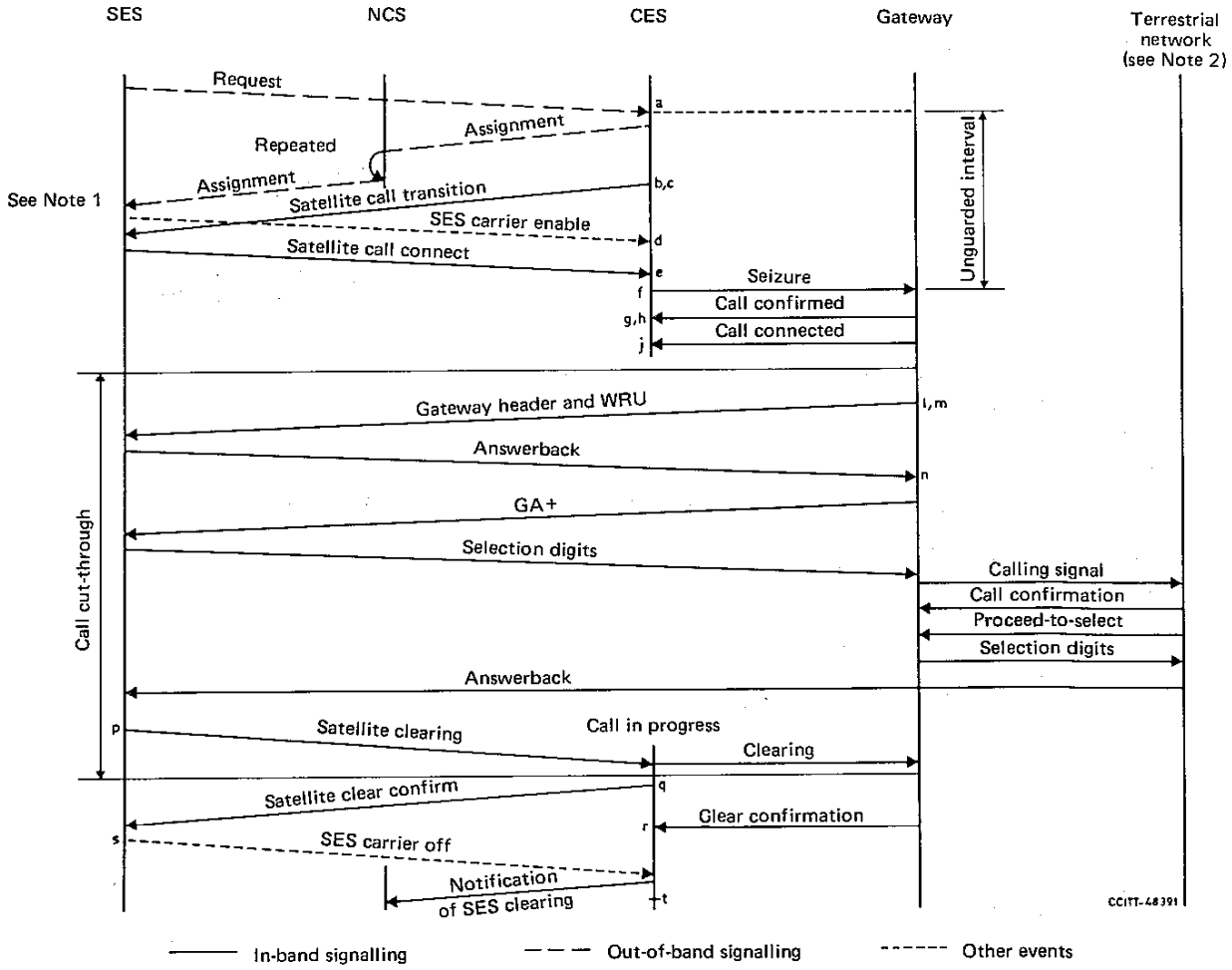
I.4.2 Release of the satellite circuit section is under the control of the coast earth station. The SES does not stop transmission of its RF carrier until:

a) it has returned a clear confirmation signal following the receipt of a clearing signal from the coast earth station; or

b) a clear confirmation signal is received from the coast earth station.

In either case, the SES maintains an A polarity signal for a maximum of 3.09 s before transmission is terminated.

I.4.3 For 6 seconds after the successful receipt of the clearing and clear confirmation signals over a circuit section between the coast earth station and a gateway switch, the coast earth station will not process any calls on that circuit section. The SES is also considered busy during this 6-second interval. This 6-second guard time is necessary to allow for proper clearing of the SES over the satellite circuit section. If another telex call is received for that SES during the 6-second guard time, the coast earth station will send back an OCC service signal. Once the guard time is past and the SES has been successfully cleared, the CES notifies the NCS that the SES is now idle.



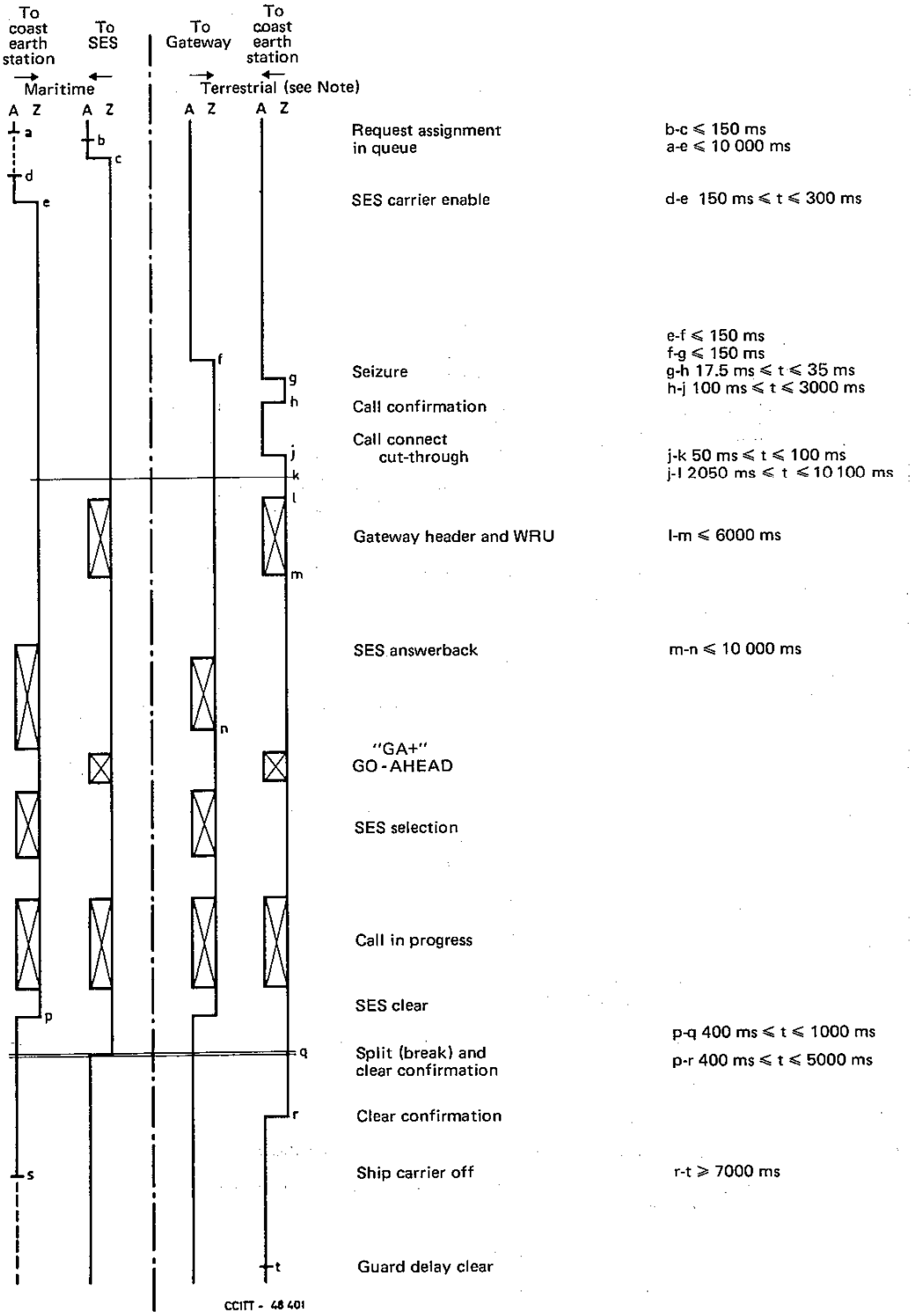
SES Ship earth station
CES Coast earth station
NCS Network coordination station

Note 1 – The assignment message and satellite call transition may arrive in either order.

Note 2 – Sequence between gateway and terrestrial network is for illustration only, as sequence can vary depending on the gateway involved.

FIGURE I-1/U.61

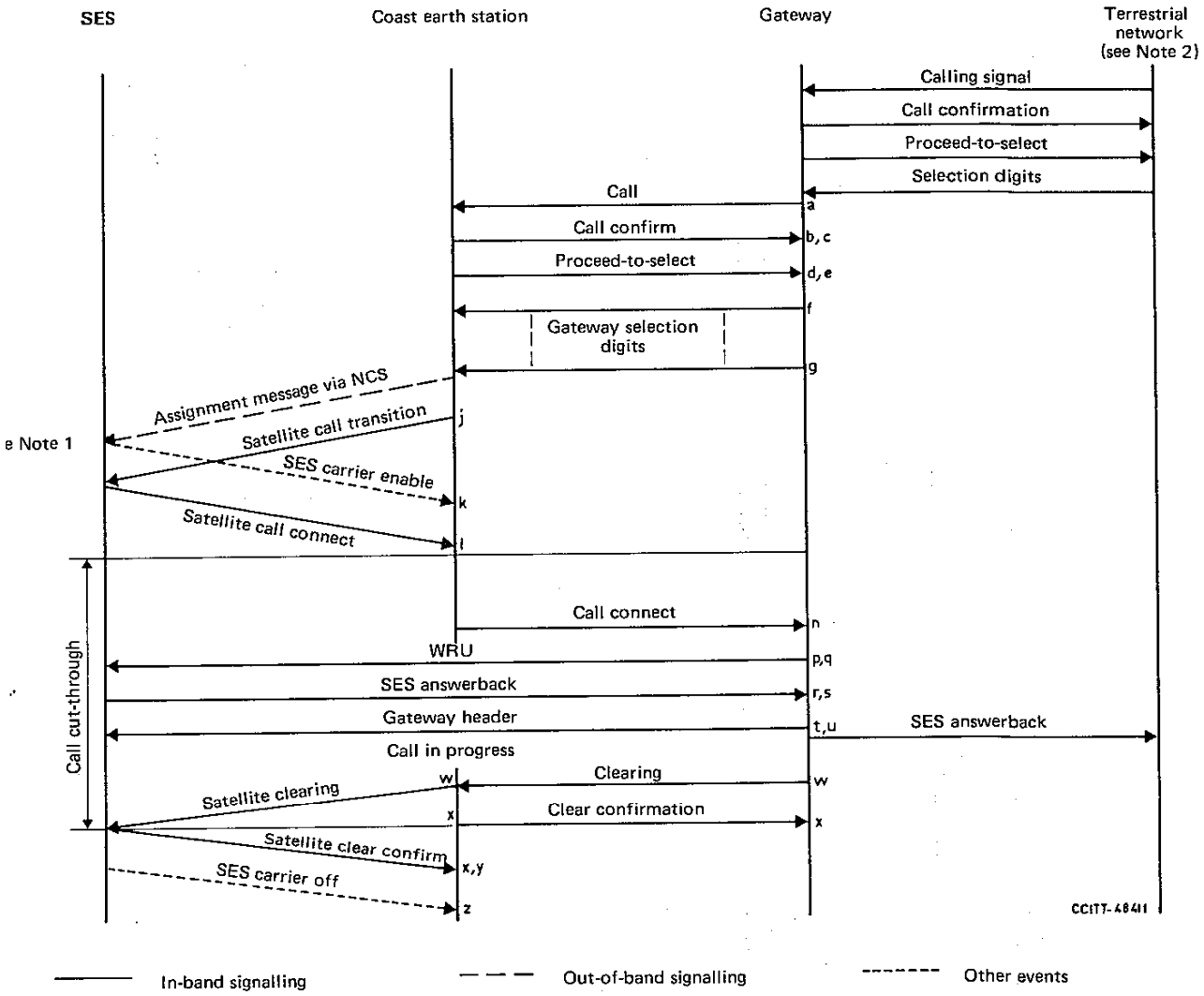
Signalling sequence for INMARSAT telex calls (SES to shore)



Note — USA coast earth station/gateway interface shown.

FIGURE I-2/U.61

Timing sequence for an SES originated INMARSAT telex call

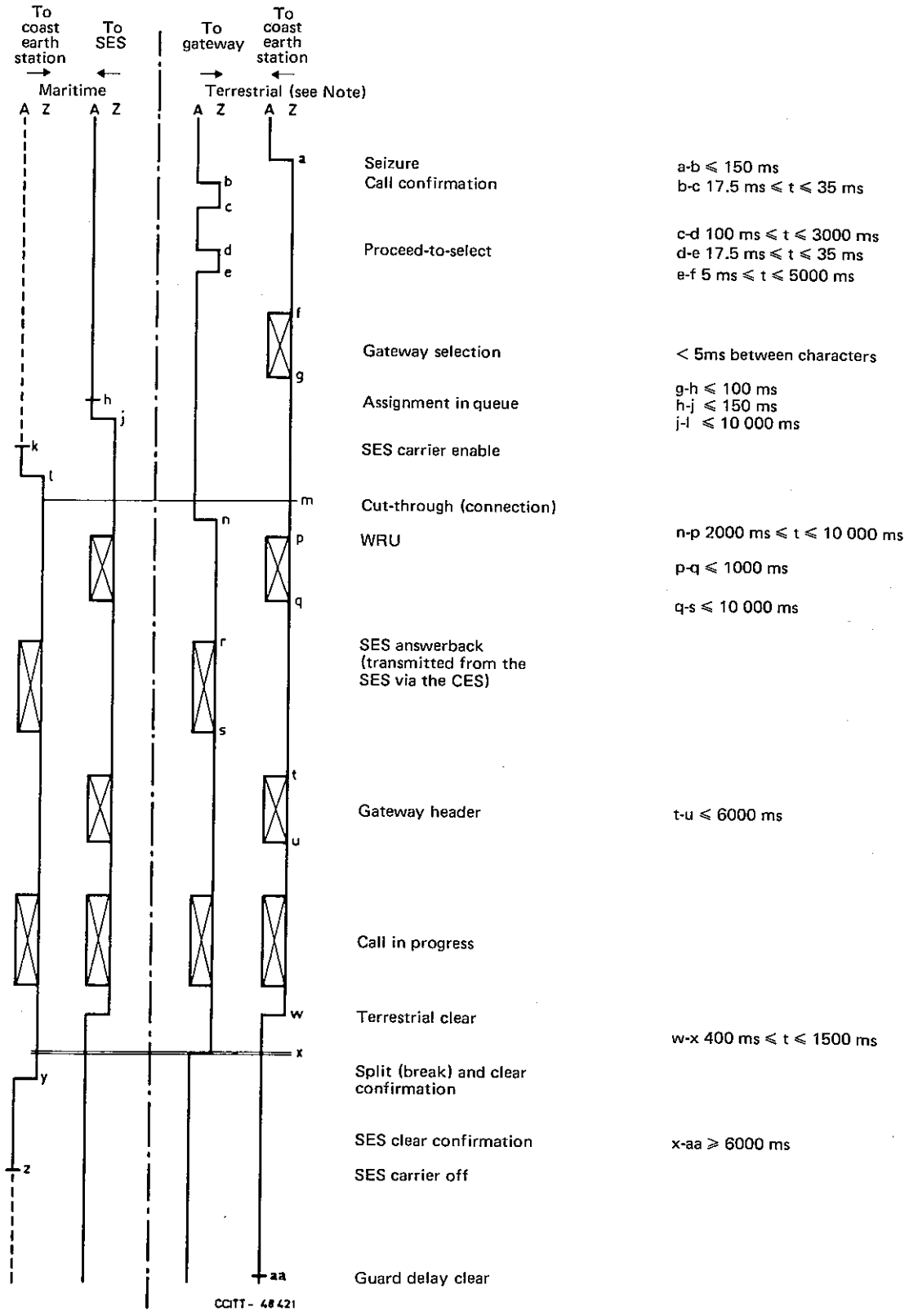


Note 1 – The assignment message and satellite call transition may arrive in either order.

Note 2 – Sequence between gateway and terrestrial network is for illustration only, as sequence can vary depending on the gateway involved.

FIGURE I-3/U.61

Signalling sequence for INMARSAT telex calls (terrestrial originated)



Note – USA coast earth station/gateway interface shown.

FIGURE I-4/U.61

Timing sequence for a terrestrial originated INMARSAT telex call

APPENDIX II

(to Recommendation U.61)

Method employed at the Nordic coast earth station to avoid periods of Z polarity within the answerback signal

The call set-up procedures employed at the Nordic coast earth station are similar to those shown in Appendix I. The coast earth station acts as an international gateway and is directly interconnected with the international telex exchange in Oslo.

The ship's answerback is obtained by the coast earth station for both ship originated and shore originated calls as soon as the satellite circuit has been established. The answerback is then stored at the coast earth station with any period of Z polarity omitted.

Whenever the coast earth station detects a WRU signal from the international telex network during the conversation phase, the path from the ship earth station is blocked as soon as the WRU signal has been sent to the ship. When the first few characters of the ship's answerback have been received at the coast earth station (in order to verify the continuity of the circuit), the coast earth station transmits the stored answerback into the international telex network at cadence speed.

References

[1] CCITT Recommendation *Operational provisions for the international telex service*, Rec. F.60.

[2] CCITT Recommendation *Plan for telex destination codes*, Rec. F.69.

[3] CCITT Recommendation *Maritime answer-back codes*, Rec. F.130.

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