INTERNATIONAL TELECOMMUNICATION UNION

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THE INTERNATIONAL
TELEGRAPH AND TELEPHONE
CONSULTATIVE COMMITTEE

BLUE BOOK

VOLUME VI – FASCICLE VI.14

INTERWORKING WITH SATELLITE MOBILE SYSTEMS

RECOMMENDATIONS Q.1100-Q.1152

IXTH PLENARY ASSEMBLY
MELBOURNE, 14-25 NOVEMBER 1988

Geneva 1989

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CONTENTS OF THE CCITT BOOK
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BLUE BOOK

FASCICLE III.6 – Line transmission of non-telephone signals. Transmission of sound-programme and television signals. Series H and J Recommendations (Study Group XV).

FASCICLE III.7 – Integrated Services Digital Network (ISDN) – General structure and service capabilities. Recommendations I.110-I.257 (Study Group XVIII).

FASCICLE III.8 – Integrated Services Digital Network (ISDN) – Overall network aspects and functions, ISDN user-network interfaces. Recommendations I.310-I.470 (Study Group XVIII).

FASCICLE III.9 – Integrated Services Digital Network (ISDN) – Internetwork interfaces and maintenance principles. Recommendations I.500-I.605 (Study Group XVIII).

Volume IV

FASCICLE IV.1 – General maintenance principles: maintenance of international transmission systems and telephone circuits. Recommendations M.10-M.782 (Study Group IV).

FASCICLE IV.2 – Maintenance of international telegraph, phototelegraph and leased circuits. Maintenance of the international public telephone network. Maintenance of maritime satellite and data transmission systems. Recommendations M.800-M.1375 (Study Group IV).

FASCICLE IV.3 – Maintenance of international sound-programme and television transmission circuits. Series N Recommendations (Study Group IV).

FASCICLE IV.4 – Specifications for measuring equipment. Series O Recommendations (Study Group IV).

Volume V – Telephone transmission quality. Series P Recommendations (Study Group XII).

Volume VI

FASCICLE VI.1 – General Recommendations on telephone switching and signalling. Functions and information flows for services in the ISDN. Supplements. Recommendations Q.1-Q.118 *bis* (Study Group XI).

FASCICLE VI.2 – Specifications of Signalling Systems Nos. 4 and 5. Recommendations Q.120-Q.180 (Study Group XI).

FASCICLE VI.3 – Specifications of Signalling System No. 6. Recommendations Q.251-Q.300 (Study Group XI).

FASCICLE VI.4 – Specifications of Signalling Systems R1 and R2. Recommendations Q.310-Q.490 (Study Group XI).

FASCICLE VI.5 – Digital local, transit, combined and international exchanges in integrated digital networks and mixed analogue-digital networks. Supplements. Recommendations Q.500-Q.554 (Study Group XI).

FASCICLE VI.6 – Interworking of signalling systems. Recommendations Q.601-Q.699 (Study Group XI).

FASCICLE VI.7 – Specifications of Signalling System No. 7. Recommendations Q.700-Q.716 (Study Group XI).

FASCICLE VI.8 – Specifications of Signalling System No. 7. Recommendations Q.721-Q.766 (Study Group XI).

FASCICLE VI.9 – Specifications of Signalling System No. 7. Recommendations Q.771-Q.795 (Study Group XI).

FASCICLE VI.10 – Digital subscriber signalling system No. 1 (DSS 1), data link layer. Recommendations Q.920-Q.921 (Study Group XI).

FASCICLE VI.11 – Digital subscriber signalling system No. 1 (DSS 1), network layer, user-network management. Recommendations Q.930-Q.940 (Study Group XI).

FASCICLE VI.12 – Public land mobile network. Interworking with ISDN and PSTN. Recommendations Q.1000-Q.1032 (Study Group XI).

FASCICLE VI.13 – Public land mobile network. Mobile application part and interfaces. Recommendations Q.1051-Q.1063 (Study Group XI).

FASCICLE VI.14 – Interworking with satellite mobile systems. Recommendations Q.1100-Q.1152 (Study Group XI).

Volume VII

FASCICLE VII.1 – Telegraph transmission. Series R Recommendations. Telegraph services terminal equipment. Series S Recommendations (Study Group IX).

FASCICLE VII.2 – Telegraph switching. Series U Recommendations (Study Group IX).

FASCICLE VII.3 – Terminal equipment and protocols for telematic services. Recommendations T.0-T.63 (Study Group VIII).

FASCICLE VII.4 – Conformance testing procedures for the Teletex Recommendations. Recommendation T.64 (Study Group VIII).

FASCICLE VII.5 – Terminal equipment and protocols for telematic services. Recommendations T.65-T.101, T.150-T.390 (Study Group VIII).

FASCICLE VII.6 – Terminal equipment and protocols for telematic services. Recommendations T.400-T.418 (Study Group VIII).

FASCICLE VII.7 – Terminal equipment and protocols for telematic services. Recommendations T.431-T.564 (Study Group VIII).

Volume VIII

FASCICLE VIII.1 – Data communication over the telephone network. Series V Recommendations (Study Group XVII).

FASCICLE VIII.2 – Data communication networks: services and facilities, interfaces. Recommendations X.1-X.32 (Study Group VII).

FASCICLE VIII.3 – Data communication networks: transmission, signalling and switching, network aspects, maintenance and administrative arrangements. Recommendations X.40-X.181 (Study Group VII).

FASCICLE VIII.4 – Data communication networks: Open Systems Interconnection (OSI) – Model and notation, service definition. Recommendations X.200-X.219 (Study Group VII).

FASCICLE VIII.5 – Data communication networks: Open Systems Interconnection (OSI) – Protocol specifications, conformance testing. Recommendations X.220-X.290 (Study Group VII).

FASCICLE VIII.6 – Data communication networks: interworking between networks, mobile data transmission systems, internetwork management. Recommendations X.300-X.370 (Study Group VII).

FASCICLE VIII.7 – Data communication networks: message handling systems. Recommendations X.400-X.420 (Study Group VII).

FASCICLE VIII.8 – Data communication networks: directory. Recommendations X.500-X.521 (Study Group VII).

Volume IX – Protection against interference. Series K Recommendations (Study Group V). Construction, installation and protection of cable and other elements of outside plant. Series L Recommendations (Study Group VI).

Volume X

FASCICLE X.1 – Functional Specification and Description Language (SDL). Criteria for using Formal Description Techniques (FDTs). Recommendation Z.100 and Annexes A, B, C and E, Recommendation Z.110 (Study Group X).

FASCICLE X.2 – Annex D to Recommendation Z.100: SDL user guidelines (Study Group X).

FASCICLE X.3 – Annex F.1 to Recommendation Z.100: SDL formal definition. Introduction (Study Group X).

FASCICLE X.4 – Annex F.2 to Recommendation Z.100: SDL formal definition. Static semantics (Study Group X).

FASCICLE X.5 – Annex F.3 to Recommendation Z.100: SDL formal definition. Dynamic semantics (Study Group X).

FASCICLE X.6 – CCITT High Level Language (CHILL). Recommendation Z.200 (Study Group X).

FASCICLE X.7 – Man-Machine Language (MML). Recommendations Z.301-Z.341 (Study Group X).

CONTENTS OF FASCICLE VI.14 OF THE BLUE BOOK

Recommendations Q.1100 to Q.1152

Interworking with Satellite Mobile Systems

REMARKS

1 The strict observance of the specifications for standardized international signalling and switching equipment is of the utmost importance in the manufacture and operation of the equipment. Hence these specifications are obligatory except where it is explicity stipulated to the contrary.

The values given in Fascicles VI.1 to VI.14 are imperative and must be met under normal service conditions.

2 The Questions entrusted to each Study Group for the Study Period 1989-1992 can be found in Contribution No. 1 to that Study Group.

CCITT NOTE

In this Volume, the expression "Administration" is used for shortness to indicate both a telecommunication Adminsitration and a recognized private operating agency.

SECTION 1

INTERWORKING WITH STANDARD A INMARSAT SYSTEM

Recommendation Q.1100

STRUCTURE OF THE RECOMMENDATIONS ON THE INMARSAT MOBILE SATELLITE SYSTEMS

1 General

This Recommendation gives an overview of those in the Q.1100-Series for interworking between the international public switched telephone network/ISDN and the INMARSAT mobile satellite systems. It also contains definitions of the terminology used in these Recommendations.

2 Terminology

2.1 aeronautical (ground) earth station (GES)

An earth station in the fixed satellite service or, in some cases, in the aeronautical mobile-satellite service, located at a specified fixed point on land to provide a feeder link for the aeronautical mobile-satellite service (see Radio Regulations Article 1).

2.2 aircraft earth station (AES)

A mobile earth station in the aeronautical mobile-satellite service located on board an aircraft (see Radio Regulations Article 1).

2.3 mobile satellite switching centre (MSSC)

Indicates the signalling interworking point between the fixed networks and the mobile satellite system which works to a single ocean area. The MSSC may be located at the antenna site of the aeronautical ground earth station or coast earth station, in which case it may operate as an independent international switching centre (ISC) connected to one or more ISCs, on national switching centres. It may also be located remotely from the antenna site, as a supplement to, or a part of an ISC. The term MSSC may also indicate a *maritime* satellite switching centre, with an identical functional definition to the above.

2.4 **international switching centre (ISC)**

The exchange (at the end of an international circuit) which switches calls destined to or originating from another country.

2.5 **ship earth station (SES)**

A station in the maritime mobile satellite service intended to be used while in motion or during halts at unspecified points and which is located on board a ship (see Radio Regulations Article 1).

2.6 **integrated services digital network (ISDN)**

An integrated digital network in which the same digital switches and digital paths are used to establish connections for different services, such as telephony, data, and so on (see CCITT I-Series Recommendations).

2.7 **telephone user part (TUP)**

This defines the necessary telephone signalling functions for use of Signalling System No. 7 (SS No. 7) for international call control signalling. It is specified with the aim of providing the same feature for telephone signalling as other CCITT telephone signalling systems (see CCITT Recommendation Q.721).

2.8 **ISDN user part (ISUP)**

This encompasses the signalling functions in SS No. 7 required to provide switched services and user facilities for voice and non-voice applications in an ISDN (see Recommendation Q.761).

2.9 **signalling connection control part (SCCP)**

This provides in SS No. 7 additional functions to the message transfer part to cater for both connectionless as well as connection oriented network services, to transfer circuit related, non-circuit related signalling information, and other types of information between exchanges and specialised centres in telecommunication networks (see CCITT Recommendation Q.711).

2.10 **coast earth station (CES)**

An earth station operating in the fixed satellite service frequency bands or, in some cases, in the maritime mobile-satellite service frequency bands located at a specified fixed point on land to provide a feeder link for the maritime mobile-satellite service (see Radio Regulations, Article 1).

3 Overview of Recommendations

3.1 *Recommendation Q.1101*

Sets out the general requirements for interworking between the first generation (Standard A) INMARSAT system and the international public telephone network. A brief description of the INMARSAT Standard A system is also included.

3.2 *Recommendation Q.1102*

Specifies the interworking between the INMARSAT Standard A system and Signalling System R2.

3.3 *Recommendation Q.1103*

Specifies the interworking between the INMARSAT Standard A system and Signalling System No. 5.

3.4 *Recommendation Q.1111*

Provides information on services offered in the INMARSAT Standard B system, and describes the requirements for connection and internetworking with the public networks. A brief description of the Standard-B system is appended.

3.5 *Recommendation Q.1112*

Presents the procedures for interworking between the INMARSAT Standard B system and the signalling systems of the international public network.

3.6 *Recommendation Q.1151*

Provides information on the services offered in the INMARSAT aeronautical system and describes the requirements for connection and interworking with the public networks. A brief description of the aeronautical system is appended.

3.7 *Recommendation Q.1152*

Presents the procedures for interworking between the INMARSAT aeronautical system and the signalling systems of the international public network.

Recommendation Q.1101

GENERAL REQUIREMENTS FOR THE INTERWORKING OF THE TERRESTRIAL TELEPHONE NETWORK AND INMARSAT STANDARD A SYSTEM

1 Introduction

1.1 The purpose of this Recommendation is to define the general interworking requirements between the telephone network and the INMARSAT Standard A system.

1.2 In order to support automatic working between subscribers in the public telephone service and telephone subscribers to the maritime mobile-satellite service, it is necessary that the interface between the terrestrial telephone network and the maritime satellite system be defined.

1.3 It should be possible to interface the maritime-mobile satellite system with any signalling system standardized by the CCITT for automatic working. In order to facilitate the preparation of the interworking equipment, and also aiming at the international standardization of the service, this Recommendation lists several basic interworking requirements common to all signalling systems.

1.4 More specific interworking requirements applicable to System No. 5 are given in Recommendation Q.1103 and System R2 are given in Recommendation Q.1102.

1.5 A brief description of the INMARSAT Standard A system is given in Annex A. SDL descriptions of incoming and outgoing signalling procedures for the INMARSAT system are given in Annexes B and C respectively.

1.6 Interworking between the telephone network/ISDN and other INMARSAT systems is given in separate Q-Series Recommendations.

2 Maritime satellite switching centre

For the purpose of this Recommendation the term Maritime Satellite Switching Centre (MSSC) is used to indicate the interworking point between the terrestrial telephone network and the maritime satellite system. The maritime satellite switching centre (MSSC) may be located at the antenna site of the coast earth station [1] and operate as an independent international switching centre connected to one or more international switching centres (ISCs) or national switching centres, or it may be remote as a supplement to or as a part of an international switching centre.

3 List of general Series Q Recommendations

Due regard should be paid to the following general Series Q Recommendations:

- Q.11, Q.11*bis*, Q.11*ter*, and Q.12, Q.13, numbering and routing plan
- Q.14, means of controlling the number of satellite links
- Q.15 through Q.22, general Recommendations
- Q.23, technical features of push-button telephone sets
- Q.25, splitting arrangement
- Q.26 through Q.33, miscellaneous provisions
- Q.35, tones of national signalling systems
- Q.40 through Q.45, transmission characteristics
- Q.102, facilities provided in international automatic working
- Q.103, numbering used
- Q.104, language digit or discriminating digit
- Q.105, national (significant) number

- Q.106, the sending-finished signal
- Q.107, sending sequence of forward-address information
- Q.107*bis*, analysis of forward-address information for routing
- Q.109, transmission of the answer signal
- Q.112 through Q.114, transmission clauses
- Q.115, control of echo suppressors
- Q.116 through Q.118*bis*, abnormal conditions.

4 Sending sequence of numerical (or address) signals

4.1 *Calls toward ship earth station* [2] *(shore-to-ship)*

In most cases the MSSC will not need the information contained in the S-digit of the country code 87S. In this situation the sequence of forward-address information sent to the MSSC should be as for a terminal international call.

Cases may arise where an MSSC requires the S-digit to distinguish between ocean areas, satellite systems or VHF/UHF vs. satellite. In this situation the sequence of forward-address information should be as for an international transit call, i.e. the sequence includes the country code 87S.

4.2 *S-digit*

It is a matter for the terrestrial subscriber to choose the proper S-digit and the MSSC to be used will be decided by the outgoing country. (For technical reasons accounting between Administrations should be performed on the basis of only 87S.)

4.3 *Calls from ship earth station (ship-to-shore)*

The desired MSSC is selected at the ship earth station by procedures within the maritime satellite system. After the dialling tone has been provided to the subscriber, he will dial a prefix followed by the full international telephone number required, whether or not the MSSC is located in the required subscriber's country (see also Recommendation Q.11*quater*).

The prefix must be suppressed by the MSSC since it is only required for internal routing in the MSSC.

For calls to subscribers in the MSSC country, the country code should also be suppressed by the MSSC.

A discriminating digit must be inserted by the MSSC according to Recommendation Q.104.

4.4 *Operator services*

The desired MSSC is selected at the ship earth station by procedures within the maritime satellite system. After the dialling tone has been provided to the subscriber, he will dial a two digit prefix, possibly followed by a 1, 2 or 3 digit country code, to identify the type of operator required (see Recommendation Q.11*quater*).

The MSSC could then convert the received dialling information as required for setting up the terrestrial connection to the operator.

4.5 *Special service terminations*

The desired MSSC is selected at the ship earth station by procedures within the maritime satellite system. After the dialling tone has been provided to the subscriber, he will dial a two digit prefix possibly followed by other digits to identify the type of special service termination required. (See Recommendation Q.11*quater*.) The MSSC should convert the received dialling information as required for setting up the terrestrial connection.

5 Special requirements related to setting-up and clearing of automatic calls

5.1 *Setting-up time for shore originated calls*

The setting-up time for shore originated calls should be as short as possible. If the MSSC has not been able to establish the connection within a period of 20 seconds after receipt of all address digits, a congestion indication should be returned.

Note - In maritime satellite systems the setting-up time is not controlled by each individual MSSC but may depend on the overall traffic load in the system and on the assignment procedure used. For several reasons the setting-up time of the radio path is likely to be longer than the setting-up time of the subscriber connection in terrestrial systems.

5.2 *Transmission of answer signal*

5.2.1 When the maritime satellite switching centre (MSSC) detects the answer signal from the maritime satellite system, the MSSC must remove the ringing tone, through-connect the circuit and return the answer signal as soon as possible to the terrestrial switching centre.

Precautions should be taken at the MSSC to avoid interpreting an interruption of the satellite link as an answer signal.

5.2.2 For ship originated calls the maritime satellite system should preferably include provisions for transferring the answer signal to the ship earth station.

5.3 *Seizure of a terrestrial circuit from the MSSC*

The maritime satellite switching centre should not seize a terrestrial circuit before each of the following conditions has been met:

- the satellite channel has been assigned;
- the continuity of the satellite channel has been verified;
- all digits necessary for routing decision by the maritime satellite switching centre have been received.

5.4 *Clear-back conditions*

5.4.1 The clear-back/re-answer sequence may not apply for shore originated calls, in which case the satellite link will be released when a clear-back signal is detected at the maritime satellite switching centre from the satellite link, without waiting for a clear-forward signal from the terrestrial network.

Precautions should be taken either at the MSSC or at the ship earth station in order to avoid unintentional clearing.

5.4.2 For ship originated calls the normal clear-back procedures should apply (see Recommendation Q.118).

5.5 *Clear-forward*

When detecting a clear-forward from the satellite link, the MSSC should immediately pass the clear-forward signal into the terrestrial network.

When detecting a clear-forward from the terrestrial network, the release guard (and clearing) sequence should follow the procedures defined for the signalling system used.

5.6 *Splitting arrangement*

When in-band signalling is used over the satellite link for setting-up and clearing of the link, a splitting arrangement shall be provided in order to avoid that signalling tones are passed into the terrestrial network. The splitting time shall be less than 20 ms.

In order to protect the maritime satellite system from line signals used on terrestrial signalling systems, it should be observed that such signalling tones passing through splitting arrangements in the terrestrial network may have a maximum duration of 50 ms.

6 Audible tones sent by the MSSC

Tones sent by the maritime switching centre (MSSC) should have the following characteristics:

Dial tone:	425 Hz (1.5 seconds maximum, minimum is determined by receipt of first dial digit)
Ringing tone:	425 Hz (1 second on, 4 seconds off, immediate ringing)
Busy tone:	425 Hz (1/2 second on, 1/2 second off)
Congestion tone:	425 Hz (1/4 second on, 1/4 second off)
Special information tone:	as defined in Recommendation Q.35.

Note - The dial tone is given as 1.5 seconds pulse in order to avoid subscribers' confusion due to the two-way transmission delay of 0.5 seconds. If the normal continuous tone with interruption after the receipt of the first digit was used, the delay would cause the tone to stay on after entry of the first digit.

7 Control of echo suppressors

Since all calls to and from a ship earth station will include a satellite link, appropriate actions must be taken to insert an incoming or outgoing half-echo suppressor at the MSSC or at an international exchange closer to the terrestrial subscriber. The ship earth station will connect to the satellite link on a 4-wire basis or will be provided with the equivalent of a half-echo suppressor. In order to reduce the analysis and control requirements at the MSSC it may prove convenient to carry out all echo suppressor control at one of the international exchanges rather than at the MSSC. This is most easily achieved by fitting permanent half-echo suppressors at the ISC end of each MSSC-ISC circuit. In any case the overall echo control requirements are the same as specified in Recommendation Q.115.

7.1 *Terrestrial signalling systems with signals for control of echo suppressors*

7.1.1 *Ship original calls*

The MSSC should send an echo suppressor indicator informing transit centres or incoming centres whether or not an incoming half-echo suppressor should be included.

Insertion of an incoming half-echo suppressor will always be requested if the MSSC does not carry out echo suppressor control.

7.1.2 *Shore originated calls*

The MSSC will decide whether or not to insert an outgoing half-echo suppressor depending on the received echo suppressor indicator. If echo control is not performed at the MSSC, the echo suppressor indicator will always inform the MSSC that an outgoing half-echo suppressor has already been included.

7.2 *Terrestrial signalling systems without signals from control of echo suppressors*

When signals for the control of echo suppressors are not available on the particular terrestrial route, significant advantage is to be gained by carrying out the echo suppressor control at the international exchange. In any case the following rules should be observed:

7.2.1 *Ship originated calls*

a) When the terrestrial connection between the outgoing ISC, (or MSSC) and the incoming ISC (or national incoming switching centre) does not normally require the use of echo suppressors, the outgoing ISC (or MSSC) should enable (or insert) an incoming half-echo suppressor associated with the satellite link.

b) When the terrestrial connection between the outgoing ISC (or MSSC) and the incoming ISC (or national incoming switching centre) normally requires the use of echo suppressors, the outgoing ISC (or MSSC) should disable (or should not insert) any half-echo suppressors associated with either the satellite link or the terrestrial link.

7.2.2 *Shore originated calls*

a) When the international connection between the outgoing ISC and the incoming ISC (or MSSC) does not normally require the use of echo suppressors, the incoming ISC (or MSSC) should enable (or insert) an outgoing half-echo suppressor associated with the satellite link.

b) When the international connection between the outgoing ISC and the incoming ISC (or MSSC) normally requires the use of echo suppressors, the incoming ISC (or MSSC) should disable (or should not insert) any half-echo suppressors associated with either the satellite or terrestrial link.

8 Handling of group calls

8.1 *General*

A group call is a simultaneous call to a given group of ships. Such calls are identified by the following international number:

$$87S0X_2X_3...X_k$$

where the first digit of the ship station number has the fixed value 0. The remaining digits determine which group of ships is being addressed.

Facilities for originating group calls from operators either in the MSSC country or another country may be readily made available by permitting such calls only when the Z digit is a language digit. Group calls originating from ordinary telephone subscribers should not be permitted so long as calling line identification is not available.

8.2 *Barring at the ISC of origin*

In order to avoid setting up of the international chain for unauthorized group calls from ordinary subscribers, barring of such calls should, as a general rule, be done at the ISC of origin.

8.3 *Barring at the MSSC*

Barring should also be provided at the MSSC in order to reject group call attempts from ships or from subscribers in countries where barring at the outgoing ISC is not possible.

9 Avoiding two or more satellite links in tandem

9.1 *Shore originated calls*

The country code 87S should be analysed at all transit centres where the call may either be routed on a circuit containing a satellite link or on a circuit not containing a satellite link. The latter circuit should always be chosen (see Recommendation Q.14).

9.2 *Ship originated calls*

If the signalling system provided between the MSSC and the terrestrial network contains signals which may be used to indicate that one satellite link is included, such signals should be used.

If the signalling system does not contain such signals, the outgoing ISC should avoid forwarding the call on an outgoing circuit which includes a satellite link. If, however, the signalling system employed between the outgoing ISC and the next ISC in the connection contains such signals, the outgoing ISC should insert the required information. The outgoing ISC could base its procedure upon incoming route identification.

10 Operator assistance for semi-automatic shore originated calls

If code 11/12 assistance facilities are not provided at the MSSC, then arrangements should be made to intercept such calls at the preceding ISC and route them to an appropriate operator.

It may be advantageous for Administrations to provide a publicized number (e.g. C12XXXX) for specialized assistance on calls to the maritime network.

ANNEX A

(to Recommendation Q.1101)

Brief description of the INMARSAT Standard A system

A.1 *Introduction*

This annex describes the signalling in the INMARSAT Standard A system in a multiple Maritime Satellite Switching Centre (MSSC) configuration, i.e., there is more than one MSSC serving an ocean region. Automatic call set-up and clearing are illustrated below. For calls which cannot be completed, the subscriber will receive from the MSSC or the terrestrial network the proper audible tone which describes the call status (i.e., busy tone, congestion tone).

A.2 *System configuration*

The INMARSAT system is composed as shown in Figure A-1/Q.1101. Only the components required for interfacing the telephone network are shown. There are additional interfaces similar to the MSSC for interfacing the telex network and the international public data network.

The purpose of the MSSC is defined in § 2 of the Recommendation.

There is one operating Network Coordination Station (NCS) in each ocean area (there may in addition be one or more standby NCSs per ocean area). The main functions of the NCS are as follows.

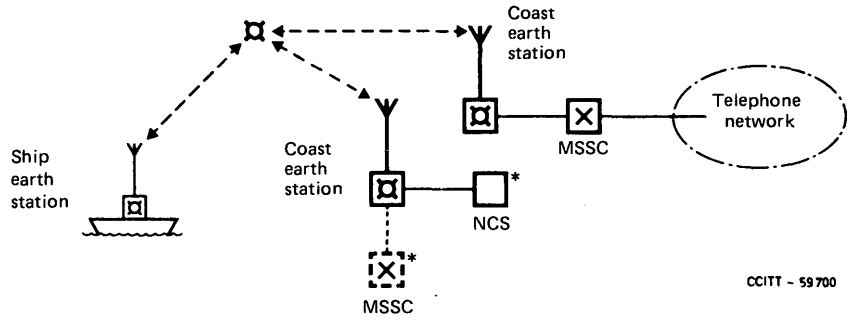
The ship earth stations can only monitor one calling channel in the shore-to-ship direction. This calling channel, denoted as the common assignment channel, is transmitted by the NCS. Each coast earth station transmits its own calling channel which is monitored by the NCS for relaying signalling messages from a coast earth station to a ship.

The NCS also performs all assignment of telephone channels on a call-by-call basis and monitors the actual use of the channels for maintenance purposes. The NCS keeps an up-dated list of all busy ships in the ocean area. If a coast earth station calls a busy ship, the NCS may thus return a ship busy indication to the calling coast earth station on the common assignment channel.

The procedures are further described below.

A.3 *Ship earth station originated calls*

The normal call set-up procedure for automatic call processing from a ship earth station is shown in Figure A-2/Q.1101. The ship earth station transmits an out-of-band request message which includes the type of call desired, the identify of the MSSC through which the terminal wishes to communicate and the identification number of the ship earth station.



* The NCS of an ocean area will normally be co-located with an MSSC of that area.

FIGURE A-1/Q.1101

Composition of the maritime satellite system for interconnection with the telephone network

The MSSC upon reacting to the received *request* message, sends a *Request for Assignment* message to the Network Coordination Station (NCS). The NCS receiving the *request for assignment* message assigns a channel (frequency) and transmits this information in an *assignment* message to both the MSSC and the ship earth station. Both the MSSC and ship earth station receive the *assignment* message, automatically select the correct frequency, and initiate a continuity by transmitting a 2600 Hz tone.

When continuity has been established, the MSSC sends a dial tone pulse to the ship earth station. The ship earth station subscriber then dials in the desired prefix, country code and national significant number followed by an end-of-selection signal. The signals are transferred as in band push button signals on the satellite link.

The MSSC proceeds to select a terrestrial trunk and follows the standard signalling sequences of the signalling system used towards the ISC (Figure A-2/Q.1101). The ringing tone from the terrestrial network is allowed to pass directly to the ship earth station subscriber. When the terrestrial party answers the call, the ISC passes the answer signal to the MSSC and the international connection is established. The answer signal, if implemented, may then be passed to the ship earth station[1)].

A.4 *Terrestrial originated calls*

The normal call set-up procedure for automatic call processing from the terrestrial network to a ship earth station is shown in Figure A-3/Q.1101. The ISC selects a circuit and sends the seizing signal and the mobile terminal identification digits to the MSSC in accordance with the procedures used in the terrestrial signalling system. The MSSC then sends a *request-for-assignment* message to the NCS containing the ship earth station identity. The NCS responds by sending an *assignment* message to both the MSSC and the ship earth station. The MSSC and the ship earth station activate their carriers and send a 2600 Hz tone. Upon receipt of the 2600 Hz tone from the ship earth station the MSSC interprets this as an address complete condition, sends the ringing tone to the terrestrial network and stops sending 2600 Hz to the ship earth station. When the operator or subscriber at the ship earth station answers, the ship earth station discontinues sending its 2600 Hz tone.

The MSSC recognizes the cutting of the 2600 Hz tone as an answer signal from the ship earth station and begins the answer sequence toward the ISC as shown in Figure A-3/Q.1101.

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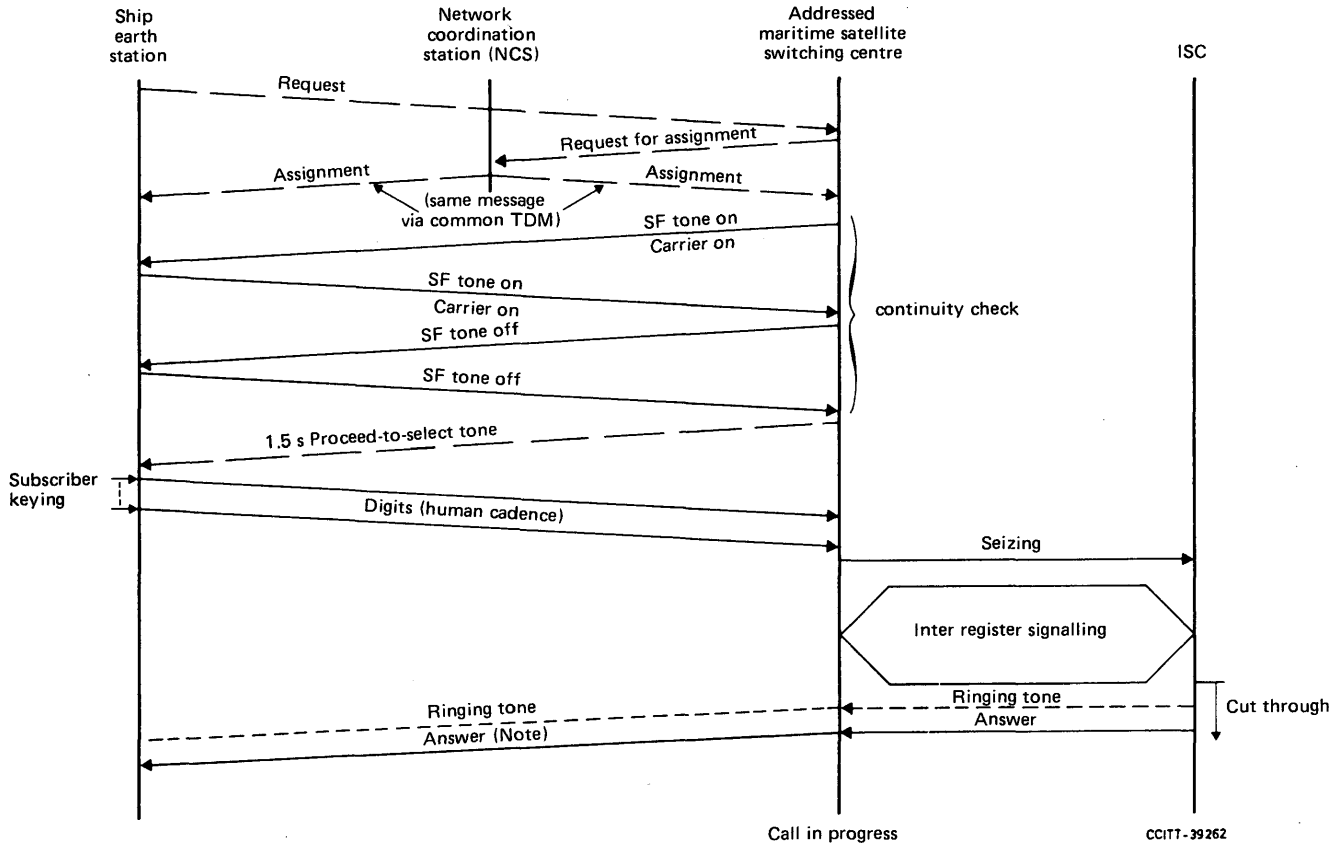
1) This is currently under study by INMARSAT.



Note - If implemented.

FIGURE A-2/Q.1101

Ship earth station originated calls

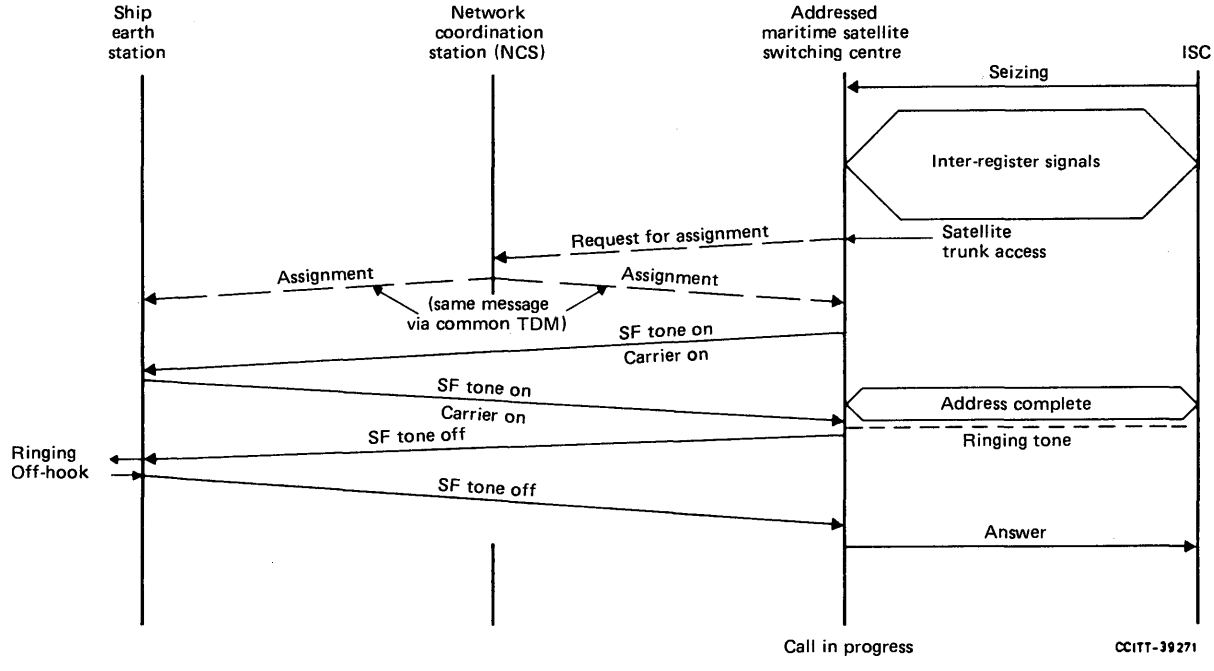


FIGURE A-3/Q.1101

Terrestrial originated automatic call

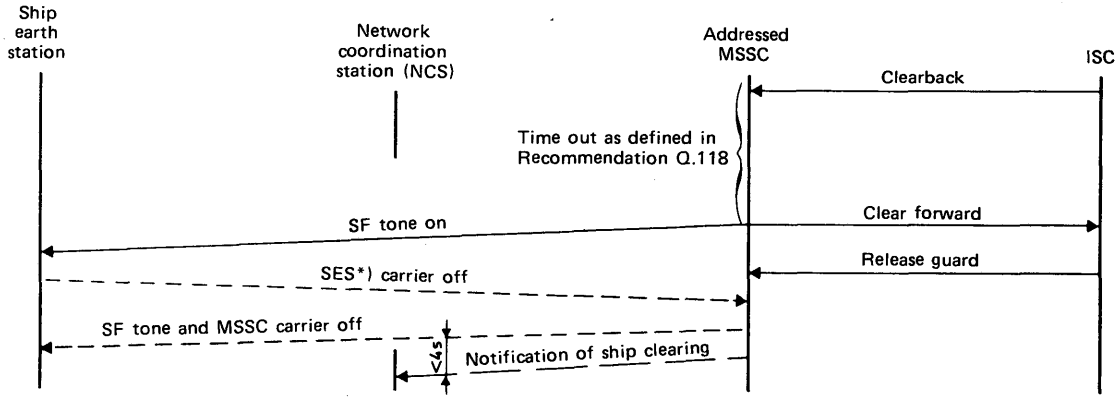
A.5 *Automatic clearing of calls*

Whether a telephone call originated from a ship earth station or from the terrestrial network, the MSSC, upon receiving a clear-forward signal, will begin to clear the call independently in each direction.

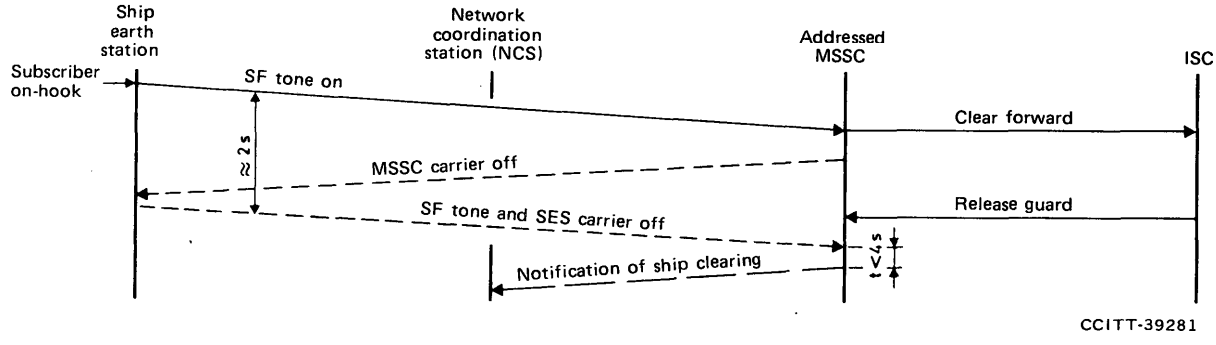
The MSSC, receiving a 2600 Hz clearing tone from a ship earth station will initiate clearing toward the terrestrial network in accordance with procedures defined for the signalling system used between the MSSC and the ISC. This applies to both clear-forward and clear-back from the ship earth station. Clearing will also be continued in the maritime satellite system independent of the terrestrial network.

Clearing initiated in the terrestrial network would be recognized by the MSSC receiving the appropiate clear-back or clear-forward signal. For clear-forward, the MSSC would continue clearing with normal terrestrial procedures and begin clearing the maritime satellite circuit. For clear-back from the terrestrial network, normal time-out supervision will take place and clear-forward will commence either after expiry of time-out or after receipt of a clear-forward from the ship, whichever happens first.

As examples of clearing sequences, Figure A-4/Q.1101 illustrates the clearing of a ship earth station originated call and Figure A-5/Q.1101 illustrates the clearing of a call originated in the terrestrial network. For a terrestrial originated call which has clearing initiated by the ship earth station, the satellite circuit is cleared after the MSSC recognizes the stopping of the ship earth station carrier. The terrestrial circuit is held until the end of release guard sequence as shown in Figure A-5/Q.1101.



a) Clear-back from terrestrial network; clearing by MSSC on time-out



b) Clearing by ship earth station

SES = Ship earth station

FIGURE A-4/Q.1101

Clearing sequences for ship earth station originated calls

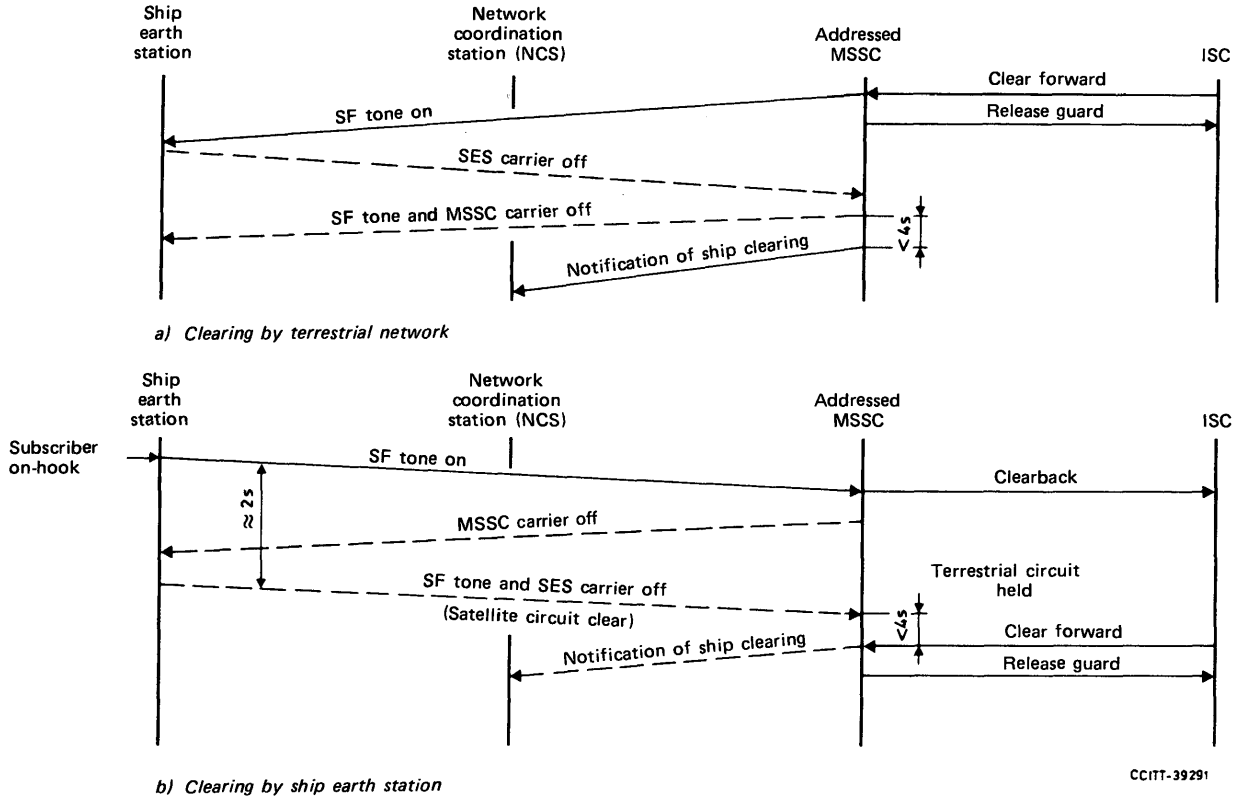


FIGURE A-5/Q.1101

Clearing sequences for terrestrial originated calls

ANNEX B

(to Recommendation Q.1101)

Logic procedures for incoming INMARSAT Standard A signalling system (ship originated call)

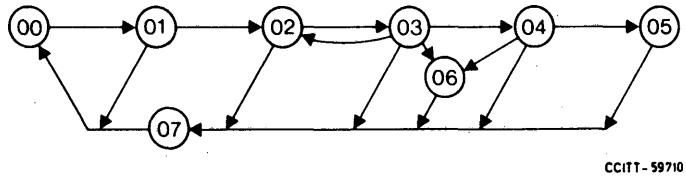
This annex only includes those elements of the Standard A INMARSAT system which have to be implemented for interworking purposes.

Internal procedures such as those required for setting-up and clearing of the satellite link are not shown. They are only indicated by task symbols.

Other procedures not shown are:

- interruption control procedures related to the satellite link:
- pre-emption procedures for assigning channels to distress call.

For more details on the first generation INMARSAT Standard A signalling system, see Annex A.



State number	*State description*	*Sheet reference*	*Timers running*
00	Idle	1	
01	Wait for continuity	1	
02	Wait for digits	1	t_1
03	Wait for result of digit analysis	2	t_1
04	Wait for call set-up	2	t_1
05	Connected	2	
06	Wait for clear-forward	2	t_2
07	Wait for clearing	1	

FIGURE B-1/Q.1101

State overview diagrams for incoming INMARSAT Standard A signalling system

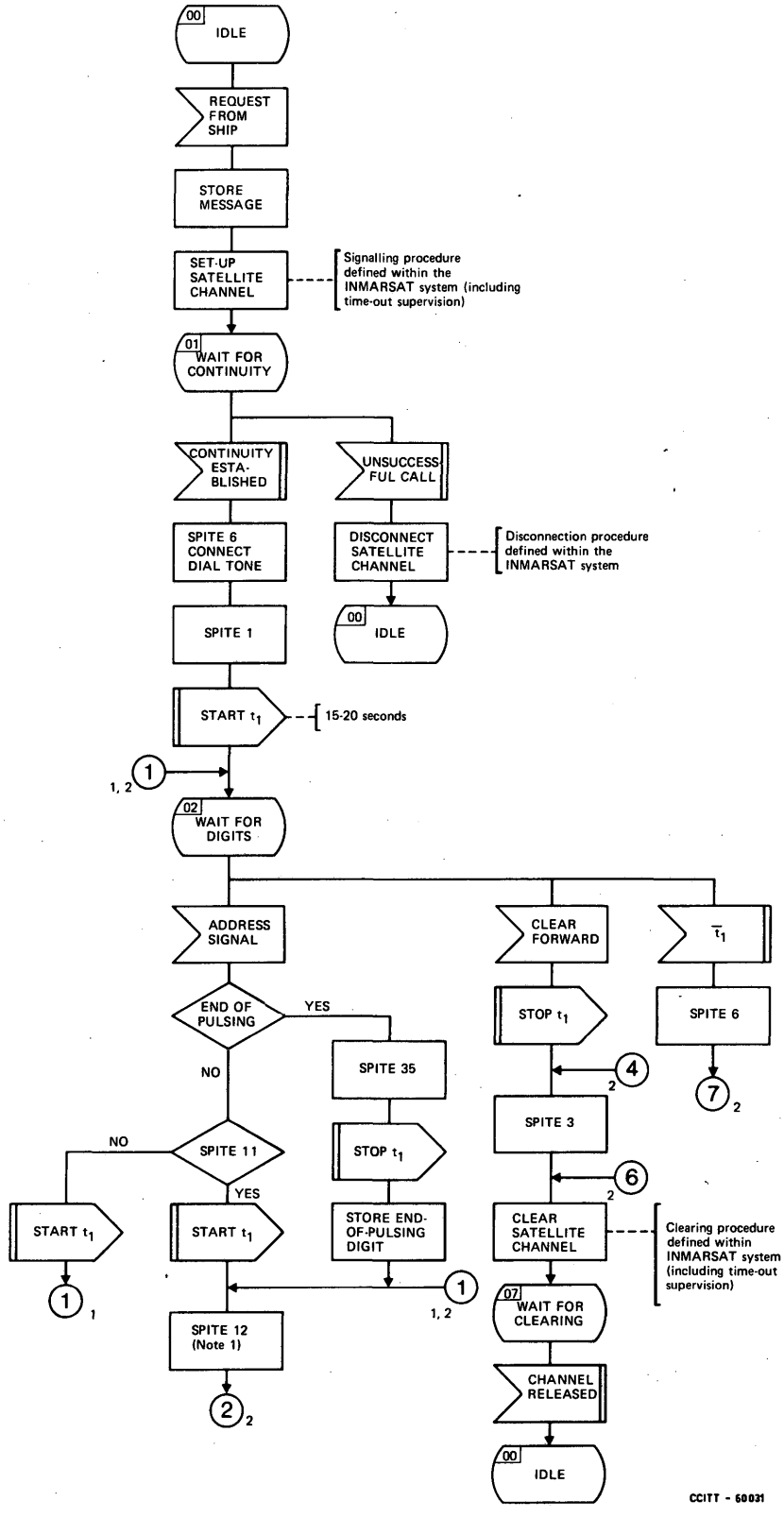
Supervisory timers for incoming INMARSAT Standard A signalling system

t_1 = 15-20 seconds

t_2 = 20-30 seconds

FIGURE B-2/Q.1101

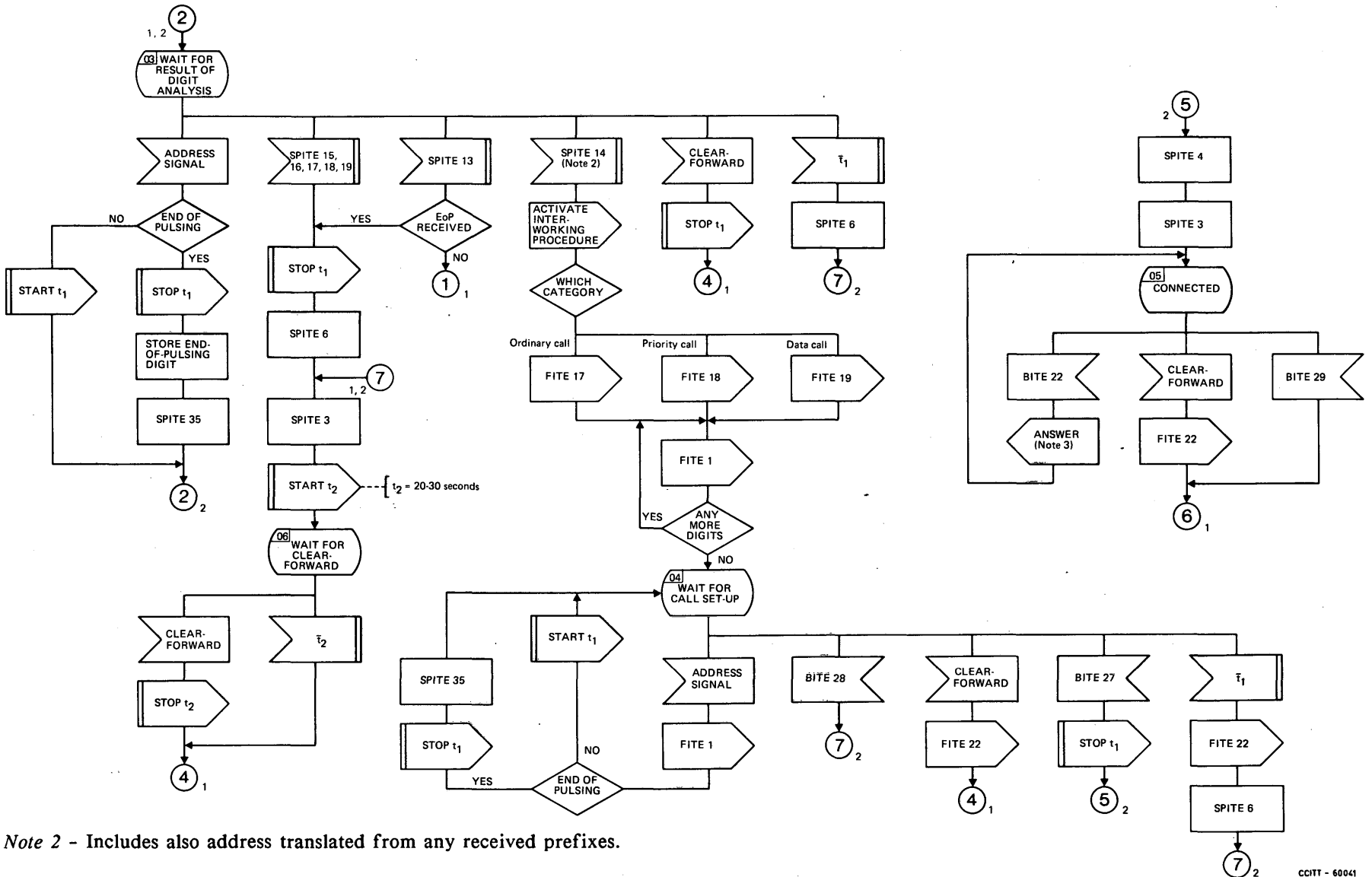
Notes to incoming INMARSAT Standard A signalling system



Note 1 - Includes also translation of prefixes to the appropriate destination number.

FIGURE B-3/Q.1101
(sheet 1 of 2)

Incoming INMARSAT Standard A signalling system



Note 2 - Includes also address translated from any received prefixes.

Note 3 - If implemented.

FIGURE B-3/Q.1101
(sheet 2 of 2)

Incoming INMARSAT Standard A signalling system

ANNEX C

(to Recommendation Q.1101)

Logic procedures for outgoing INMARSAT Standard A signalling system (shore originated call)

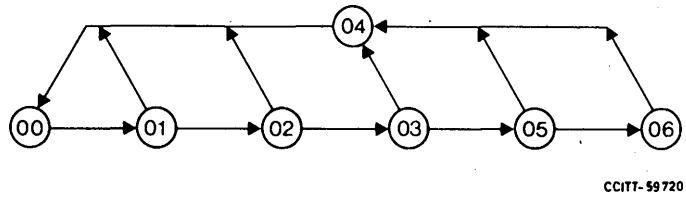
This annex only includes those elements of the INMARSAT Standard A system which have to be implemented for interworking purposes.

Internal procedures such as those required for setting-up and clearing of the satellite link are not shown. They are only included by task symbols.

Other procedures not shown are:

- interruption control procedures related to the satellite link;
- pre-emption procedures for assigning channels to distress calls.

For more details on the first generation INMARSAT Standard A signalling system, see Annex A.



State number	*State description*	*Sheet reference*
00	Idle	1
01	Wait for CPCI Fite	1
02	Wait for Fite 1	1
03	Wait for continuity	1
04	Wait for clearing	1
05	Wait for answer	1
06	Answered	1

FIGURE C-1/Q.1101

State overview diagram for outgoing INMARSAT Standard A signalling system

FIGURE C-2/Q.1101

(Reserved for future notes)

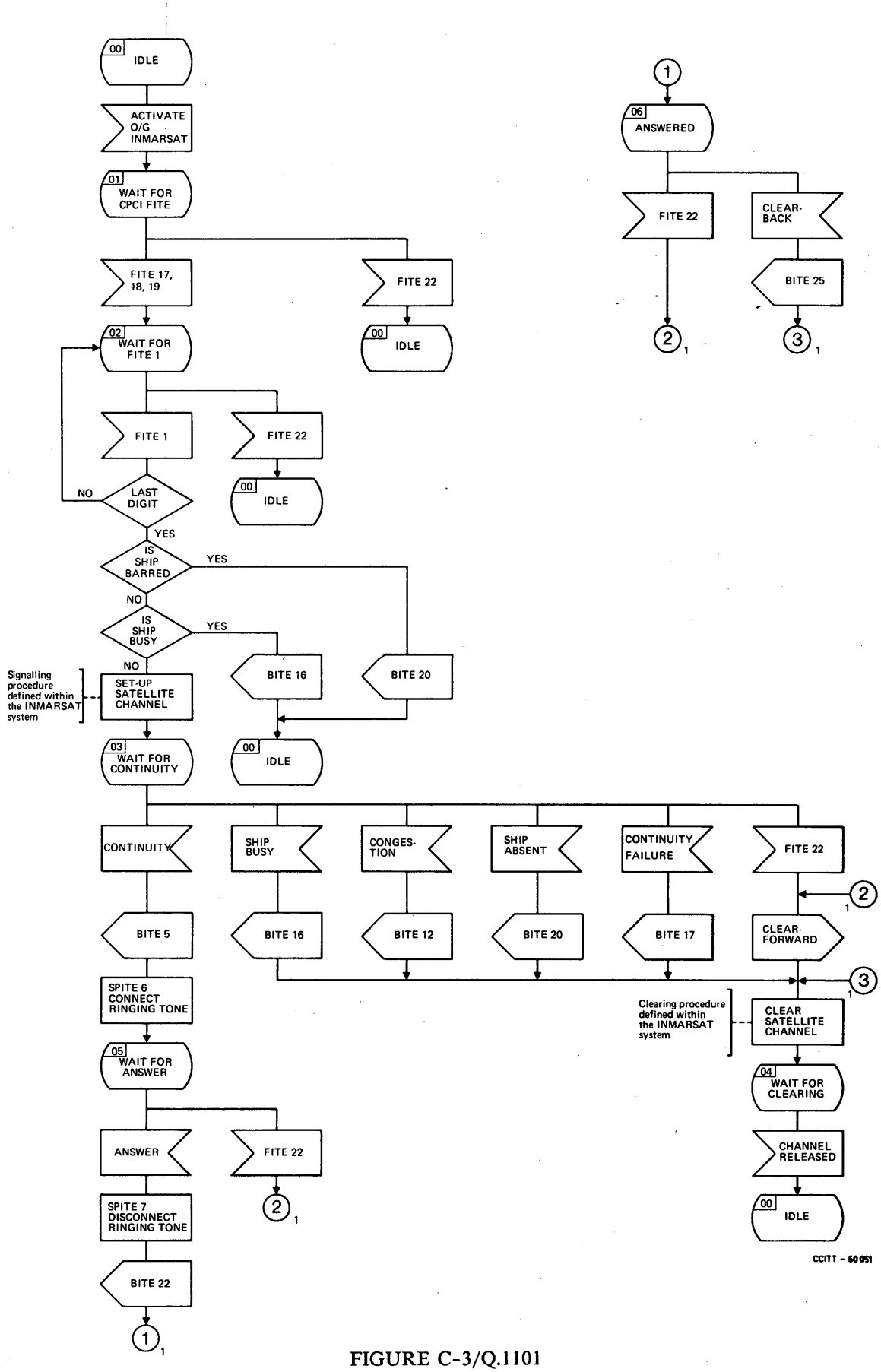


FIGURE C-3/Q.1101

Outgoing INMARSAT Standard A signalling system

References

[1] Radio Regulations (Article 1, No. 71), ITU, Geneva, 1982.

[2] *Ibid.*, (Article 1, No. 73).

Recommendation Q.1102

INTERWORKING BETWEEN SIGNALLING SYSTEM R2 AND INMARSAT STANDARD A SYSTEM

1 Introduction

It is necessary to specify the interworking of Signalling System R2 and the signalling systems used in the INMARSAT Standard A system. This is because:

a) it may be desirable that a Maritime Satellite Switching Centre (MSSC)[1)] be connected to an international switching centre (ISC) by employing System R2 on the circuits between the MSSC and the ISC;

b) the signalling system used in the Maritime Mobile-Satellite Service will be different from System R2. Therefore it would be necessary to establish rules by which signalling events in one system may be related to corresponding events in the other system.

It is desirable that the interworking be such that the full capability of both System R2 and the maritime satellite signalling system be utilized.

This Recommendation considers only automatic interworking between the MSSC and an ISC utilizing either the analogue or digital versions of System R2 signalling.

For description of the INMARSAT Standard A signalling system, see annex A to Recommendation Q.1101.

2 Calls from Signalling System R2 to the maritime satellite system (see figure 1/Q.1102)

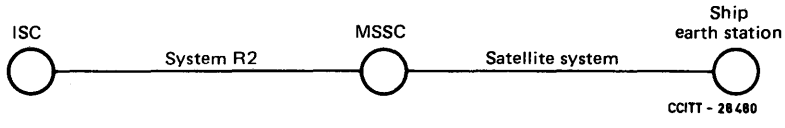


FIGURE 1/Q.1102

2.1 The ISC sends the seizing signal followed by either of the following sequences of address signals:

2.1.1 Signal I-10 or a language digit when the country code 87S is not required for routing in the MSSC. At the MSSC this signal should be acknowledged by the signal A-5 in order to obtain the calling subscriber's category (Group II signal). The Group II signal is acknowledged at the MSSC by A-1. The ISC then continues to send further address signals which are acknowledged in compelled cycles with A-1 at the MSSC.

2.1.2 The country code indicator when the country code 87S is required for routing in the MSSC.

One of the following signals can be used as country code indicator:

- Signal I-11 when the MSSC has to insert an outgoing half-echo suppressor;
- Signal I-14 when an outgoing half-echo suppressor has been inserted.

---

1) For definition, see Recommendation Q.1101.

At the MSSC this signal should be acknowledged by the signal A-5 in order to obtain the calling subscriber's category (Group II signal). The Group II signal is acknowledged at the MSSC by A-1. The ISC continues to send the country code digits and further address signals which are acknowledged in compelled cycles with A-1 at the MSSC.

2.1.3 Any numerical (or address) signal of the above sequences may be acknowledged by the signals A-3 or A-4:

- A-4 if congestion or abnormal release occurs in the MSSC;
- A-3 may, for example, be used in order to indicate to the ISC barring of unauthorized group calls. Such calls are identified from the first digit following the discriminating digit. The appropriate Group B signal would in this case be B-2.

  This use of A-3 is only possible if analysis of the discriminating (or language) digit and the first digit of the subscriber number takes place before the whole number has been received by the MSSC. If this is not the case, the procedure of § 2.2 should be followed.

2.2 When the last address signal has been received at the MSSC, and number analysis has been completed, one of the following events leading to unsuccessful call completion may occur:

- The called ship earth station is excluded from participating in the system, the number of the called terminal has been changed or the received number is an unauthorized group call number (see also § 2.1.3 above). In these cases the MSSC shall send the A-3 signal followed by B-2 after the Group II signal has been received from the ISC.
- The NCS/MSSC is out of service. In this case the A-4 signal is sent, or the A-3 signal followed by B-4 after receipt of the Group II signal.
- The received number does not belong to any ship earth station. In this case the A-3 signal is sent followed by B-5 after receipt of the Group II signal.

2.3 If the received number is valid, the MSSC sends A-1 as an acknowledgement to the last digit (or the end-of-pulsing signal I-15) in order to suspend the compelled signalling.

2.4 The MSSC sends a *Request-for-Assignment* message to the Network Coordination Station (NCS) in order to obtain a satellite channel (see Annex A to Recommendation Q.1101).

"If no reply to this request is received within 4 seconds (or 8 seconds if the request is repeated by the MSSC) or, if a congestion message is received from the NCS, the MSSC sends the pulsed A-4 signal or the A-3 signal followed by B-4 after receipt of the Group II signal."

If a *Ship busy* message is received, the MSSC sends the pulsed A-3 signal followed by the B-3 signal after recognition of the forward Group II signal.

If an *Assignment* message is received from the NCS, the MSSC connects the continuity tone on the assigned satellite channel. If a continuity tone is received from the ship earth station within 10 seconds, the MSSC sends the pulsed A-3 signal followed by the B-6 signal after recognition of the forward Group II signal.

The continuity check may fail in two ways:

- no radio carrier is received from the ship earth station within 10 seconds (e.g. the ship is outside the satellite coverage area), or
- a radio carrier but no continuity tone is received from the ship earth station within 10 seconds.

The MSSC sends the pulsed A-3 signal followed by B-2 or B-8 respectively after recognition of the forward Group II signal.

2.5 When the MSSC detects the answer signal from the ship earth station, the MSSC must send the answer signal as soon as possible to the ISC.

2.6 When the MSSC detects the clear forward from the terrestrial network, the terrestrial circuit and the satellite link will clear down according to their respective specifications. If, however,

switching at the MSSC is achieved by direct frequency selection then it will be necessary to delay the release-guard on the terrestrial link until the satellite link is idle.

2.7 The MSSC should send the clear-back signal into the terrestrial network when clear-back is detected on the satellite link. The satellite link will be released so that the provisions of Recommendation Q.118 do not apply for this part of the connection.

2.8 For the SDL description of incoming Signalling System R2, see Recommendation Q.616 [1].

2.9 For the SDL description of interworking between incoming Signalling System R2 and the outgoing INMARSAT signalling system see Annex A.

2.10 For SDL description of outgoing INMARSAT signalling system, see Annex C to Recommendation Q.1101.

3 Calls from the maritime satellite system to Signalling System R2 (see figure 2/Q.1102)

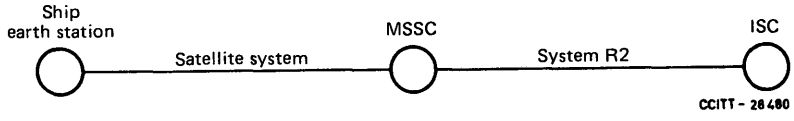


FIGURE 2/Q.1102)

3.1 The MSSC should not seize a terrestrial circuit before each of the following conditions have been met:

- the satellite channel has been assigned;
- the continuity of the satellite channel has been verified;
- all digits necessary for routing decisions by the MSSC have been received.

3.2 The first register signal to be sent by the MSSC is:

- the discriminating digit I-10 if the call is destined for a country whose ISC has direct connections to the MSSC;
- the country code indicator I-14 if the call is destined for another country and the incoming half-echo suppressor is to be inserted at a later ISC;
- the country code indicator I-12 if the call is destined for another country and the incoming half-echo suppressor can only be inserted at the MSSC.

3.3 The MSSC must respond to Group A or Group B signals in accordance with current Signalling System R2 specifications.

The following special requirements should however be taken into account:

- If the signal A-14 is received from the ISC, the MSSC must either forward I-14 in order to indicate that an incoming half-echo suppressor is required, or forward the next address signal where the MSSC has already inserted an incoming half-echo suppressor.
- If the signal A-3 or A-5 is received from the ISC, the MSSC should send the II-7 signal (for the time being no other category signal would be required).

The signals A-3, A-5 and A-14 may be received at any time during interregister signalling sequence.

If the signal A-11 is received from the ISC, the MSSC should send:

- I-14 to indicate that an incoming half-echo suppressor is required, or
- I-12 where the MSSC has already inserted an incoming half-echo suppressor.

If the signal A-12 is received, the next signal shall be the discriminating digit (I-10).

The MSSC should be capable of responding to signal A-13 with the signal A-14 in order to indicate that a satellite link is included (see Recommendation Q.480 [2]).

3.4 The end of pulsing signal I-15 should be sent by the MSSC, if required and requested, if the equivalent end-of-pulsing signal is received from the ship earth station.

3.5 The tones sent by the MSSC to the ship earth station in response to Group B signals received from the terrestrial network should comply with Recommendation Q.474 [3]. The characteristics of the tones are given in Recommendation Q.1101.

3.6 Time-out supervision on the answer signal at the MSSC should comply with the provisions given in Recommendation Q.118, § 4.3.1.

3.7 If the MSSC receives a clear-back signal from the terrestrial network, the time-out of Recommendation Q.118, § 4.3.2 shall be started. The satellite and terrestrial links will be cleared either by the ship earth station or by expiry of the 1-2 minute time-out.

3.8 When the MSSC detects a release condition on the satellite link, the terrestrial connection should be cleared forward as soon as possible.

3.9 For the SDL description of outgoing System R2, see Recommendation Q.626 [4].

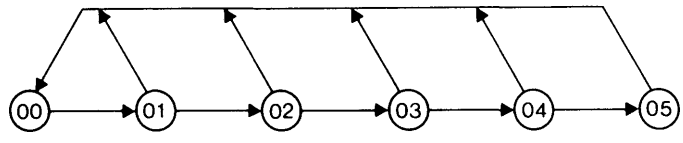
3.10 The SDL description of the interworking between incoming INMARSAT Standard A signalling system and outgoing System R2 is given in Annex B.

3.11 For the SDL description of incoming INMARSAT Standard A signalling system, see Annex B to Recommendation Q.1101.

ANNEX A

(to Recommendation Q.1102)

Logic procedures for interworking of Signalling System R2 to the INMARSAT Standard A signalling system



State number	*State description*	*Sheet reference*
00	Idle	1
01	Wait for CPCI Fite	1
02	Wait for digits	1
03	Wait for Bite 5	1
04	Wait for answer	1
05	Answered	1

FIGURE A-1/Q.1102

State overview diagram for interworking of Signalling System R2 to the INMARSAT Standard A signalling system

FIGURE A-2/Q.1102

(Reserved for future notes)

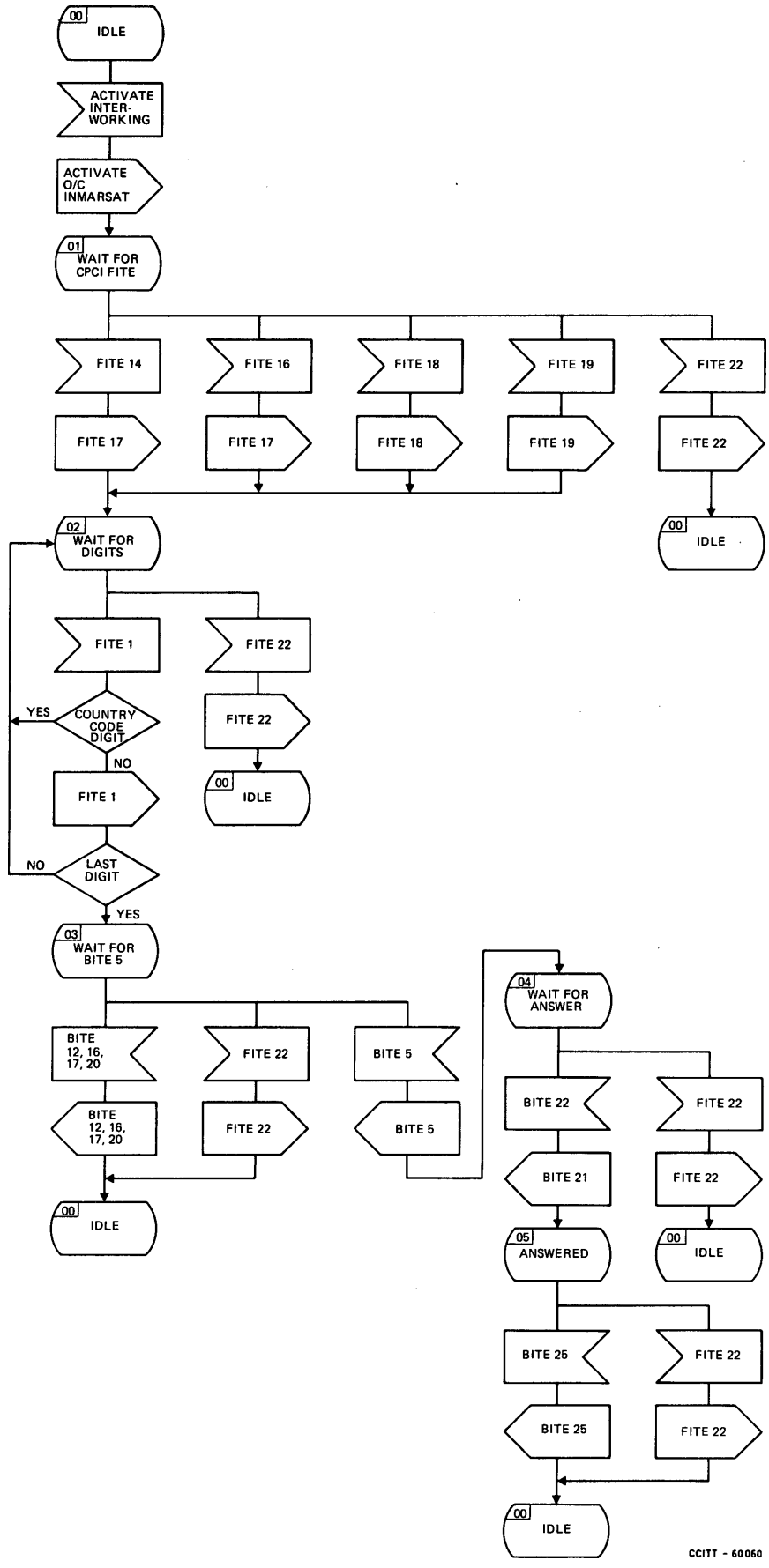


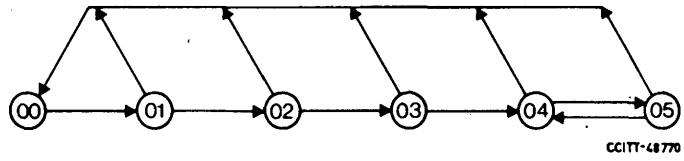
FIGURE A-3/Q.1102

Interworking of Signalling System R2 to the INMARSAT Standard A signalling system

ANNEX B

(to Recommendation Q.1102)

Logic procedures for interworking of the INMARSAT Standard A signalling system to Signalling System R2



State number	*State description*	*Sheet reference*	*Timers running*
00	Idle	1, 2	
01	Wait for CPCI Fite	1	
02	Wait for address complete	2	
03	Wait for answer	2	t_1
04	Answered	2	
05	Clear-back	2	t_2

FIGURE B-1/Q.1102

State overview diagram for interworking of the INMARSAT Standard A signalling system to Signalling system R2

Supervisory timers for interworking of the INMARSAT Standard A signalling system to Signalling System R2

t_1 = 2-4 minutes Recommendation Q.118, § 4.3.1

t_2 = 1-2 minutes Recommendation Q.118, § 4.3.2

FIGURE B-2/Q.1102

Notes to interworking of the INMARSAT Standard A signalling system to Signalling System R2

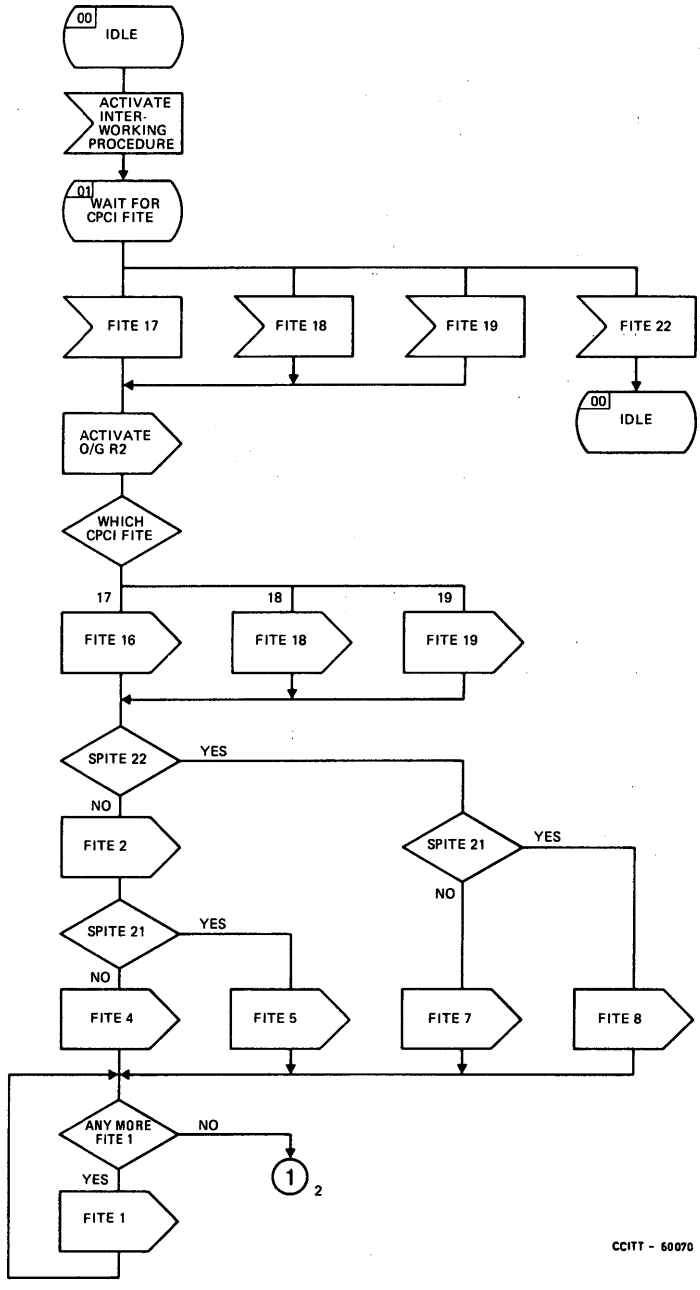


FIGURE B-3/Q.1102 (sheet 1 of 2)

Interworking of the INMARSAT Standard A signalling system to Signalling System R2

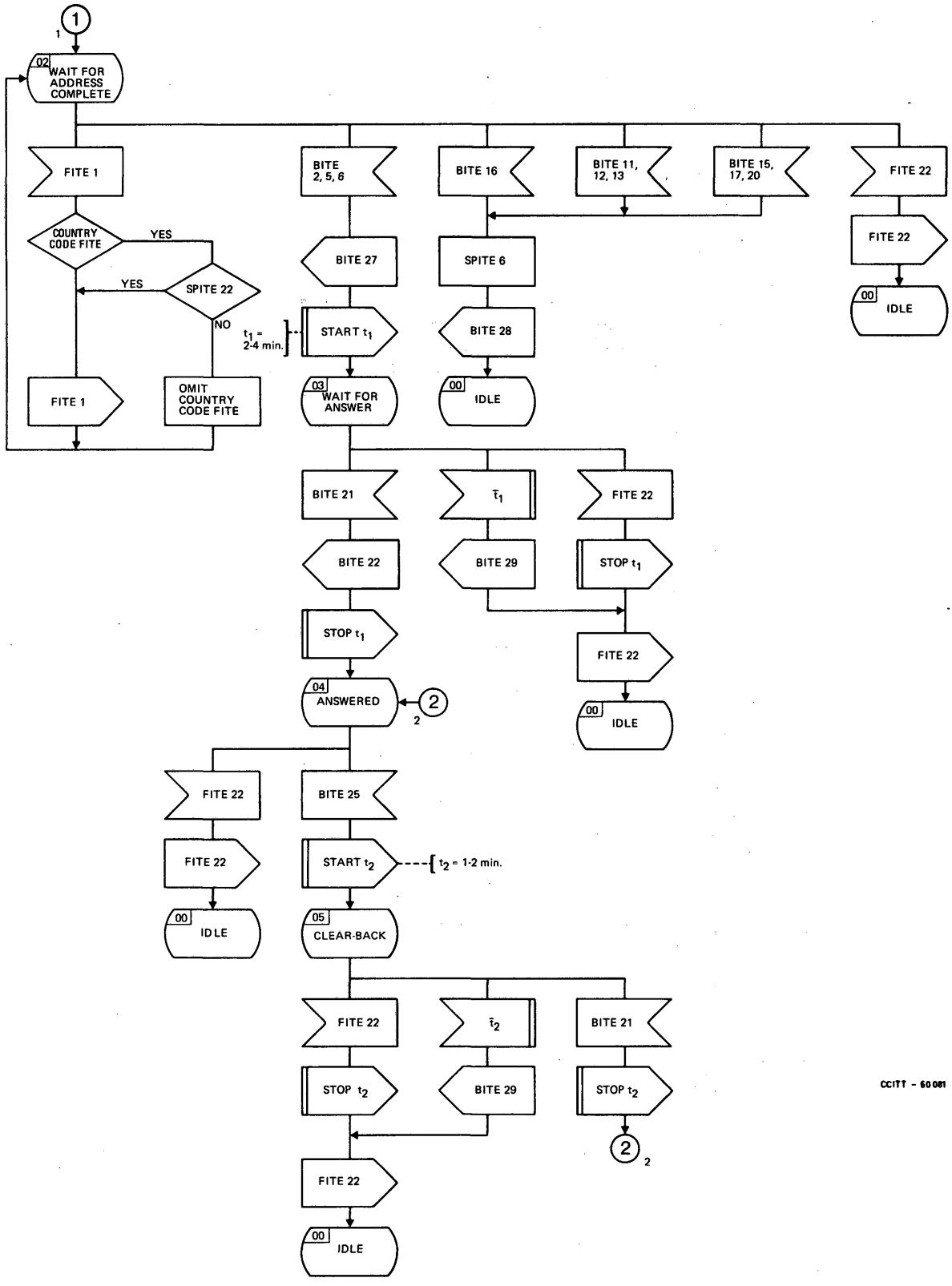


FIGURE B-3/Q.1102 (Sheet 2 of 2)

Interworking of the INMARSAT Standard A signalling system to Signalling System R2

References

[1] CCITT Recommendation *Logic procedures for incoming Signalling System R2*, Vol. VI, Rec. Q.616.

[2] CCITT Recommendation *Miscellaneous procedures*, Vol. VI, Rec. Q.480.

[3] CCITT Recommendation *Use of group B signals*, Vol. VI, Rec. Q.474.

[4] CCITT Recommendation *Logic procedures for outgoing Signalling System R2*, Vol. VI, Rec. Q.626.

Recommendation Q.1103

INTERWORKING BETWEEN SIGNALLING SYSTEM No. 5 AND INMARSAT STANDARD A SYSTEM

1 Introduction

It is necessary to specify the interworking of Signalling System No. 5 and the signalling system used in the INMARSAT Standard A system. This is because:

a) it may be desirable that a Maritime Satellite Switching Centre (MSSC)[1)] be connected to an international switching centre (ISC) by employing System No. 5 on circuits between the MSSC and the ISC;

b) the signalling systems used in the Maritime Mobile-Satellite Service will be different from System No. 5. Therefore it would be necessary to establish rules by which signalling events in one system may be related to corresponding events in the other system.

It is desirable that the interworking be such that the full capability of both System No. 5 and the maritime satellite signalling system can be utilized.

This Recommendation considers only automatic interworking between the MSSC and an ISC utilizing System No. 5.

For description of the INMARSAT Standard A signalling system, see Annex A to Recommendation Q.1101.

2 Calls from Signalling System No. 5 to the maritime system (see figure 1/Q.1103)

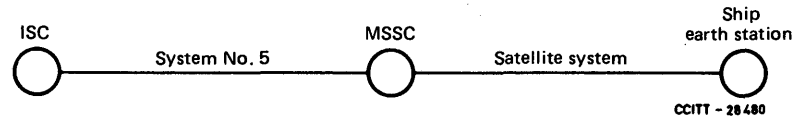


FIGURE 1/Q.1103

2.1 The ISC sends the seizing signal followed by either of the following sequences of address signals:

2.1.1 Signal KP1 followed by the discriminating (or language) digit and the number of the wanted ship earth station when the country code 87S is not required for routing in the MSSC.

2.1.2 Signal KP2 followed by 87S, discriminating (or language) digit and the number of the wanted ship earth station when the country code is required for routing in the MSSC.

2.2 The MSSC register should ignore further digits when either:

a) the ST signal has been received by the MSSC, or

b) the busy-flash signal has been sent by the MSSC.

2.3 The answer signal should be sent in the backward direction as soon as the answer signal over the satellite link has been detected.

---

1) For definition, see Recommendation Q.1101.

2.4 The busy-flash signal should be sent if the call cannot be completed for any of the following reasons:

a) congestion at the MSSC or in the maritime satellite system;

b) the satellite channel has not been assigned within 20 seconds of the receipt of the ST signal;

c) the NCS/MSSC is out of service.

2.5 If the called ship earth station is busy, then the MSSC may either return the busy tone or the busy-flash signal.

2.6 The special information tone should be sent if the call cannot be completed for any of the following reasons:

a) the ship earth station does not respond to the call;

b) the called ship earth station is excluded from participating in the service;

c) the received number does not belong to any ship earth station;

d) the received number is an unauthorized group call;

e) the called ship earth station is faulty;

f) continuity of the satellite link is not established.

2.7 When a clear-back signal is detected on the satellite link, this signal shall result in sending of the clear-back signal on the terrestrial connection. The satellite link should be released so that the provisions of Recommendation Q.118 do not apply for this part of the connection.

2.8 When the MSSC detects the clear-forward from the terrestrial network, the terrestrial and satellite links will clear down according to their respective specification. If, however, switching at the MSSC is achieved by direct frequency selection, then it will be necessary to delay the release guard on the terrestrial link until the satellite link is idle.

2.9 For the SDL description of incoming System No. 5, see Recommendation Q.612 [1].

2.10 The SDL description of interworking between incoming System No. 5 and outgoing INMARSAT signalling system is given in annex A.

2.11 For the SDL description of outgoing INMARSAT signalling system, see Annex C to Recommendation Q.1101.

3 Calls from the maritime satellite system to Signalling System No. 5 (see figure 2/Q.1103)

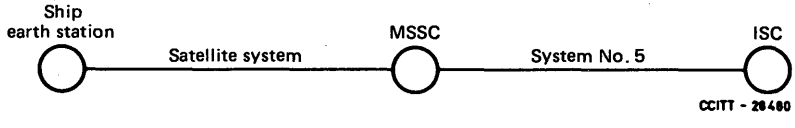


FIGURE 2/Q.1103

3.1 The terrestrial circuit should not be seized before a satellite channel has been allocated, the continuity of the channel has been verified, and all digits have been received.

3.2 The KP signal should be used subject to the following conditions:

a) KP1 if the call is terminated in the MSSC country (in this case the country code is suppressed) or in another country having direct connection to the MSSC;

b) KP2 if the call is transit connected to another country.

3.3 The discriminating digit should be inserted according to [2].

3.4 The ST signal should be sent according to [3].

3.5 The congestion tone should be sent to the ship earth station when the busy-flash signal is received.

3.6 Time-out supervision of the answer signal at the MSSC should comply with the provisions of Recommendation Q.118, § 4.3.1.

3.7 If the MSSC receives a clear-back signal from the terrestrial network, the time-out of Recommendation Q.118, § 4.3.2 shall be started. The satellite and terrestrial links will be cleared either by the ship earth station or by expiry of the 1-2 minutes time-out.

3.8 When the MSSC detects a release condition on the satellite link, the terrestrial connection should be cleared forward as soon as possible.

3.9 For the SDL description of outgoing System No. 5, see Recommendation Q.622 [4].

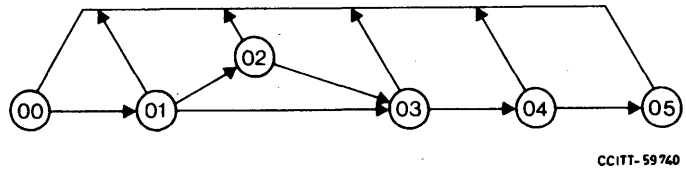
3.10 The SDL description of interworking between incoming INMARSAT Standard A signalling system and outgoing System No. 5 is given in Annex B.

3.11 For the SDL description of incoming INMARSAT signalling system, see Annex B to Recommendation Q.1101.

ANNEX A

(to Recommendation Q.1103)

Logic procedures for interworking of Signalling System No. 5 to the INMARSAT Standard A signalling system



State number	*State description*	*Sheet reference*
00	Idle	1
01	Wait for CPCI Fite	1
02	Wait for ST signal	1
03	Wait for address complete	1
04	Wait for answer	1
05	Answered	1

FIGURE A-1/Q.1103

State overview diagram for interworking of Signalling System No. 5 to the INMARSAT Standard A signalling system

FIGURE A-2/Q.1103

(Reserved for future notes)

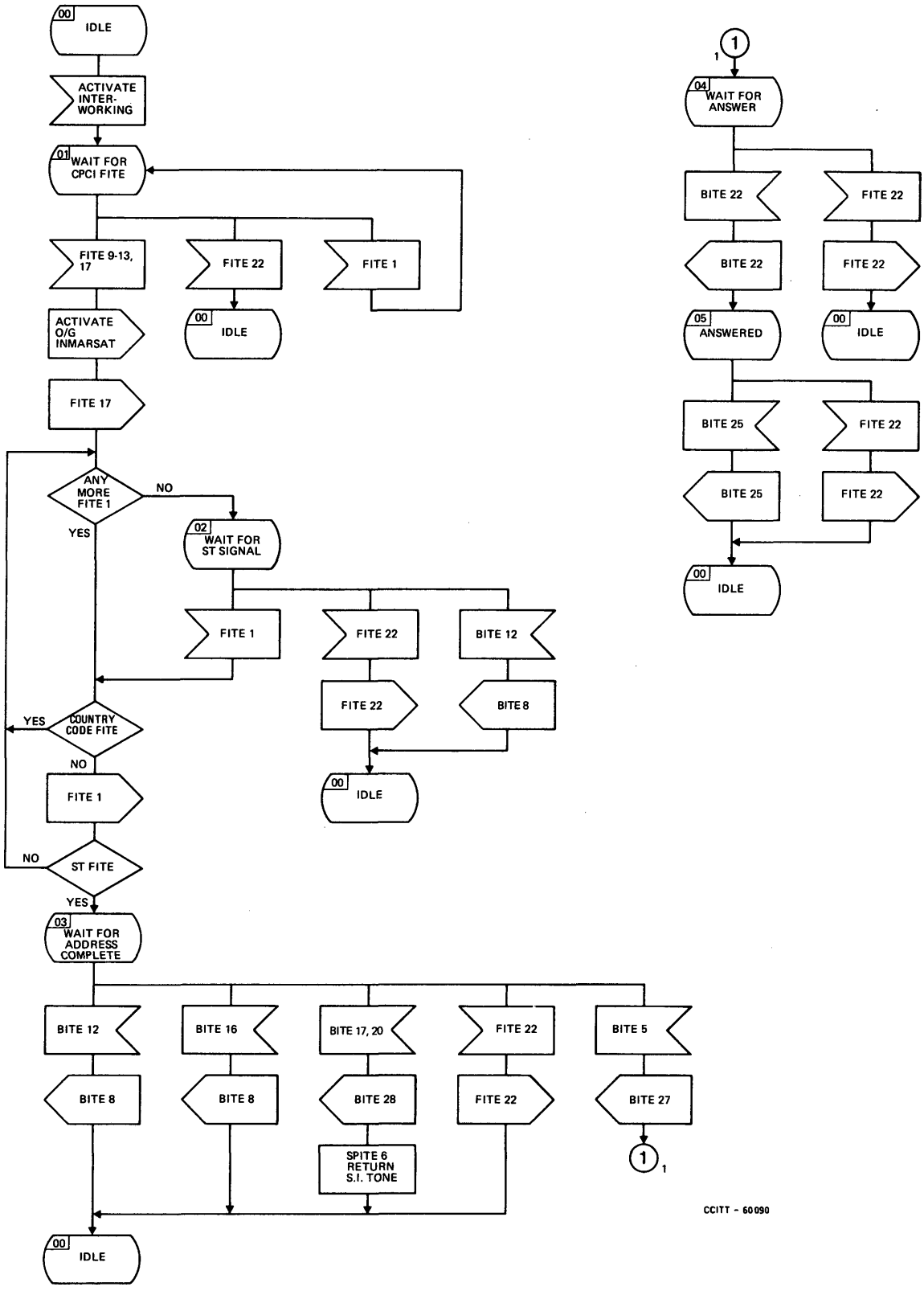


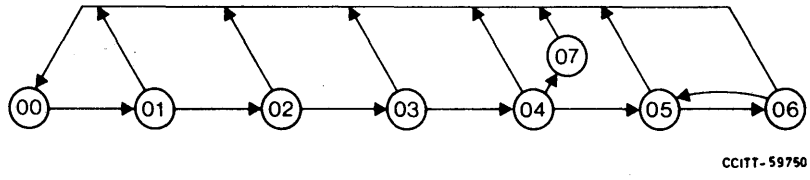
FIGURE A-3/Q.1103

Interworking of Signalling System No. 5 to the INMARSAT Standard A signalling system

ANNEX B

(to Recommendation Q.1103)

Logic procedures for interworking of the INMARSAT Standard A signalling system to the Signalling System No. 5



State number	*State description*	*Sheet reference*	*Timers running*
00	Idle	1, 2	
01	Wait for CPCI Fite	1	
02	Wait for address complete	2	
03	Wait for register deactivation	2	
04	Wait for answer	2	t_1
05	Answered	2	
06	Clear-back	2	t_2
07	Wait for clear forward	2	t_3

FIGURE B-1/Q.1103

State overview diagram for interworking of the INMARSAT Standard A signalling system to Signalling System No. 5

Supervisory timers for interworking of the INMARSAT Standard A signalling system to Signalling System No. 5

t_1 = 2-4 minutes Recommendation Q.118, § 4.3.1

t_2 = 1-2 minutes Recommendation Q.118, § 4.3.2

t_3 = 20 seconds

FIGURE B-2/Q.1103

Notes to interworking of the INMARSAT Standard A signalling system to Signalling System No. 5

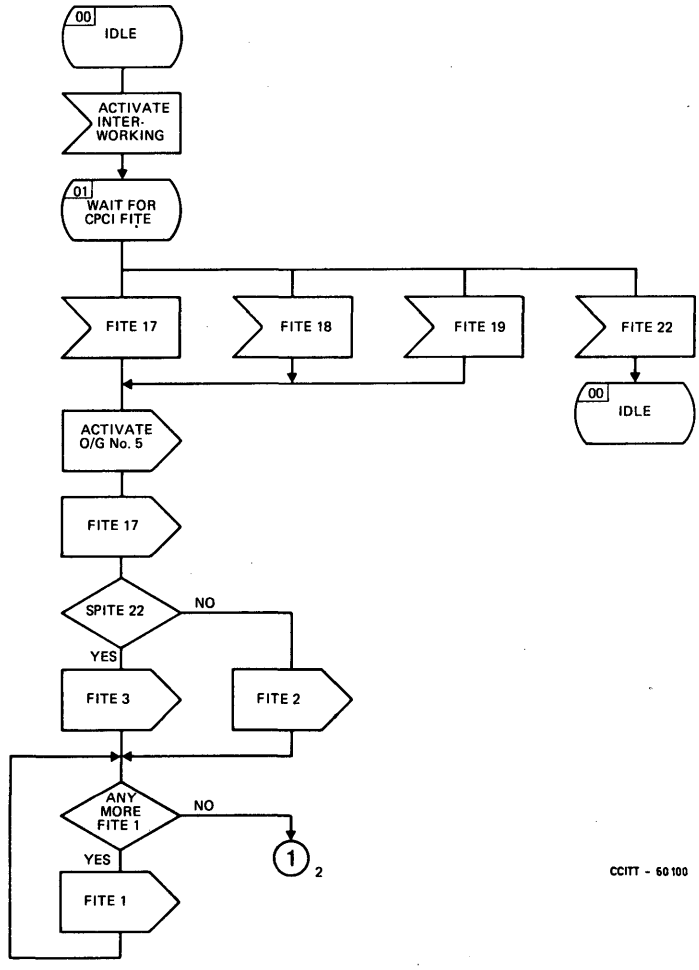


FIGURE B-3/Q.1103 (sheet 1 of 2)

Interworking of the INMARSAT Standard A signalling system to Signalling system No. 5

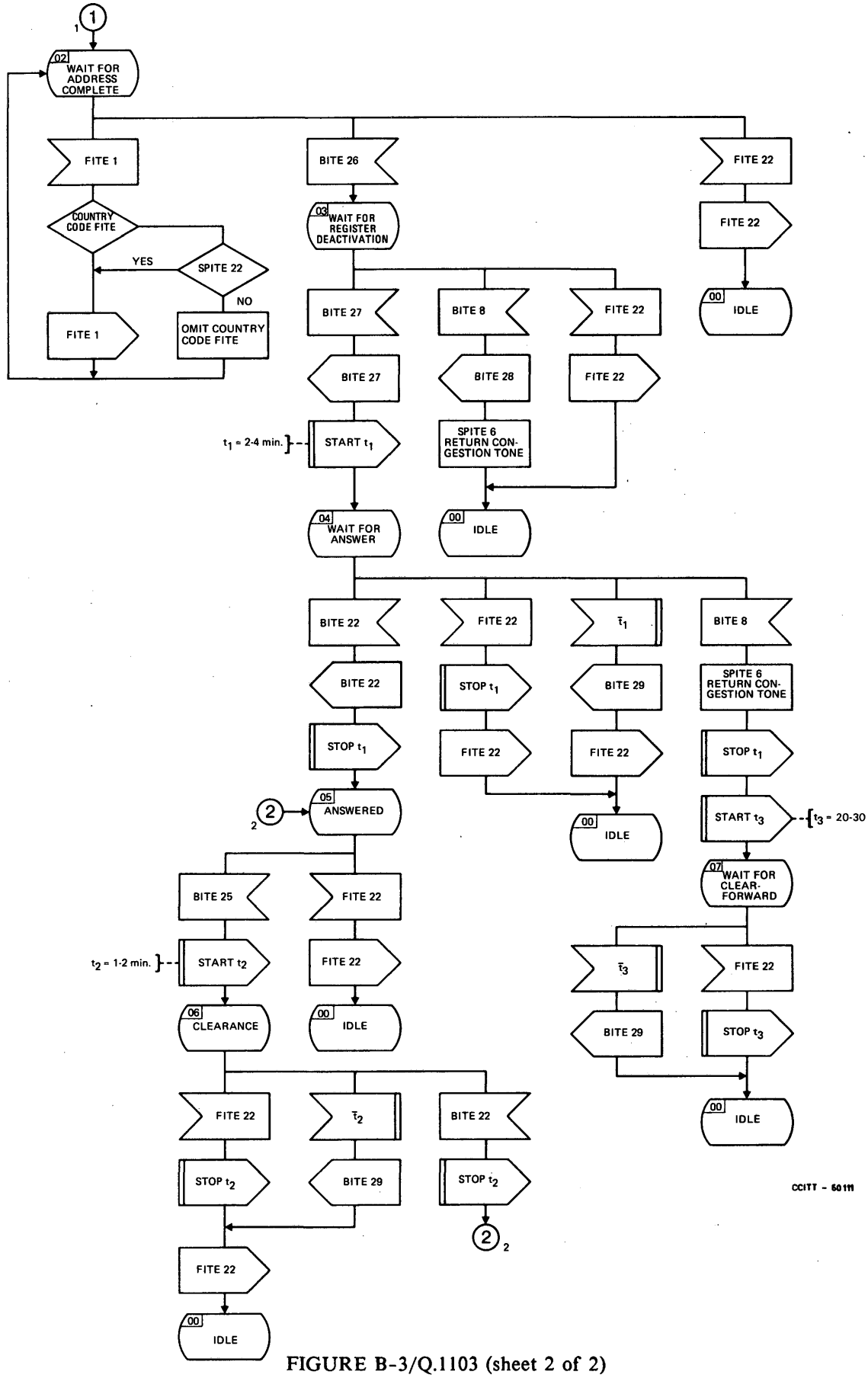


FIGURE B-3/Q.1103 (sheet 2 of 2)

Interworking of the INMARSAT Standard A signalling system to Signalling system No. 5

References

[1] CCITT Recommendation *Logic procedures for incoming Signalling System No. 5*, Vol. VI. Rec. Q.612.

[2] CCITT Recommendation *Analysis of digital information for routing*, Vol. VI, Rec. Q.155, § 3.4.5.

[3] CCITT Recommendation *End-of-pulsing conditions - Register arrangements concerning ST (end-of-pulsing) signal*, Vol. VI, Rec. Q.152, § 3.2.1, b), (2).

[4] CCITT Recommendation *Logic procedure for outgoing Signalling System No. 5*, Vol. VI, Rec. Q.622.

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SECTION 2

INTERWORKING WITH THE STANDARD B INMARSAT MARITIME SYSTEM

Recommendation Q.1111

INTERFACES BETWEEN THE INMARSAT STANDARD B SYSTEM AND THE INTERNATIONAL PUBLIC SWITCHED TELEPHONE NETWORK/ISDN

1 General

This Recommendation includes information on the services offered in the ISDN relevant to the Standard-B INMARSAT system and describes the requirements for connection and internetworking with the public networks. Special terminology for this Recommendation is defined in Recommendation Q.1100.

Detailed interworking procedures are set out in Recommendation Q.1112.

Note - Recommendations Q.1101, Q.1102 and Q.1103 define the interworking procedures for the Standard-A INMARSAT system.

1.2 In addition to providing the capability to interwork using common channel signalling techniques between the terrestrial ISDN and the Standard-B INMARSAT system, due regard should be paid to the open systems interconnection reference model (X.200-Series of Recommendations) and ISDN services and signalling methods (I-Series of Recommendations) with a view to achieving uniformity in user procedures and formats, and to achieving generally applicable facilities.

1.3 Within the constraint of the need to operate as economically as possible, the preferred interworking cases are with the ISDN and with those parts of the international telephone network employing common channel signalling. If these cases do not exist at the ISC to which an MSSC is connected then another signalling system from the Q-Series of Recommendations should be used.

1.4 The use of the ISDN for call connect purposes from the MSSC to the fixed user is expected to offer both improvements in quality and more flexibility in service. It will be possible to supply either voice, voice band data or digital data over the same user/network interface with the ability to change from one to the other under control of the ship earth station terminal.

2 Service capabilities

A general description of the INMARSAT Standard-B system is contained in Appendix I.

2.1 *Channel capabilities*

The system supports a range of channel capabilities as follows:

- single channel per carrier (SCPC) channels;

- time division multiplex/time division multiple access (TDM/TDMA) channels and random access (RA) channels with information bit rates of up to 16 kbit/s.

Further capabilities may be supported in the future, e.g. channels with information bit rates of up to 64 kbit/s. The services supported by each channel type are indicated in the following paragraphs.

2.2 *INMARSAT Standard-B bearer capabilities*

2.2.1 *SCPC channels*

The following bearer services on SCPC channels with an information transfer rate attribute of 16 kbit/s and with the following information transfer attributes corresponding to those defined in Recommendation I.211 should be supported:

a) *Speech at 16 kbit/s* and optionally at 9.6 kbit/s. (Transcoding to 64 kbit/s should take place at the MSSC);

b) *Circuit mode 3.1 kHz audio services at 16 kbit/s* (Transcoding to the circuit mode 64 kbit/s, 8 kHz structured bearer service, usable for 3.1 kHz audio information, of Recommendation I.211, should take place in the MSSC);

c) *Virtual call bearer service* at an information bit rate of 16 kbit/s or 9.6 kbit/s with rate adaptation in the MSSC to 64 kbit/s, e.g. using flow control and flag stuffing;

d) *Digital data, circuit mode* - Interworking with the ISDN should take place as defined in Recommendation X.30 for data terminals designed to Recommendation X.21, and Recommendation X.32 for data terminals designed to Recommendation X.25.

2.2.2 *TDM/TDMA channels*

The following bearer services on TDM/TDMA channels should be supported with information transfer rates of 0.05, 0.3 and 1.2 kbit/s:

a) *Telex* - Interworking with the ISDN should take place as defined in Recommendation U.202;

b) *Virtual call bearer service* - Interworking with the ISDN should take place as defined for interworking between PSPDNs and the ISDN;

c) *Digital data, circuit mode* - Interworking with the ISDN should take place as defined in Recommendation X.30 for data terminals designed to Recommendation X.21, and Recommendation X.32 for data terminals designed to Recommendation X.25;

Note - Adaptors designed to CCITT Recommendations may not support call setup for ship earth station terminating calls. This requires further study by INMARSAT.

d) *Digital data, asynchronous circuit mode, symmetric* - For further study by INMARSAT;

e) *Digital data, asynchronous circuit mode, asymmetric* - For further study by INMARSAT.

2.2.3 *RA channels*

The following bearer services on random access channels may be supported:

a) *Connectionless data service* - For further study by INMARSAT.

2.3 *Teleservices*

Teleservices should be supported as defined in Recommendation I.212. It is to be observed that not all teleservices of ISDN may be supported with bearer services that can be provided on SCPC or TDM/TDMA channels operating at net bit rates of 16 kbit/s or less.

3 Interworking scenarios

Three interworking scenarios can be envisaged for the interface between the MSSC and the fixed networks.

3.1 The first of these is shown in Figure 1/Q.1111. No interworking is envisaged between the MSSC and the ISDN, with the MSSC interfaced directly to the telex, public switched telephone and public data networks. In this scenario interworking with the PSTN supports speech and 3.1 kHz audio services.

3.2 Figure 2/Q.1111 shows the situation where an ISDN exists and the MSSC has an interface to it. Interworking with the PSTN is achieved via the ISDN. Interworking with PDN's may be by direct interface with the PDN or via the ISDN, as in the case of the PSTN. A direct interface will be required for interworking with the telex network.

In this scenario interworking with the ISDN supports speech, 3.1 kHz audio and data services as indicated in § 2.2.1. Other data services as indicated in §§ 2.2.2 and 2.2.3 may require interworking with PDNs.

3.3 In the fully integrated interworking scenario the MSSC interfaces only to the ISDN. This is the preferred scenario and is illustrated in Figure 3/Q.1111. Interworking with the PSTN and the PDNs is achieved via the ISDN interface. However, interworking with the telex network may require a direct interface between the MSSC and the telex network.

In this scenario also, data services as indicated in §§ 2.2.2 and 2.2.3 are converted to formats which correspond to bearer services in the ISDN. The MSSC may then contain adaptors with functions equivalent to those defined for the ISDN.

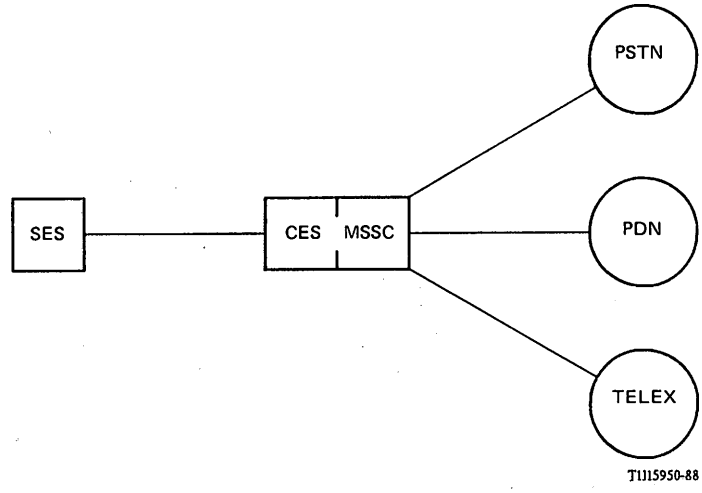


FIGURE 1/Q.1111

Interworking scenario with no ISDN interfaces

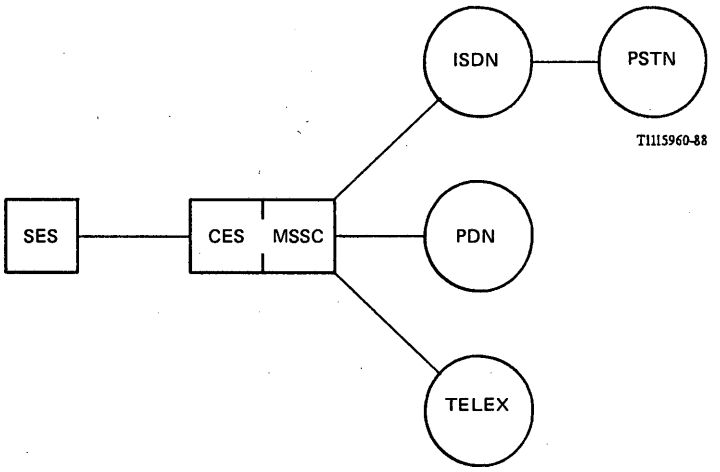


FIGURE 2/Q.1111

Interim interworking scenario with interfaces to ISDN and other fixed networks

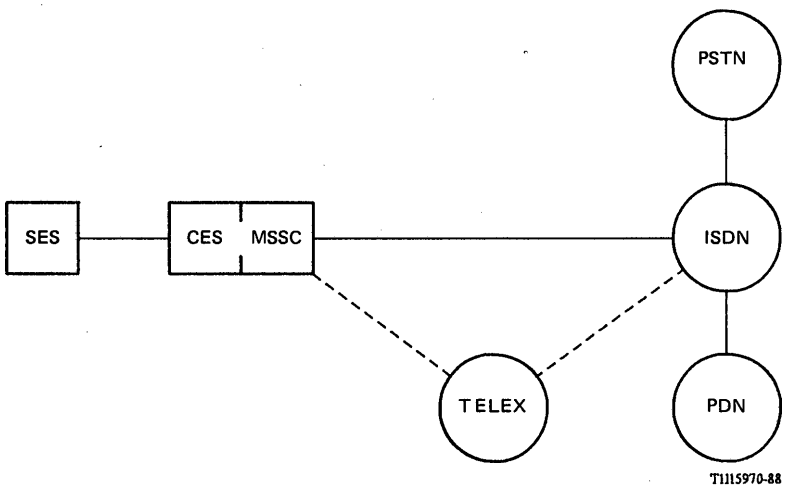


FIGURE 3/Q.1111

Interworking scenario with interface to ISDN only

4 Connection interface requirements

4.1 *General*

This section identifies the information that must be available at the interfaces between the ship earth station and the MSSC and between the MSSC and the fixed network, principally for the connection of services identified in § 4.3.

4.2 *MSSC-network interface*

For ISDN connections ISUP should be used for message transfer. For non-ISDN or where ISUP is not available, TUP would be preferred.

If information transport between MSSCs over the fixed network is required, it is suggested that the procedures of the SCCP are used. Detailed interworking procedures are defined in Recommendation Q.1112.

4.3 *SES-MSSC interface*

Prior to and during call initiation the signalling channel functions may be provided by one or more common control channels.

A signalling capability should always be available during conversation in case it is needed for call clearing, call control, or for call management purposes. During a call the signalling channel may be multiplexed with the traffic channel at a lower bit rate so as to conserve radio channel capacity.

The multiplexed signalling channel on TDM/TDMA/RA channels may be used for bearer services such as connectionless data services, or connection oriented data services not requiring the establishment of a traffic channel.

The traffic channel should be used for bearer services such as:

- speech;
- circuit mode data services;
- packet mode data services;
- voice band data services.

4.4 *Terminal to ship earth station interface*

4.4.1 *Non-ISDN interface*

A configuration for non-ISDN terminals is shown in Figure 4/Q.1111. Digits may be entered either from telephone hand sets, or data terminals, which use Q.23 tone signalling formats. The signalling interface between the ship earth station and the terminals must also provide a means for detecting the hook-on/off condition. The line connection to the terminal from the ship earth station may use either analogue or digital techniques.

The ship earth station must convert both the signalling (digits and on/off-hook) information and the line connection format (analogue or digital) into the protocols used on the radio path.

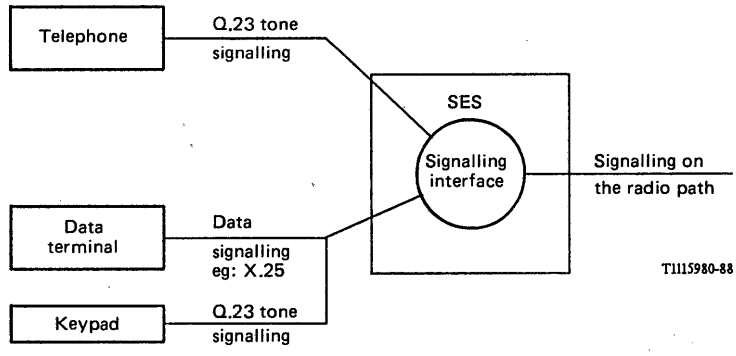


FIGURE 4/Q.1111

SES signalling interface for non-ISDN terminals

4.4.2 *ISDN interface*

The system should permit the connection of standard ISDN terminals to ship earth stations.

A typical example of the type of interface required could be as shown in Figure 5/Q.1111. In this case the ship earth station needs to provide a function equivalent to NT2 of the ISDN for termination of the ISDN basic access (see Recommendation I.420).

The ship earth station must convert the signalling protocol of Recommendation Q.931 to that used on the radio path.

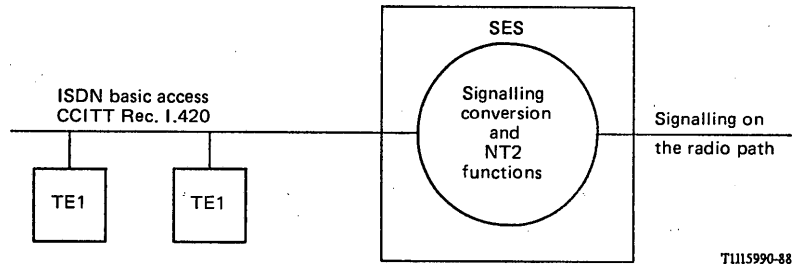


FIGURE 5/Q.1111

SES signalling interface for ISDN terminals

4.5 *Calling procedures*

4.5.1 *Ship-to-shore call*

a) *Information elements on the radio path*

The ship earth station should include the following information in the "access request" message:

- the calling party address;
- connection request;
- bearer capabilities;
- special category indication such as priority, etc.;
- special user facilities.

This may be followed by the "service address" message, containing the called party address. In order to expedite the call set-up all digits (and other information) should be entered into the ship earth station terminal prior to the request to the MSSC to set-up the call.

b) *Information elements on the fixed network*

The MSSC in addition to the information provided, should also add the following where the signalling system supports it:

- continuity indicator;
- echo suppressor indicator;
- satellite indicator.

The call should then be progressed by the MSSC in the normal manner, with the following indications being returned to the ship earth station upon receipt from the network:

- called party answer;

- cause indicator (information indicating the cause for the failure of an unsuccessful call attempt);

- clearing signal.

The answer signal, clearing signal or channel release signal, and called party address may be used by the ship earth station to generate charging information. On receipt of a message with a cause indicator, the ship earth station should generate the appropriate audible tones (see Recommendation Q.35), and/or visible message information if an ISDN terminal is used.

c) *Clearing of call:*

If the ship earth station wishes to clear a call, the ship earth station terminal should generate a "channel release" message to the MSSC. The MSSC should forward this to the network to release connections in the ISDN. The MSSC should receive a "release complete" message from the fixed network.

The MSSC should also deal with a "call release" message from the network. A "channel release" message should be forwarded to the ship earth station to clear the connection and a "release complete" message should be generated to return to the network.

Special facilities for "malicious call" detection needs further study.

For ship originated calls normal clearback procedures should apply (see Recommendation Q.118) when interworking with the PSTN with the supervision applied at the MSSC. Handling of suspend/resume messages to and from the ISDN requires further study by INMARSAT.

4.5.2 *Shore subscriber initiated call*

a) *Deletion of country code:*

In most cases the MSSC will not need the information contained in the S-digit of the country code 87S. In this situation the sequence of forward-address information sent to the MSSC should be as for a terminal international call. However, if the MSSC requires the S-digit to distinguish between ocean areas, the forward-address information should include the country code 87S, as for an international transit call.

b) *General interworking procedure:*

The MSSC upon receipt of a "request connection" message should use the information contained to determine the called ship's number. A call should then be generated to the SES on the signalling channel. The ship earth station should reply with a "response message". A "connect signal" message is sent when the "answer" message is received from the called terminal.

The MSSC should on receipt of these signals generate a "called party answer" message, or insert the relevant "cause indicator".

Call clearing by either party will be as indicated previously.

4.5.3 *MSSC control functions*

a) The MSSC should always perform a continuity check on the satellite circuit before connecting a circuit into the ISDN.

b) *Control of echo control devices*

Since all calls to and from a ship earth station will include a satellite link, appropriate actions must be taken, when necessary, to insert an incoming or outgoing echo control device in the circuit. This may be carried out either at the MSSC, or within an international exchange in the fixed network. The ship earth station will normally connect to the satellite link on a 4 wire basis (see Recommendation Q.115), but where necessary (e.g. for 2 wire extensions), will incorporate the equivalent of an echo control device. In order to reduce the analysis and control requirements at the MSSC it may prove convenient to carry out control of all echo control devices at the international exchanges rather than at the MSSC.

c) *Barring of group call numbers*

Barring of calls having group call numbers, from unauthorized users, shall be provided at the MSSC. However, in order to avoid setting up of the international chain for unauthorized group calls from ordinary subscribers, barring of such calls should, as a general rule, be done at the ISC of origin.

d) *Barring of calls to/from individual ship earth stations*

The MSSC should have the capability of barring calls to or from individual ship earth stations. Such barring shall not apply to distress priority calls.

5 Routing requirements

5.1 *Avoiding two or more satellite links in tandem*

5.1.1 *Shore originated calls*

The country code 87S should be analyzed at all transit centres where the call may either be routed on a circuit containing a satellite link or on a circuit not containing a satellite link. The latter circuit should always be chosen (see Recommendation Q.14).

5.1.2 *Ship originated calls*

If the signalling system provided between the MSSC and the terrestrial network contains signals which may be used to indicate that one satellite link is included, such signals should be used.

If the signalling system does not contain such signals, the outgoing ISC should avoid forwarding the call on an outgoing circuit which includes a satellite link. If, however, the signalling system employed between the outgoing ISC and the next ISC in the connection contains such signals, the outgoing ISC should insert the required information. The outgoing ISC could base its procedure upon incoming route identification.

6 Maritime and supplementary services

6.1 *Maritime services available via INMARSAT*

See Recommendation E.216, Annexes A and B.

6.2 *Supplementary services*

For supplementary services offered by Standard B, the subscriber access and control procedures should be as for equivalent services of the ISDN.

APPENDIX I

(to Recommendation Q.1111)

INMARSAT Standard-B mobile-satellite system description

I.1 *Introduction*

I.1.1 The INMARSAT Standard-B system provides a wide range of public correspondence and distress services between maritime and shore-based users. Links to and from ships are established via the INMARSAT space segment, which provides quasi-global coverage, and the associated ground segment which is provided at the discretion of INMARSAT Signatories with connections to the terrestrial networks including the Integrated Services Digital Network (ISDN). The applications of the Standard-B system include telephony, facsimile, telex and data services which are carried by means of digital satellite channels.

I.1.2 The major elements of the baseline Standard-B system as shown in Figure I-1/Q.1111 are as follows:

a) *INMARSAT space segment*, in particular the satellite communications transponders and associated frequency bands assigned by the International Telecommunication Union (ITU) and used by INMARSAT for the Standard-B system;

b) *Standard-B ship earth stations (SES)*, which are designed, manufactured, type-approved, commissioned and operated in accordance with the relevant INMARSAT technical requirements procedures, and which interface with the space segment at L-band (1.5/1.6 GHz) for communications with coast earth stations;

c) *INMARSAT coast earth stations (CES)*, which operate in accordance with INMARSAT technical requirements, and which interface with the space segment at C-band (4/6 GHz) and L-band, and with the terrestrial networks for communications with SESs;

d) *INMARSAT network coordination stations (NCS)*, located at designated earth stations, which interface with the space segment at C-band and L-band for the purpose of signalling with SESs and CESs, and for overall network control and monitoring functions, in accordance with INMARSAT technical requirements.

I.1.3 The functions of these four system elements are combined to form the following major Standard-B sub-systems:

a) *Communications sub-system*, providing the demand-assigned digital satellite communications links between SESs and CESs, with extensions into the terrestrial networks;

b) *Access control and signalling sub-system*, providing the automatic satellite signalling links between SESs, CESs and NCSs.

I.1.4 The Standard-B system is made up of independent communications networks for each Satellite Ocean Region, each network comprising an operational satellite and associated ground control facilities, ship earth stations (SES) and coast earth stations (CES) operating within that region, and a network coordination station (NCS) which provides overall network management functions. CESs are capable of establishing ship-originated calls without the intervention of the NCS; thus failure of the NCS does not disrupt distress and safety communications or the bulk of routine commercial traffic. Conversely, the NCS acts as a back-up to CESs in handling ship-originated distress calls.

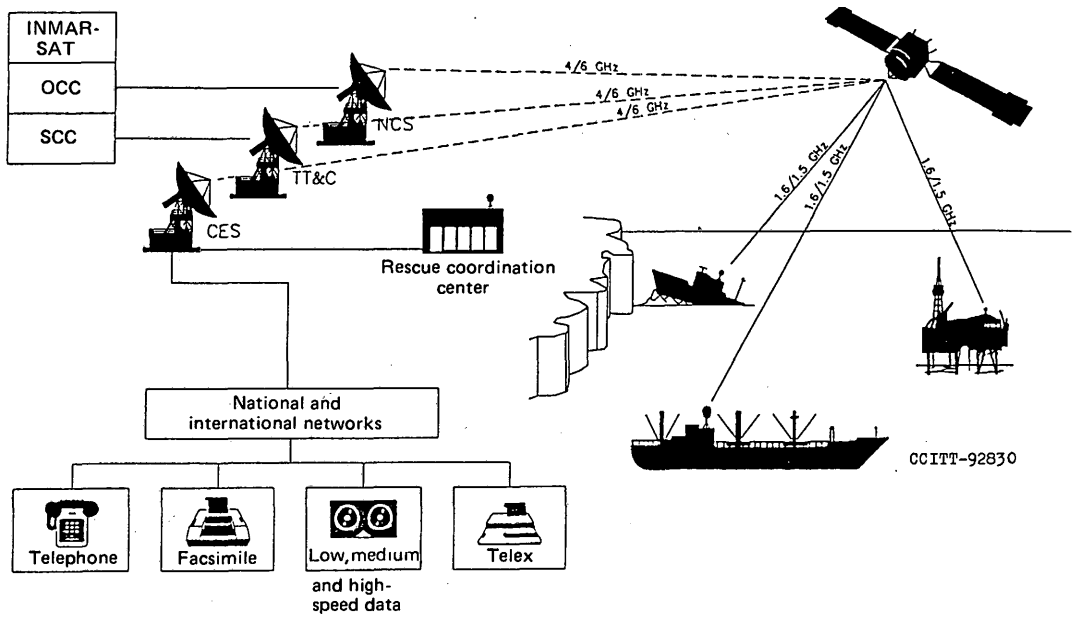


FIGURE I-1/Q.1111

Standard-B network configuration

I.2 *Channel configurations*

I.2.1 *Functional channel configuration*

The satellite channels used for communications services and signalling in the Standard-B system are as follows and summarised in Table I-1/Q.1111:

a) *Voice channel:* single-channel-per-carrier (SCPC) digital voice channel supporting a voice coding rate of 16 kbit/s with Adaptive Predictive Coding (APC), used in both the forward (shore-to-ship) and return (ship-to-shore) directions. The channels in the forward and return directions are denoted by CESV and SESV respectively. The use of the channel is controlled by assignment and release signalling at the start and end of each call. Voice activation is implemented on forward carriers. These channels also support voice-band data (including facsimile) up to 2400 bit/s information rate and sub-band signalling (VSUB);

b) *SCPC data channel:* SCPC digital data channel supporting an information rate of 9.6 kbit/s, used in both forward and return directions. The channels in the forward and return directions are denoted by CESD and SESD respectively. The use of the channel is controlled by assignment and release signalling at the start and end of each call. These channels also support Group-3 facsimile and sub-band signalling (DSUB);

c) *CES assignment (CESA) channel*: time-division multiplex (TDM) channel, used in the forward direction to carry CES signalling messages to SESs, including channel assignments for ship-originated calls. The transmission is continuous from each CES in the satellite network;

d) *CES telex (CEST) channel*: time-division multiplex (TDM) channel, used in the forward direction to carry telex messages (ITA No. 2 alphabet) from shore-to-ships. The transmission is continuous from each CES in the satellite network;

e) *CES low speed data (CESDL) channel*: time-division multiplex (TDM) channel, used in the forward direction to carry low speed data (IA No. 5 alphabet) in an asynchronous mode at information rates up to 300 bit/s. The transmission is continuous from each CES in the satellite network;

f) *CES interstation (CESI) channel*: time-division multiplex (TDM) channel used in the C-to-L (forward) direction from each CES to carry signalling information from the CES to the NCS in the satellite network. The transmission is continuous from each CES in the satellite network;

g) *NCS common (NCSC) channel*: time-division multiplex (TDM) channel, used in the forward direction to carry NCS signalling messages including call announcements, network status information (Bulletin Board). The transmission is continuous from the NCS serving each satellite network;

h) *NCS assignment (NCSA) channel*: time-division multiplex (TDM) channel, used in the forward direction to carry channel assignment messages for shore-originated calls. The transmission is continuous from the NCS serving each satellite network;

i) *NCS spot-beam (NCSS) channel*: time-division multiplex (TDM) channel, transmitted in the forward direction (one frequency per spot beam) to enable SESs to identify their spot beams location. The transmission is continuous from the NCS serving each satellite network;

j) *NCS interstation (NCSI) channel*: time-division multiplex (TDM) channel, used in the C-to-L (forward) direction to carry signalling information from the NCS to each CES in the satellite network. The transmission is continuous from each NCS in the satellite network;

k) *SES telex (SEST) channel*: time-division multiple access (TDMA) channel, used in the return direction to carry telex (ITA No. 2). The transmission from each SES is in burst mode;

l) *SES low speed data (SESDL) channel*: time-division multiple access (TDMA) channel, used in the return direction to carry data (IA No. 5) in an asynchronous mode at information rates up to 300 bit/s. The transmission from each SES is in burst mode;

m) *SES request (SESRQ) channel*: random access (Aloha) channel used in the return direction to carry SES signalling information, specifically the request signals which initiate a ship-originated call transaction to CESs;

n) *SES response (SESRP) channel*: TDMA channel used in the return direction to carry SES signalling information to CESs, specifically the response information required for a shore-originated call transaction.

TABLE I-1/Q.1111

Standard-B communications and signalling channels

Functional channel type	Origin (Note 1)	Destination (Note 1)	Characteristics	L-band satellite beam (Note 2)
1 *Voice channel*				
a) SESV	SES(M)	CES(M)	Voice, SCPC	G and S
b) CESV	CES(M)	SES(M)	Voice, SCPC (both 16 kbit/s) and Sub-band signalling in V-Channel (VSUB)	G and S
2 *SCPC data channel*				
a) SESD	SES(O)	CES(O)	SCPC Data	G and S
b) CESD	CES(O)	SES(O)	SCPC Data (both 9.6 kbit/s) and Sub-band signalling in SCPC Data Channel (DSUB)	G and S
3 *CES TDM channel*				
a) CESA	CES(M)	SES(M)	Signalling	G
b) CEST	CES(M)	SES(O)	Telex	G and S
c) CESDL	CES(O)	SES(O)	Low speed data up to 300 bit/s	G and S
d) CESI	CES(M)	NCS(M)	Interstation Signalling	G
4 *SES TDMA channel*				
a) SEST	SES(O)	CES(M)	Telex	G and S
b) SESDL	SES(O)	CES(M)	Low speed data up to 300 bit/s	G and S
5 *SESRQ*	SES(M)	CES(M) NCS(M)	Request, Aloha	G
6 *SESRP*	SES(M)	CES(M)	Response, TDMA	G
7 *NCS TDM channel*				
a) NCSC	NCS(M)	SES(M)	Common Channel	G
b) NCSA	NCS(M)	SES(M)	Assignment Channel	G
c) NCSI	NCS(M)	CES(M)	Interstation Signalling Channel	G
8 *NCSS*	NCS(M)	SES(M)	Spot-Beam Identification Channel	S

Note 1 - M and O denote mandatory and optional capabilities respectively.

Note 2 - G and S denote global and spot beams respectively.

I.2.2 *Physical channel configuration*

Initially, whilst traffic demand permits, functional channels having the same format are combined and transmitted as a single physical channel. Later, as the system develops, separate physical channels may be required.

The resultant physical channels, as shown in Figure I-2/Q.1111, in the initial implementation are:

a) Voice channels.

b) SCPC data channels.

c) CES TDM channel (combination of CESA, CEST, CESDL, CESI).

d) NCS TDM channel (combination of NCSC, NCSI, NCSA).

e) SES TDMA channel (combination of SEST, SESDL).

f) SESRQ channel.

g) SESRP channel.

The NCSS channel will be required when a spot beam satellite is introduced.

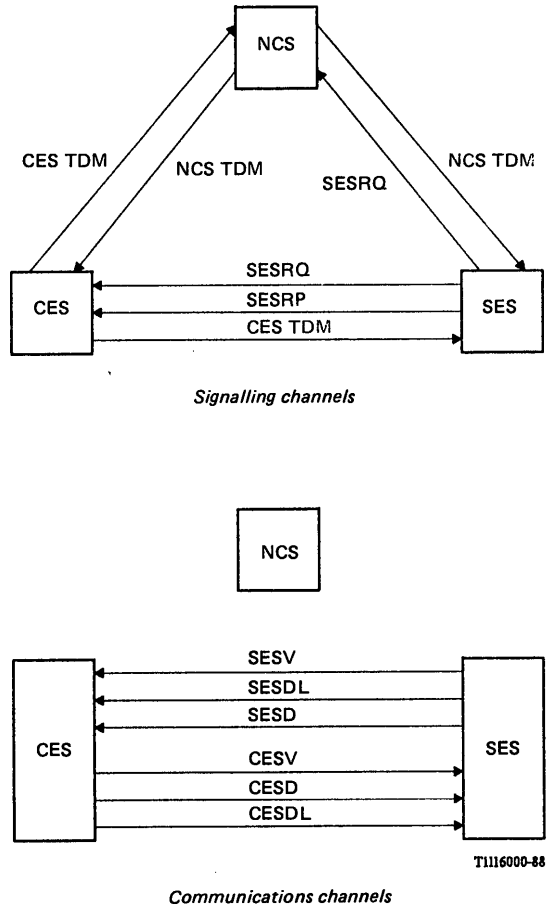


FIGURE 1-2/Q.1111

Standard-B physical channel configuration

I.2.3 *Forward error correction coding*

All Standard-B channel types use Forward Error Correction (FEC) coding consisting of a convolution encoder of constraint length k = 7 and an 8-level soft decision Viterbi decoder. The

FEC coding rate is either 3/4 or 1/2. The rate 3/4 code is derived by puncturing the 1/2, k = 7 convolution code.

I.2.4 *Information scrambling*

A PN scrambler with a 15-stage generator register is used for scrambling before FEC encoding. The concept of a PN scrambler is explained in CCIR Report 384, Annex III, Section 3, Method 1. The scrambler and descrambler configurations are exactly as shown in the CCIR report.

I.2.5 *Power control*

All SCPC forward channels employ power control to conserve satellite L-band power. The power control scheme is open loop, and depends on knowledge, at the CES, of the SES antenna elevation angle to the satellite. This information is used to adjust the output power setting of the CES, according to a predetermined algorithm.

I.3 *Access control and signalling sub-system*

I.3.1 The Standard-B system provides efficient channel access operation based on demand assignment, and enables power control to be employed on forward SCPC carriers for efficient satellite power utilization. Ship earth station operational compatibility with current and planned space segment configurations is also provided for, including the ability to operate with future spot-beam satellites.

I.3.2 The NCS provides a wide range of system monitoring functions, so as to facilitate a change in carrier frequency assignments in the event of interference on signalling channels. It also manages channel assignments and controls distributed and overflow modes of operation.

I.3.3 For SCPC channels (16 kbit/s telephony and 9.6 kbit/s data), blocks of carrier frequencies are temporarily pre-assigned by INMARSAT to CESs which then make their own individual SCPC channel assignments from within each block on a call-by-call basis, and operate essentially independently of the NCS on the basis of CES distributed control. If the CES pre-assigned capacity is insufficient to meet peak-hour traffic demand, additional assignments can be made from the NCS pool of frequencies on a call-by-call basis (overflow mode). The size of the CES pre-assigned block can be increased or decreased by INMARSAT, in consultation with the CES Operator. CES Operators with low traffic requirements, may thus elect to operate only in overflow mode with no pre-assigned SCPC capacity.

I.3.4 For telex and 300 bit/s data channels (TDM/TDMA), all CESs operate with distributed control. Carrier frequencies are preassigned to each CES, which manages its own channel time slot assignments to SESs. There is no overflow mode of operation for TDM/TDMA telex and data channels.

I.3.5 For shore-originated calls, the NCS transmits call announcement messages on the NCSC channel and channel assignment messages on the NCSA channel to SESs, in response to requests from CESs. If traffic increases to such an extent that congestion is likely, a separate (NCSA) channel can be made available to carry the assignment messages.

I.3.6 For ship-originated calls, SES channel assignments are made by CESs on CESA channels with no direct intervention by the NCS unless the overflow mode for telephone calls is in use.

I.3.7 When operating to spot-beam satellites, the SES performs spot-beam identification by measuring the channel bit error rate and/or relative signal strength of forward signalling NCSS carriers transmitted through each spot-beam transponder. The carrier frequencies and spot-beam identities are advised to SESs via the NCSC channel Bulletin Board to allow identification of the appropriate spot beam when establishing calls.

I.3.8 The signalling system is based on the use of out-of-band, sub-band and in-band signalling depending on the particular access control and communication channel requirements. Out-of-band and sub-band signalling use fixed length signal units which have a specific function according to the

required message type. The definitions of these signal units contain sufficient spare capacity so as to enable future services and facilities to be readily implemented as required at SESs and CESs.

I.4 *Communications sub-system*

I.4.1 *Modulation and coding*

Standard-B satellite channels use digital modulation to efficiently utilise satellite power and bandwidth, with forward error correction (FEC).

The basic modulation techniques are filtered offset-quadrature phase-shift keying (O-QPSK) and filtered differentially encoded binary phase-shift keying (BPSK). Convolutional coding at either rate 1/2 and/or rate 3/4 (using punctured coding) is used with the former, and convolutional coding at rate 1/2 with the latter.

Adaptive predictive coding (APC) at 16 kbit/s is the voice coding technique adopted, at 24 kbit/s channel rate with O-QPSK modulation and rate 3/4 FEC. As a SES and CES option, 9.6 kbit/s APC with 15 kbit/s channel rate, with rate-3/4 FEC, may be provided in addition.

The APC algorithm is capable of supporting voice-band data and facsimile at rates of up to 2400 bit/s with 16 kbit/s APC, and up to 1200 bit/s with 9.6 kbit/s APC.

Telex and 300 bit/s data (e.g., for connection to data base and electronic mail systems) are provided in the forward link (CEST and CESDL channels) at 6 kbit/s channel rate, with BPSK modulation and rate 1/2 FEC. In the return direction these services are provided at 24 kbit/s channel rate, with O-QPSK modulation and rate 1/2 FEC.

Data (up to 16 kbit/s and 9.6 kbit/s information rate) and facsimile (up to 9.6 kbit/s information rate) are provided by means of digital data satellite channels at 24 kbit/s channel rate with O-QPSK and rate 1/2 FEC, which can at the option of the CES Operator be interfaced with the fixed networks including the public switched telephone network (PSTN), public switched data networks (e.g., PSPDN for packet data) or private wires as appropriate.

I.4.2 *Channel access methods*

The Standard-B system makes use of channel access methods appropriate to the communications services offered, in order to maximise efficiency and to minimise call connection delays. Access methods are as follows:

a) telephony: single-channel-per-carrier (SCPC) in frequency-division multiple access (FDMA);

b) telex and 300 bit/s Data: time-division multiplex (TDM/FDMA) in the forward direction, and time-division multiple access (TDMA/FDMA) in the return direction. Each CES is pre-assigned one or more forward TDM carrier frequencies; and

c) 16 kbit/s and 9.6 kbit/s Data, and Facsimile: SCPC/FDMA.

I.5 *Link layer formats and protocols*

I.5.1 *General*

All signalling messages are formatted into uniform signal units of 96 bits (12 octets). This signal unit (SU) size allows for the most common transactions to be carried out with only one signal unit with a minimum of spare unused capacity. The use of these signal units applies to signalling transactions on the sub-band signalling channel of the SCPC voice and data channels as well as out-of-band signalling on all other channels.

I.5.2 *Basic signal unit concepts*

A signalling message that can be accommodated in a single signal unit is formatted into a "Lone Signal Unit" (LSU). Longer messages are formatted into more than one Signal Unit (SU), of which the first is an "Initial Signal Unit" (ISU) followed by one or more "Subsequent Signal Units" (SSU).

Each signalling SU includes 16 check bits (the last two octets) for error detection, these being calculated from the first 10 octets of the SU using the following generator polynomial (see Recommendation X.25, § 2.2.7) : $x^{16} + x^{12} + x^5 + 1$.

The undetected error rate on the sub-band channels, under nominal worst case conditions is typically less than one in 10^{10} SUs.

On reception the check bits for each SU are calculated, and if there is a mismatch with the received check bits the SU is discarded. Recovery from lost and corrupted SUs is handled by the relevant signalling logic procedures.

For the NCS and CES signalling channels and all sub-band channels, if no SU is ready when the channel becomes available, a fill-in SU is sent. For the SES signalling channels each SU is formatted into its own burst; SES sub-band channels always contain either sub-band signalling messages or fill-in SUs, both of which include the SES ID.

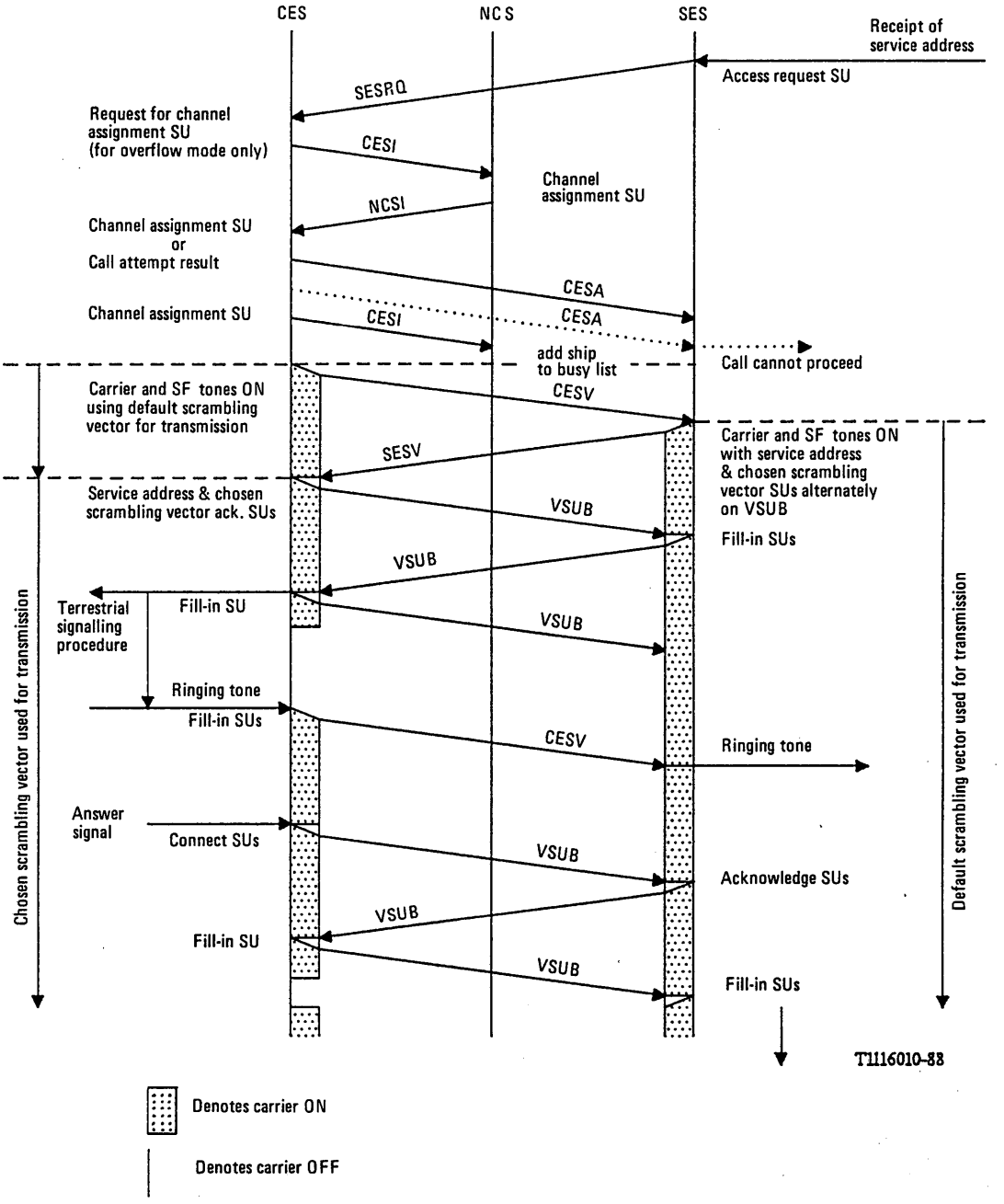
I.6 *Telephone services*

I.6.1 *General*

Telephone services are provided using a pair of voice (V) channels, assigned from a pool held by the CES, or by the NCS from a common pool. The function of the NCS is to make V-channel assignments in response to requests from CES (when the latter runs out of frequencies) on a call by call basis.

I.6.2 *Call set-up ship-to-shore*

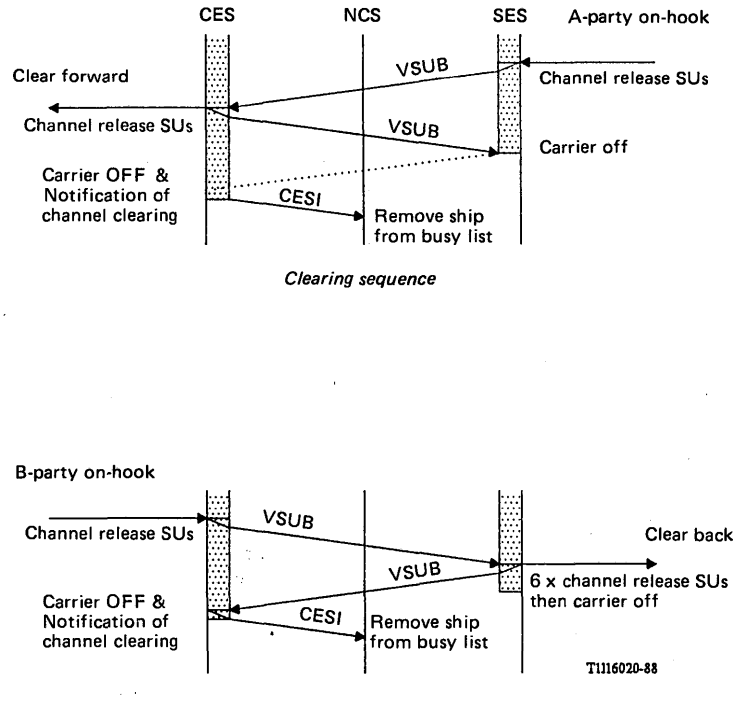
The basic sequences for ship-to-shore telephone call set-up are shown in Figure I-3/Q.1111, covering various cases including use of the NCS. The sequences for call clearing (both SES and CES initiated) are given in Figure I-4/Q.1111.



Note - Interworking procedures are specified in Recommendation Q.1112.

FIGURE I-3/Q.1111

Standard-B ship to shore telephone call set-up sequence



Note - Interworking procedures are specified in Recommendation Q.1112.

FIGURE I-4/Q.1111

Standard-B clearing sequence for ship to shore telephone calls

I.6.2.1 From the point of view of the SES, all the cases are the same, with the SES receiving the number to be called prior to starting the request process.

I.6.2.2 An initial request is sent using the SESRQ Channel to the CES, including SES elevation angle and spot-beam ID information, and a channel assignment is received on the designated CESA channel. The communications channel is then set up, tested using an exchange of SF tones, and the called party address is transmitted via the sub-band channel together with the scrambling vector. To provide secure transfer of the address without the protocol complication of a repeat request arrangement, the SES sends the address continuously until an acknowledgment is received from the CES or the expiry of a timer.

I.6.2.3 The called CES allots a channel, if available, from its pool and transmits the channel assignment information to the SES over the CESA channel, and to the NCS over the CESI channel. The corresponding signalling sequence is shown in Figure I-3/Q.1111. The SES is added to the Busy List at the CES and NCS.

I.6.2.4 In overflow mode the CES, on receipt of an access request from the SES, sends a Request for Assignment message over the inter-station link to the NCS, whereupon the NCS responds by sending a channel assignment to the requesting CES over the NCSI channel. The CES sends this channel assignment to the SES over the CESA channel. If the requested spot beam channel is not available at the NCS, the NCS allots a global beam channel.

I.6.2.5 At the CES the decision as to whether a call (with the exception of distress priority calls) can be set up or not depends on the availability of each of the following:

a) a CES channel unit compatible with the service parameters requested;

b) frequencies for the forward and return channels.

For distress priority calls, the CES preempts a channel unit, if none is available, also for these calls, the service parameters are voice (16 kbit/s) and telex.

I.6.2.6 The on-hook signal from the SES initiates a series of Channel Release signals on the sub-band channel, and when one of these is received at the CES it responds with a series of Channel Release signals. The SES removes its carrier when it receives a Channel Release signal from the CES. The CES monitors the carrier to confirm that it stops. If the carrier persists (e.g., due to a fault in the SES), the CES detects this by time-out and sends a Selective Channel Release request to the NCS for transmission over the NCSC channel to the SES. Similar but reversed procedures apply for clearing by the called party.

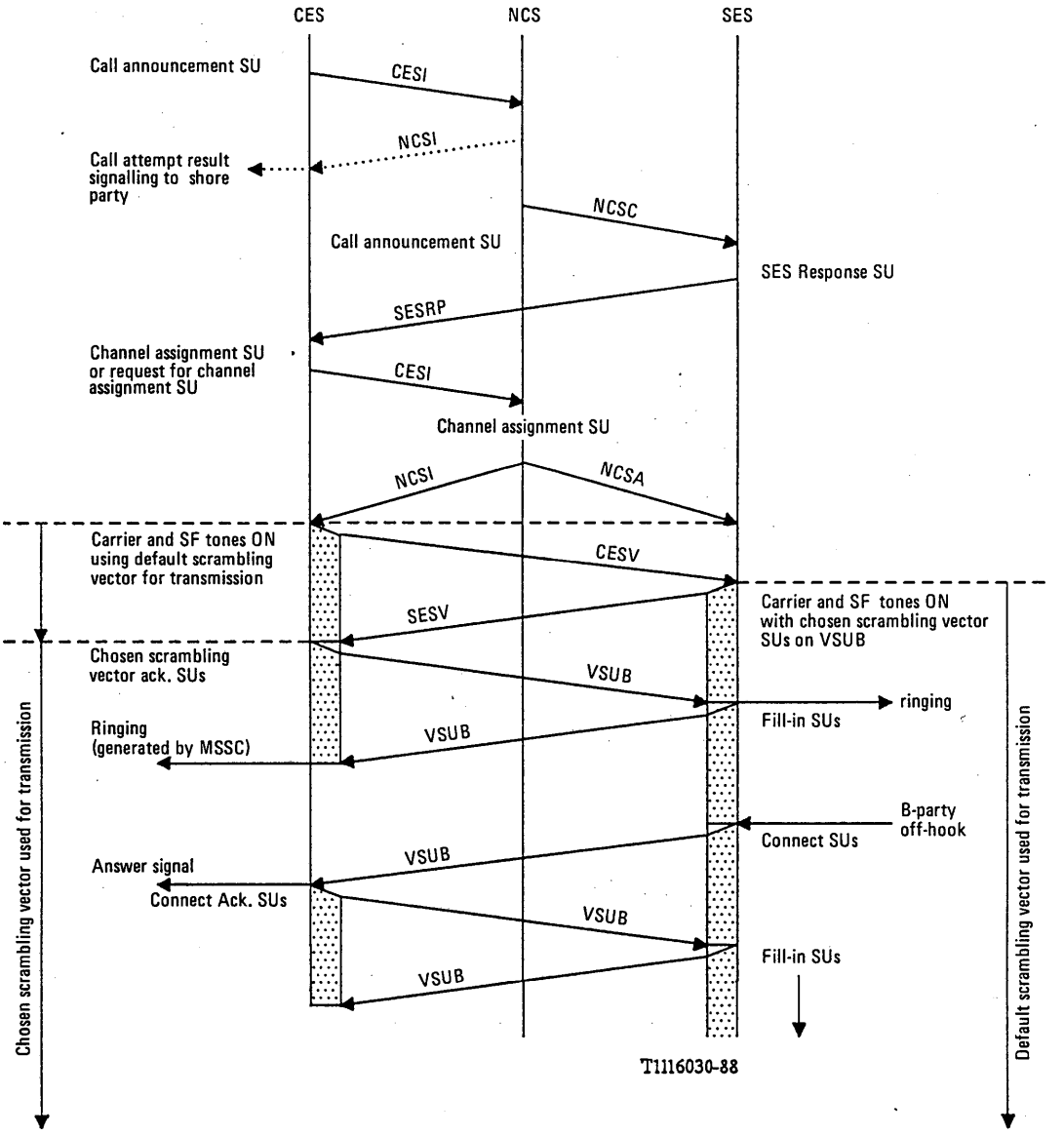
I.6.2.7 At the end of each call the CES sends the notification of channel release information to the NCS via the CESI channel, to return an overflow channel to the NCS common pool and to up-date the SES Busy List; the NCS and CES then remove the SES from the Ship Busy list. The NCS does not acknowledge receipt of the CES message.

I.6.2.8 In the event of NCS failure, only existing pre-assigned and demand-assigned capacity is available to those CESs electing to operate in stand-alone mode, and additional NCS selective release and Busy List functions are not implemented.

I.6.2.9 The SES maintains in its memory the ID of a preferred CES for distress priority calls, modified as necessary depending on current ocean region and CES status. The NCS provides backup for ship originated distress priority calls.

I.6.3 *Call set-up, shore-to-ship calls*

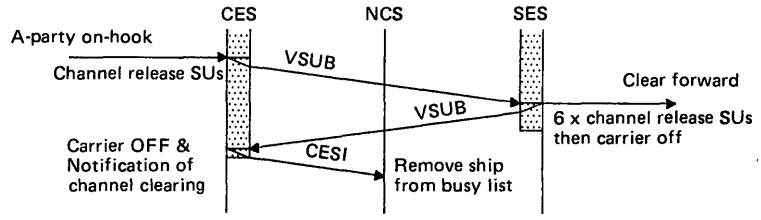
The sequences for shore-to-ship telephone call set-up are shown in Figure I-5/Q.1111, covering various cases including use of the NCS. The sequences for both CES and SES initiated call clearing are given in Figure I-6/Q.1111.



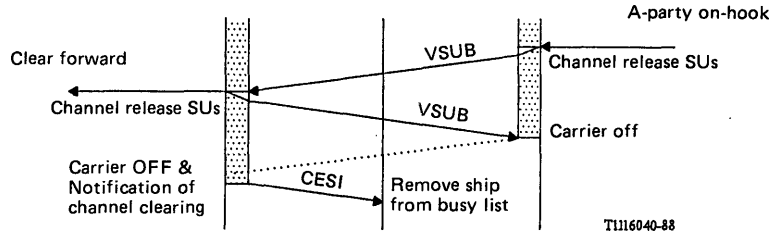
Note - Interworking procedures are specified in Recommendation Q.1112.

FIGURE I-5/Q.1111

Standard-B shore-to-ship telephone call set-up sequence



Clearing sequence



Clearback sequence

Note - Interworking procedures are specified in Recommendation Q.1112.

FIGURE I-6/Q.1111

Standard-B clearing sequence for shore to ship telephone calls

I.6.3.1 From the viewpoint of the SES, all the cases are similar with the NCS sending the call announcement information to the SES over the NCSC Channel. The SES responds using the SESRP Channel and then tunes to the NCSA channel for receiving the channel assignment message. The continuity check for proper channel set-up and the channel release functions over the satellite link are carried out using signals on the sub-band channel and SF tones, as in § I.6.2.2 above.

I.6.3.2 The CES (or International Exchange connected to the CES) receives and analyses the ship number dialled by the shore subscriber, where the T-digit may be used to route the call to the appropriate CES equipment serving the Standard-B system.

I.6.3.3 If an appropriate CES channel unit is available, a call announcement request is sent to the NCS via the CESI channel and the NCS then announces the call to the SES via the NCSC channel to which all SESs tune when in the idle mode.

I.6.3.4 The SES transmits a response on the SESRP channel to the CES, including SES antenna elevation angle and spot-beam ID information. The response channel is *not* used for telephony group calls.

I.6.3.5 The CES allots a channel, if available, from its pool and transmits the channel assignment information to the NCS over the CESI channel. The SES is added to the Busy List at the CES and NCS.

I.6.3.6 The NCS transmits the assignment information to the SES and CES over the designated NCSA and NCSI channels respectively.

I.6.3.7 In overflow mode, the CES, after receiving the response burst from the SES, sends a request for channel assignment message to the NCS over the CESI link. Call set-up then proceeds as described above, but with the assignment made by the NCS and notified to the SES and CES over the NCSA and NCSI channels, respectively.

I.6.3.8 At the CES the decision as to whether a call can be set up or not is based on the same criteria as for ship-to-shore calls described in § I.6.2.5 above, plus a determination by the CES of the availability of the appropriate channel codec/terminal at the called SES. For distress priority calls, as in the ship-to-shore calls, this availability criterion is not checked as these are always for voice or telex.

I.6.3.9 The sequences for call clearing are shown in Figure I-6/Q.1111 for both SES initiated clearing and CES initiated clearing. Upon receipt of the clearing signal the CES sends a sequence of channel release signals on the forward sub-band channel. On receipt of one of these channel release signals the SES responds with a total of six channel release signals on the return sub-band channel and removes its carrier. When the CES detects that the SES carrier has ended, the CES puts off its carrier and returns the channel to the pool. If the carrier persists (e.g., due to a fault in the SES), the CES detects this by time-out and follows the same procedure as described in § I.6.2.5 above. Similar procedures apply for SES initiated call clearing.

I.6.3.10 At the end of each call the procedures described above in § I.6.2.7 apply for removal of the SES from the busy list.

I.6.3.11 In the event of NCS failure, only existing pre-assigned and demand-assigned capacity is available to those CESs electing to operate in stand-alone model, and additional NCS selective release and busy list functions are not implemented.

I.6.4 *Call set-up, ship-to-ship*

The call set-up procedure for ship-to-ship calls is a two stage combination of ship-to-shore call set-up procedure and shore-to-ship call set-up procedure. The SES follows the same procedure as for a normal ship-to-shore call. Based on the service direction and service address, a shore-to-ship call is established (following the shore-to-ship call set-up sequence). Thus completing the two stage call set-up procedure.

I.6.5 *Supervisory signalling*

After channel set-up for telephone calls, all subsequent supervisory functions are normally performed by means of sub-band signalling (VSUB).

I.6.5.1 In-band signalling in the form of single frequency (SF) tones is used for end-to-end circuit continuity checks.

I.6.5.2 Sub-band signalling within the telephone channel frame is used for connect/clearing signals, identification of SES transmissions (as an aid to locating a malfunctioning SES in the event of interference), and to provide additional signalling capacity for potential future use in connecting the channel with terrestrial ISDN networks.

I.6.5.3 Terrestrial network audible tones (ringing, busy, unobtainable etc.) are passed to the SES in-band over the voice channel for ship-originated calls. In the case of shore-originated calls, the MSSC generates the appropriate audible tone back into the terrestrial network to the shore subscriber.

I.6.6 *Voice coding*

Adaptative predictive coding (APC) at 16 kbit/s and optionally at 9.6 kbit/s, is the voice coding method used for the Standard-B system.

I.6.7 *Indication of call duration*

For ship-originated telephone calls, the SES can derive a close estimate of the chargeable call duration information using the appropriate sub-band signals. The call duration may be obtained by the SES by measuring the elapsed time between the receipt of connect signal and call-clear signal. Both these messages are transmitted by the CES in the sub-band channel for shore-originated clearing. For ship-originated clearing, only the former is transmitted in the sub-band by the CES as the latter is available at the SES from the on-hook signal. Using the call duration, the SES can derive an estimate of the charge for the call, display it to the user and/or record this information at the ship.

Recommendation Q.1112

PROCEDURES FOR INTERWORKING BETWEEN INMARSAT STANDARD B SYSTEM AND THE INTERNATIONAL PUBLIC SWITCHED TELEPHONE NETWORK/ISDN

1 Introduction

This Recommendation presents the detailed procedures for interworking between INMARSAT Standard-B system and signalling systems of the fixed network. For a brief description of INMARSAT Standard-B system, see Appendix I to Recommendation Q.1111.

2 Conversion of information elements

Tables 1/Q.1112 to 16/Q.1112 give the relationship between signals of the fixed network signalling systems and the INMARSAT Standard-B system.

2.1 Signalling System No. 7 (TUP)

2.1.1 Table 1/Q.1112 gives the relationship between forward signals in Signalling System No. 7 TUP and messages and information elements sent on the radio path in INMARSAT Standard-B signalling system for shore to ship calls, i.e. interworking of Signalling System No. 7 TUP to INMARSAT Standard-B. In the comment column actions taken by the MSSC are indicated, in particular for signals of TUP which have no equivalent message or information element in INMARSAT Standard-B.

Table 2/Q.1112 shows the relationship between messages and information elements in INMARSAT Standard-B signalling system and forward signals in Signalling System No. 7 TUP for ship-to-shore calls, i.e. interworking of INMARSAT Standard-B to Signalling System No. 7 TUP.

The signal numbers for forward signals of Signalling System No. 7 TUP are those given in Table A-5bis of Annex A to Recommendations Q.601-Q.608.

2.1.2 Table 3/Q.1112 gives the relationship between messages and information elements in INMARSAT Standard-B signalling system and backward signals in Signalling System No. 7 TUP for shore-to-ship calls, i.e, interworking of Signalling System No. 7 to INMARSAT Standard-B.

Backward signals in Signalling System No. 7 TUP generated by the MSSC for unsuccessful shore-to-ship calls are given in Table 3bis/Q.1112. These signals are not related to any specific message or information element received from the ship earth station.

Table 4/Q.1112 gives the relationship between backward signals in Signalling System No. 7 TUP and messages and information elements in INMARSAT Standard-B signalling system for ship-to-shore calls, i.e. interworking of INMARSAT Standard-B to Signalling System No. 7 TUP. The comments column indicates specific actions taken by the MSSC.

The signal numbers for backward signals of Signalling System No. 7 TUP are those given in Table A-9bis of Annex A to Recommendations Q.601-Q.608.

2.2 *Signalling System R2*

2.2.1 Tables 5/Q.1112 and 6/Q.1112 are similar to Tables 1/Q.1112 and 2/Q.1112, respectively, and apply to forward signals in Signalling System R2.

The signal numbers for forward signals of Signalling System R2 are those of Table A-7 of Annex A to Recommendations Q.601-Q.608.

2.2.2 Tables 7/Q.1112, 7bis/Q.1112 abd 8/Q.1112 are similar to Tables 3/Q.1112, 3bis/Q.1112 and 4/Q.1112, respectively, and appy to backward signals in Signalling System R2.

The signal numbers for backward signals in Signalling System R2 are those of Table A-11 of Annex A to Recommendations Q.601-Q.608.

2.3 *Signalling System No. 7 (ISUP)*

The relationship between forward and backward signals of Signalling System No. 7 ISUP and messages and information elements of INMARSAT Standard-B signalling system is for further study.

Tables 9/Q.1112 through 12/Q.1112 are reserved for this purpose.

2.4 *Signalling System No. 5*

2.4.1 Tables 12/Q.1112 and 14/Q.1112 are similar to Tables 1/Q.1112 and 2/Q.1112, respectively, and apply to forward signals in Signalling System No. 5.

the signal numbers for forward signals in Signalling System No. 5 are those given in Table A-4 Annex A to Recommendations Q.601-Q.608.

2.4.2 Tables 15/Q.1112, 15bis/Q.1112 and 16/Q.1112 are similar to Tables 3/Q.1112, 3bis/Q.1112 and 4/Q.1112, respectively, and apply to backward signals in Signalling System No. 5.

The signal numbers for backward signals in Signalling System No. 5 are those given in Table A-8 of Annex A to Recommendations Q.601-Q.608.

TABLE 1/Q.1112

Conversion of forward signals in Signalling System No. 7 TUP and INMARSAT Standard-B Signalling System shore-to-ship calls

Signalling System No. 7		INMARSAT Standard-B	Comments
Signal No.	Signal name	Message: info element: value	
1	Address signals	Announcement message: SES number, called terminal	-
2	Nature of address indicator national significant number	-	Interpreted and used by MSSC
3	Nature of address indicator international number	-	Interpreted and used by MSSC
4	Nature of circuit indicator one satellite in connection	-	Ignored by MSSC
5	Nature of circuit indicator one satellite in connection	-	Ignored by MSSC
6	Echo suppressor indicator out-going half-echo suppressor not included	-	MSSC will insert echo control device if needed
7	Echo suppressor indicator out-going half-echo suppressor included	-	Interpreted and used by MSSC
8-12	Calling party's category indicator, language digit	Assignment message: service: telephone priority: routine	-
13	Calling party's category indicator, ordinary calling subscriber	Assignment message: service: telephone priority: routine	-
14	Calling party's category indicator, calling subscriber with priority	Assignment message: service: telephone priority: further study	-

TABLE 1/Q.1112 *(contd.)*

Conversion of forward signals in Signalling System No. 7 TUP and INMARSAT Standard-B Signalling System shore-to-ship calls

Signalling System No. 7		INMARSAT Standard-B	Comments
Signal No.	Signal name	Message: info element: value	
15	Calling party's category indicator, data call	-	Not applicable
16	Clear forward signal	Channel release message	
17	Forward transfer signal	-	Not applicable
18	Continuity proved	-	Interpreted and used by MSSC
19	Continuity check failure	Channel release message	-
20	Continuity check required on this circuit	-	Interpreted by MSSC
21	Continuity check not required on this circuit	-	Interpreted by MSSC
22	Continuity check performed on previous circuit	-	Interpreted and used by MSSC
23	Service information	-	Interpreted by MSSC
24	General setup message	-	Interpreted by MSSC

TABLE 2/Q.1112

Conversion of forward signals in Signalling System No. 7 TUP and INMARSAT Standard-B Signalling System ship-to-shore calls

INMARSAT standard-B	Signalling system No. 7	
Message: info element: value	Signal name	Signal No.
Address message: called number	Address signals: Nature of address indicator	1 2 or 3
Request message: -priority: routine -service: telephone or 3.1 kHz audio	Calling party's category indicator, ordinary calling subscriber	13
Request message: -priority: urgency, safety or distress -service: telephone or 3.1 kHz audio	Calling party's category indicator, calling subscriber with priority	14
Channel release message	Clear forward signal	16
Continuity check tone	Continuity check performed on previous circuit	22

Note - Nature of circuit indicator, one satellite in connection (Signal No. 5) is generated by the MSSC.

TABLE 3/Q.1112

Conversion of backward signals in Signalling System No. 7 TUP and INMARSAT Standard-B Signalling System shore-to-ship calls

INMARSAT standard-B	Signalling system No. 7	
Message: info element: value	Singal name	Signal No.
Continuity check tone	AFC: Address complete subscriber free, charge	4
Connect message	ANC: Answer charge	16
Channel release message	CLB: Clear back	19
Call result: cause value:		
-user busy	SGB: Subscriber busy	12
-no channel available	CGC: Circuit group congestion	8
-destination out of service	LOS: Line out of service	13
-others	SST: Send special info tone	14

TABLE 3bis/Q.1112

Unsuccessful call events and backward signals in Signalling System No. 7 TUP shore-to-ship calls

INMARSAT standard-B	Signalling system No. 7	
Event in INMARSAT system	Signal name	Signal No.
Congestion in MSSC	SEC: switching equipment congestion	7
No satellite channel available	NNC: National network congestion	9
Incomplete SES number	ADI: Address incomplete	10
Unallocated SES number	UNN: Unallocated number	11
SES busy	SGB: Subscriber busy	12
Continuity test failure	LOS: Line out of service	13
SES absent (no response)	SST: Send special information tone	14
SES barred for incoming access	SST: Send special information tone	14
SES unauthorized	SST: Send special information tone	14

TABLE 4/Q.1112

Conversion of backward signals in Signalling System No. 7 TUP and INMARSAT Standard B Signalling System ship-to-shore calls

Signalling system No. 7		INMARSAT standard-B	
Signal No.	Signal name	Message: info element: value	Comments
1	ADC: Address complete, charge	-	Connect through circuit
2	ADN: Address complete, no charge	-	No-charge information used by MSSC only
3	ADX: Address complete, coinbox	-	Connect through circuit
4	AFC: Address complete, subscriber free, charge	-	Connect through circuit
5	AFN: Address complete, subscriber free, no charge	-	No-charge information used by MSSC only
6	AFX: Address complete, subscriber free, coinbox	-	Connect through circuit
7	SEC: Switching equipment congestion	Call result message: international network, switching equipment congestion	-
8	CGC: Circuit-group congestion	Call result message: international network, no channel available	-
9	NNC: National network congestion	Call result message: remote public network, switching equipment congestion	-
10	ADI: Address incomplete	Call result message: remote public network, invalid number format	-

TABLE 4/Q.1112 *(contd.)*

Conversion of backward signals in Signalling System No. 7 TUP and INMARSAT Standard-B Signalling System ship-to-shore calls

Signalling system No. 7		INMARSAT standard-B	
Signal No.	Signal name	Message: info element: value	Comments
11	UNN: Unallocated number	Call result message: remote public network, unassigned number	-
12	SGB: Subscriber busy	Call result message: remote public network, user busy Call result message:	-
13	LOS: line out of service	remote public network, destination out of service	-
14	SST: Send special information tone	Call result message: international network, unspecified	-
15	CFL: Call failure	Call result message: international network, unspecified	-
16	ANC: Answer, charge	Connect message	-
17	ANN: Answer, no charge	Connect message	No-charge information used by MSSC only
18	RAN: Reanswer		Clearback supervision done by MSSC
19	CLB: Clearback	Channel release	Clearback supervision done by MSSC
20	GRQ: General request message	-	Interpreted by MSSC
21	Call unsuccessful access barred	Call result message: remote public network, unspecified	-
22	DPN: Call unsuccessful digital path not provided	-	For further study

TABLE 5/Q.1112

Conversion of forward signals in Signalling System R2 and INMARSAT Standard-B Signalling System shore-to-ship calls

Signalling system R2		INMARSAT standard-B	Comments
Signal No.	Signal name	Message: info element: value	
1	Address signals	Announcement message: SES number, called terminal	-
2-7	Language digit, discriminating digit	-	Ignored by MSSC
8	I-11: Country code indicator, outgoing half-echo suppressor required	-	MSSC will suppress the country code and insert echo control device if needed
9	I-12: Country code indicator, no echo suppressor required	-	The MSSC will suppress the country code
10	I-14: Country code indicator, incoming half-echo suppressor required	-	The MSSC will suppress the country code
11	I-14: Incoming half-echo suppressor required	-	Interpreted by MSSC
12	II-7: Calling party's category, subscriber or operation without forward transfer facility	Assignment message: -service: telephone -priority: routine	-
13	II-8: Calling party's category, data transmission control	-	Not applicable
14	II-9: Calling party's category, subscriber with priority	Assignment message: -service: telephone -priority: for further study	-

TABLE 5/Q.1112 (contd)

Signalling system R2		INMARSAT standard-B	Comments
Signal No.	Signal name	Message: info element: value	
15	II-10: Calling party's category, operator with forward transfer facility	Assignment message: -service telephone -priority: routine	-
16	Clear forward signal	Channel release message	-
17	Forward transfer signal	-	Not applicable
18	First digit I-1.....I-10	-	Interpreted and used by MSSC
19	Reply to A-14	-	Not applicable
20-21	Reply to A-13	-	Not applicable

TABLE 6/Q.1112

Conversion of forward signals in Signalling System R2 and INMARSAT Standard-B Signalling System ship-to-shore calls

INMARSAT standard-B	Signalling system R2	
Message: info element: value	Signal name	Signal No.
Address message: called number	Address signals: Country code indicator	1 10
Request message: -priority: routine -service: telephone or 3.1 kHz audio	II-7: Calling party's category, subscriber or operator without forward transfer facility	12
Request message: -priority: urgency, safety or distress -service: telephone or 3.1 kHz audio	II-9: Calling party's category, subscriber with priority	14
Channel release message	Clear forward signal	16
Continuity check tone	Not applicable	-

TABLE 7/Q.1112

Conversion of backward signals in Signalling System R2 and INMARSAT Standard-B Signalling System shore-to-ship calls

INMARSAT standard-B	Signalling system R2	
Message: info element: value	Signal name	Signal No.
Continuity check tone	International, subscriber line free, charge	13
Connect message	Answer signal	11
Channel release message	Clear back signal	12
Call result message: cause value: -user busy -no Channel available -destination out of service -others	 Subscriber line busy Congestion on the national network Subscriber line out of order International, send special info tone	 5 1 10 14

TABLE 7bis/Q.1112

Unsuccessful call events and backward signals in Signalling System R2 shore-to-ship calls

INMARSAT standard-B	Signalling system R2	Signal No.
Event in INMARSAT system	Signal name	
Congestion in MSSC	A-4: Congestion on the national network or B-4: Congestion	1 or 6
No satellite channel available	A-4: Congestion on the national network or B-4: Congestion	1 or 6
Incomplete SES number	B-5: Unallocated number	7
Unallocated SES number	B-5: Unallocated number	7
SES busy	B-3: Subscriber line busy	5
Continuity test failure	B-8: Subscriber line out of order	10
SES absent (no response)	B-2: Send special information tone	4
SES barred for incoming access	B-2: Send special information tone	4
SES unauthorised	B-2: Send special information tone	4

TABLE 8/Q.1112

Conversion of backward signals in Signalling System R2 and INMARSAT Standard-B Signalling System ship-to-shore calls

Signalling system R2		INMARSAT standard-B	
Signal No.	Signal name	Message: info element: value	Comments
1	A-4: Congestion on the national network	Call result message: remote public network switching equipment congestion	
2	A-6: Address complete charge, set up speech conditions	-	Connect through circuit
3	A-15: Congestion in an international exchange or at its output	Call result message: international network, switching equipment congestion	-
4	B-2: Send special information tone	Call result message: remote public network, unspecified	-
5	B-3: Subscriber line busy	Call result message: remote public network, user busy	-
6	B-4: Congestion	Call result message: remote public network, switching equipment congestion	-
7	B-5: Unallocated number	Call result message: remote public network, unassigned number	-
8	B-6: Subscriber line free, charge	-	Connect through circuit
9	B-7: Subscriber line free, no charge	-	No-charge information used by MSSC only

TABLE 8/Q.1112 *(contd.)*

Conversion of backward signals in Signalling System R2 and INMARSAT Standard-B Signalling System ship-to-shore calls

Signalling system R2		INMARSAT standard-B	
Signal No.	Signal name	Message: info element: value	Comments
10	B-8: Subscriber line out of order	Call result message: remote public network, destination out of service	-
11	Answer signal	Connect message	Clearback supervision by MSSC
12	Clear back signal	Channel release	-
13	B-1: International, subscriber line free, charge	-	Connect through circuit
14	B-9, B-10: International, send special information tone	Call result message: international network, unspecified	-
15	B-11 to B-15	Call result message: remote public network, switching equipment congestion	-

TABLE 9/Q.1112

Conversion of forward signals in Signalling System No. 7 ISUP and INMARSAT Standard-B Signalling System shore-to-ship calls

For further study.

TABLE 10/Q.1112

Conversion of forward signals in Signalling System No. 7 ISUP and INMARSAT Standard-B Signalling System ship-to-shore calls

For further study.

TABLE 11/Q.1112

Conversion of backward signals in Signalling System No. 7 ISUP and INMARSAT Standard-B Signalling System shore-to-ship calls

For further study.

TABLE 11bis/Q.1112

Unsuccessful call events and backward signals in Signalling System No. 7 ISUP and INMARSAT Standard-B Signalling System shore-to-ship calls

For further study.

TABLE 12/Q.1112

Conversion of backward signals in Signalling System No. 7 ISUP and INMARSAT Standard-B Signalling System ship-to-shore calls

For further study.

TABLE 13/Q.1112

Conversion of forward signals in Signalling System No. 5 and INMARSAT Standard-B Signalling System shore-to-ship calls

Signalling system No. 5		INMARSAT standard-B	
Signal No.	Signal name	Message: info element: value	Comments
1	Address signal	Announcement message: -SES number, called terminal	-
2-16	Language digit	-	Interpreted by MSSC
7	Discriminating digit 0	Announcement message: -service: telephone	-
8	Start of pulsing KP1	-	Interpreted by MSSC
9	Start of pulsing KP2	-	Interpreted by MSSC
10	Clear forward message	Channel release	-
11	Forward transfer	-	Not applicable

TABLE 14/Q.1112

Conversion of forward signals in Signalling System No. 5 and INMARSAT Standard-B Signalling System ship-to-shore calls

INMARSAT standard-B	signalling system No. 5	
Message: info element: value	Signal name	Signal No.
Address Message: Called number	Address signals start of pulsing KP1 or start of pulsing KP2	1 8 9
Continuity check tone	Not applicable	-
Channel release message	Clear forward	10
Request message: -priority: routine -service: telephone or 3.1 kHz audio	Discriminating digit 0	7
Request message: -priority: urgency, safety or distress -service: telephone or 3.1 kHz audio	Discriminating digit 0	7

TABLE 15/Q.1112

Conversion of backward signals in Signalling System No. 5 and INMARSAT Standard-B Signalling System shore-to-ship calls

INMARSAT standard-B	Signalling system No.5	
Message: info element: value	Signal name	Signal No.
Continuity check tone	Inform that ST has been sent	5
Connect message	Answer signal	2
Channel release	Clear back	3
Call attempt result: Cause value		
-User busy	Busy flash signal	1
-No channel available	Busy flash signal	1
-Destination out of service	Information tone (Note)	-
-Others	Information tone (Note)	-

Note - May include appropriate recorded announcement.

TABLE 15bis/Q.1112

Unsuccessful call events and backward signals in Signalling System No. 5 shore-to-ship calls

Events in INMARSAT system	Signalling system No. 5	
Message: info element: value	Signal name	Signal No.
Congestion in MSSC	Busy flash	1
No satellite channel available	Busy flash	1
SES busy	Busy flash	1
Incomplete SES number	Information tone (Note)	-
Unallocated SES number	Information tone (Note)	-
Continuity test failure	Information tone (Note)	-
SES absent	Information tone (Note)	-
SES barred	Information tone (Note)	-
SES unauthorised	Information tone (Note)	-

Note - May include appropriate recorded announcement

TABLE 16/Q.1112

Conversion of backward signals in Signalling System No. 5 and INMARSAT Standard-B Signalling System ship-to-shore calls

Signalling system No. 5		INMARSAT standard-B	
Signal No.	Signal name	Message: info element: value	Comments
1	Busy Flash	Call Result: international network, unspecified	
2	Answer signal	Connect	
3	Clear back	Channel release	
4	Proceed to send	-	
5	Inform that ST has been sent	-	

3 Incoming INMARSAT procedures (ship-to-shore calls)

Figure 1/Q.1112 contains the procedures for the incoming INMARSAT Standard-B system.

This description only includes those aspects of the INMARSAT Standard-B system which have to be implemented for interworking purposes. Internal procedures, such as those required for setting up/clearing the satellite channel, are not shown. This also applies to pre-emption procedures for assigning channels to distress calls.

The following details should be noted.

3.1 A call is initiated by a ship earth station (SES), by means of an "access request" message. The coast earth station (CES) begins to set up a channel for the voice communication, upon receipt of this message. The call may be aborted at this point, if the requested service is not available, a satellite circuit is not available, or the calling SES is not authorized. The SES is informed of the call abortion by means of a "call result" message.

3.2 The called address and other information required for call set-up is contained in the service address message received from the ship.

Digit analysis (SPITE 12) commences when the service address has been received. This includes also check of address validity, and translation of prefixes to the appropriate destination number.

Unsuccessful events, shown as SPITEs 13, 15, 16, 17, 18 and 19, are indicated to the ship earth station by call result message with the cause field set as shown in Table 17/Q.1112.

The calling party's category indications used are related to information elements of the request message as shown in Table 18/Q.1112.

TABLE 17/Q.1112

Relationship between result of digit analysis and cause field in call result messages

SPITE	Cause field
13: Digit analysis	Local network, invalid number format
15: Unallocated number	Local network, unassigned number
16: Unprovided routing	Local network, no route to destination
17: Barred routing	Local network, call rejected
18: Switching equipment congestion	Local network, switching equipment congestion
19: Circuit group congestion	Local network, no circuit available

TABLE 18/Q.1112

Calling Party's category indications used for calls in INMARSAT Standard-B Signalling System

INMARSAT information elements	Calling party's category fite
Priority: routine Service: telephone or 3.1 kHz audio	17: Subscriber, ordinary call
Priority: urgency, safety or distress Service: telephone or 3.1 kHz audio	18: Subscriber, call with priority

3.3 The interworking procedure is activated when countinuity of the satellite circuit has been established. If there is no outgoing circuit available in the MSSC at that time, the satellite circuit is cleared by a call result message with the cause field set to "local network, no circuit available".

3.4 Upon receipt of an address complete indication (BITE 27) or an address complete, subscriber free signal (BITEs 5, 6 or 7) the circuit is through-connected in the MSSC in order to allow supervisory tones to be passed to the ship earth station.

3.5 For unsuccessful call set-up one of the following BITEs may be received from the interworking procedure: BITEs 9 through 17, 19 and 20. The corresponding cause indicated in the call result message sent to the ship earth station should be as shown in Table 19/Q.1112.

TABLE 19/Q.1112

Relationship between unsuccessful call BITEs and cause field in call result messages

BITE	Cause field
9: Switching equipment congestion	International network, switching equipment congestion
10: Circuit group congestion	International network, no channel available
11: Switching equipment congestion or circuit group congestion	International network, switching equipment congestion
12: National network congestion	Remote public network, switching equipment congestion
13: Address complete, national network congestion	Remote public network switching equipment congestion
14: Address incomplete	Remote public network, invalid number format
15: Unallocated number	Remote public network, unassigned number
16: Address complete, subscriber busy	Remote public network, user busy
17: Address complete, line out of service	Remote public network, destination out of service
19: Call failure	International network, unspecified
20: Send special information tone	International network, unspecified

Note - See also Tables 4/Q.1112, 8/Q.1112 and 16/Q.1112.

3.6 The connect message is sent when an answer signal is received.

3.7 Clear back from the fixed network is not immediately relayed to the ship earth station. However, clear-back supervision is done by the interworking procedure.

Normal clearing takes place when a channel release signal is received from the ship earth station or a clear-back indication (BITE 25) is received from the interworking procedure. BITE 25 is generated when the timer defined in Recommendation Q.118, § 4.3.2 expires, (see the various interworking procedures defined below).

3.8 Additional procedures required for interworking with ISUP are for further study.

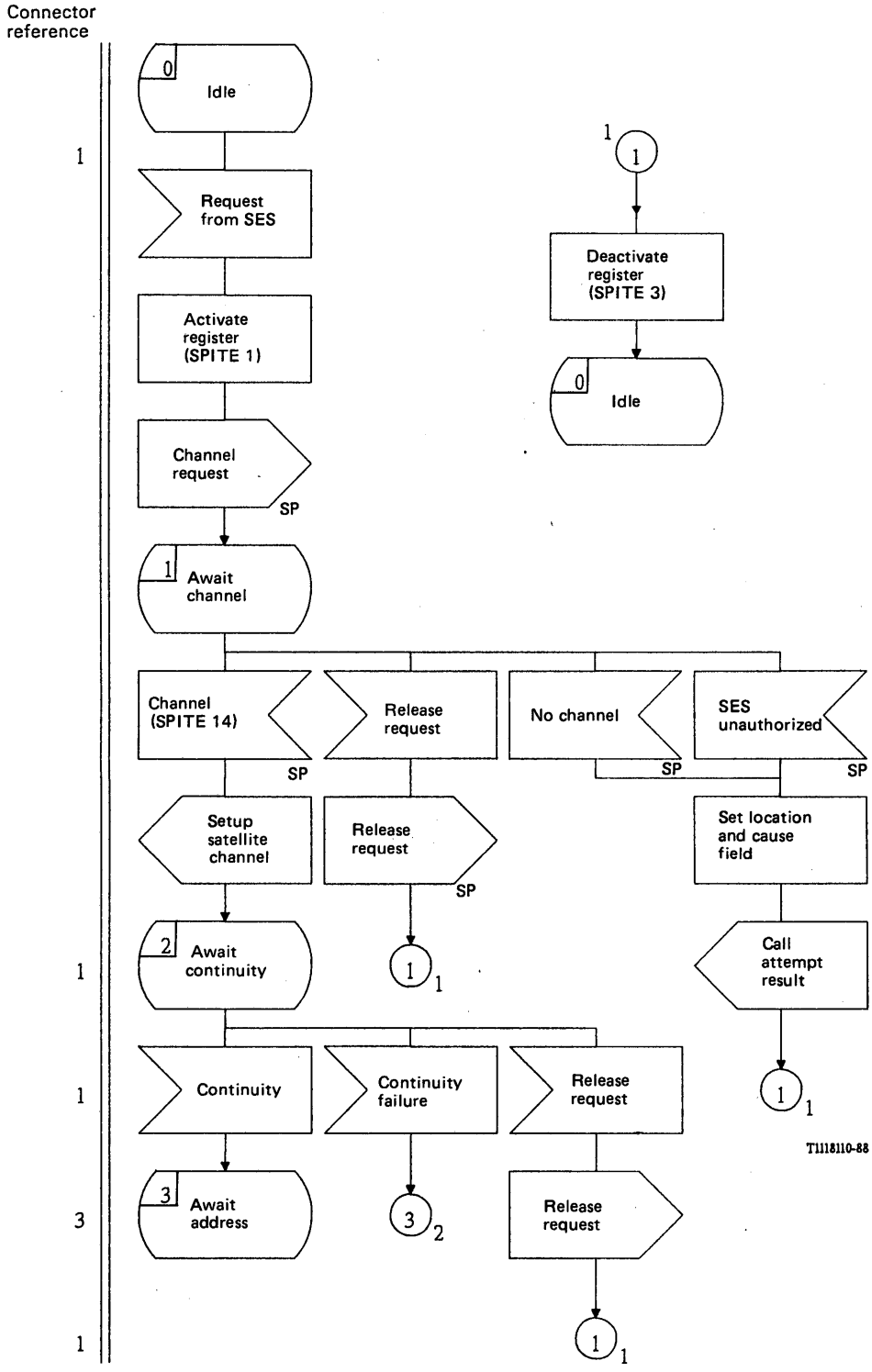


FIGURE 1/Q.1112 (sheet 1 of 3)

Logic procedures for incoming INMARSAT Standard B signalling (ship to shore calls)

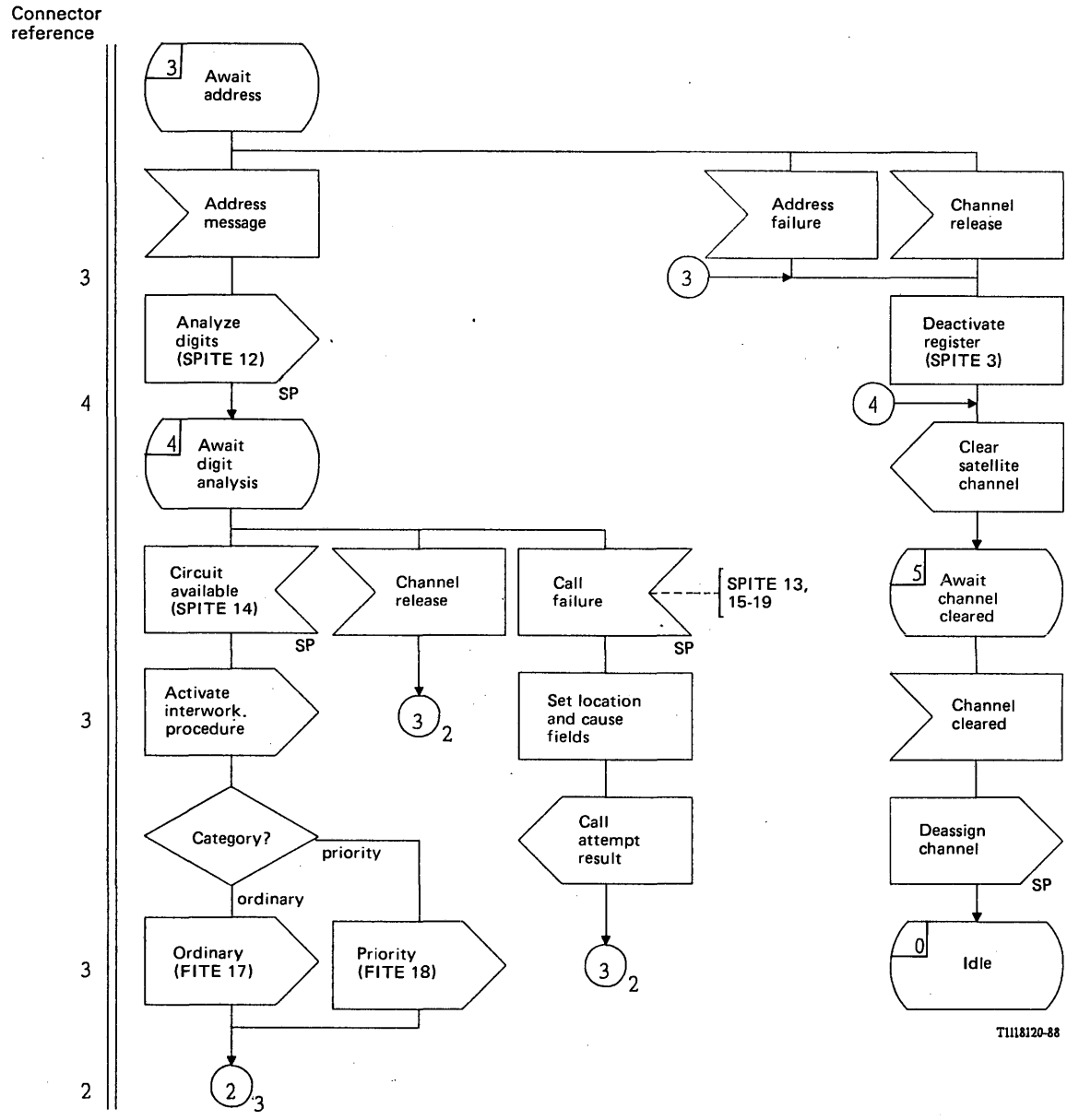


FIGURE 1/Q.1112 (sheet 2 of 3)

Logic procedures for incoming INMARSAT Standard B signalling (ship to shore calls)

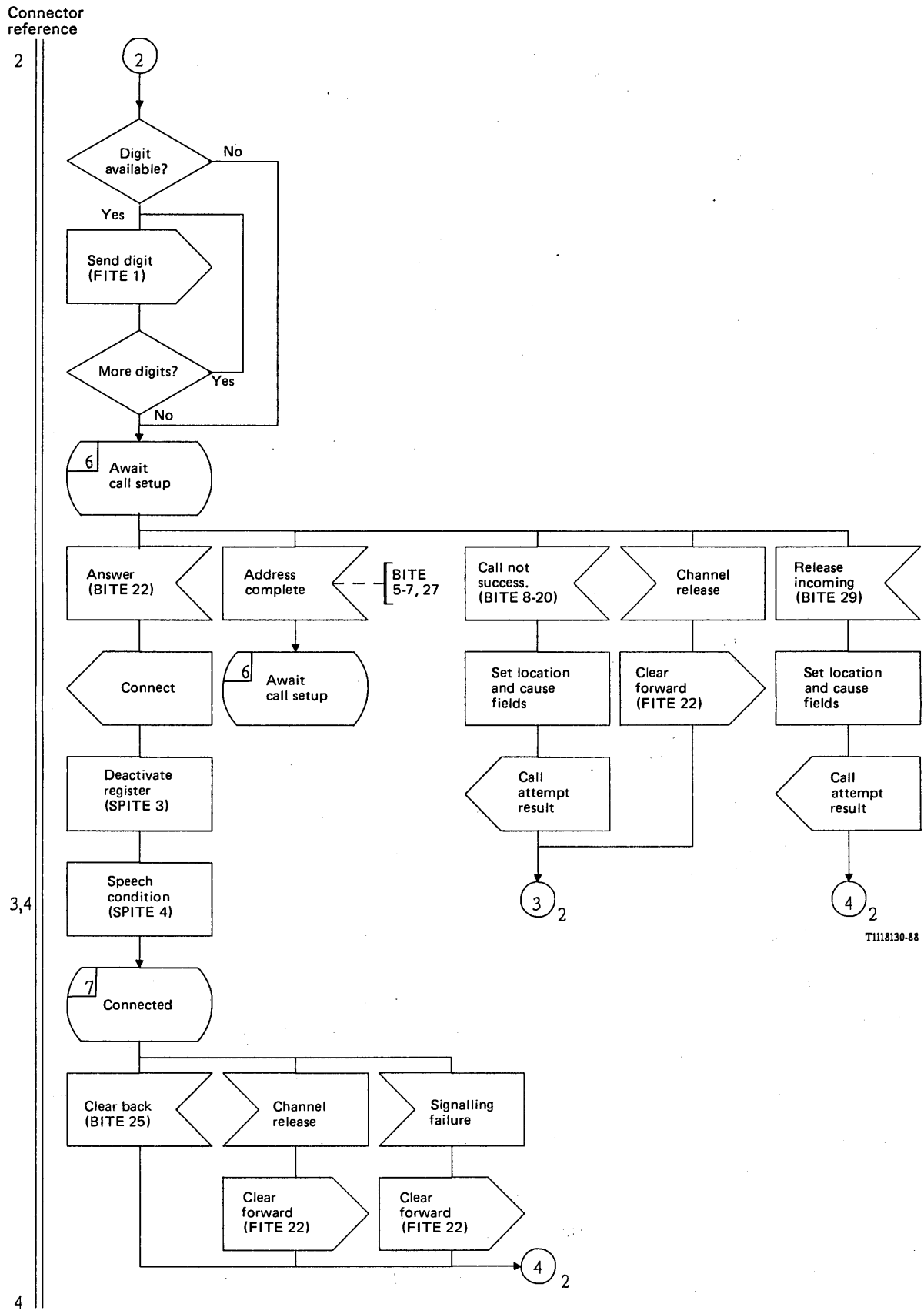


FIGURE 1/Q.1112 (sheet 3 of 3)

Logic procedures for incoming INMARSAT Standard B signalling (ship to shore calls)

4 Outgoing INMARSAT procedures (shore-to-ship calls)

Figure 2/Q.1112 contains the procedures for the outgoing INMARSAT Standard-B Signalling System.

This description only includes those aspects of the INMARSAT Standard-B system which have to be implemented for interworking purposes. Internal procedures, such as those required for setting up and clearing the satellite channel, are not shown. This also applies to preemption procedures for assigning channels to distress calls.

The following details should be noted.

4.1 The satellite circuit is established when all digits of the SES number have been received. The MSSC will check if the SES is barred for incoming calls or busy. This may involve information exchange with the Network Coordination Station. Call barring is indicated to the fixed network by use of BITE 20: send special information tone. For ISDN interworking (Signalling System No. 7) the cause may be indicated more precisely.

4.2 Calling party's category indicators are converted to information elements in INMARSAT Standard B signalling system as shown in Table 20/Q.1112.

TABLE 20/Q.1112

Conversion of calling party's category indicators to information elements in INMARSAT Standard-B Signalling System

Calling party's category indicator FITE	Information elements in INMARSAT
9-13: Operator, language indication	
14: Operator with forward transfer facility	
15: Subscriber	Priority: routine Service: telephone
16: Subscriber or operator with forward transfer facility	
17: Subscriber, ordinary call	
18: Subscriber, call with priority	Priority: for further study Service : telephone
19: Data call	Priority: routine Service: telephone (3.1 kHz audio)

Note - FITEs 9-16 are converted to FITE 17 by the interworking procedure.

4.3 The following events may occur during call set-up:

- the SES is busy (BITE 16); this is indicated by the NCS during call set-up;

- there is no available satellite channel for the requested service; in this case network congestion indication (BITE 12) is provided back to the fixed network;

- the continuity test may fail; in this case the subscriber line out of service indication (BITE 17) is used.

If the called terminal on the ship is not available (even though the SES could make the connection) or does not support the requested service type, the SES will indicate this by a call result message. This is for further study.

4.4 When a clear forward signal is received from the fixed network, the MSSC will clear the satellite circuit with a channel release message.

The ship earth station may clear the satellite circuit by sending a channel release message to the MSSC. When receiving such a message, the MSSC will initiate clearing of the satellite circuit and provide a clear-back signal to the fixed network.

Precautions should be taken at the ship earth station in order to avoid unintentional clearing by the user. This could be done by allowing some time (e.g. five seconds) for a reanswer signal to appear before the channel release message is sent to the MSSC.

The MSSC may also release the circuit if problems are detected on the radio path. In this case also a clear-back signal should be provided to the fixed network.

4.5 Additional procedures required for interworking with ISUP are for further study.

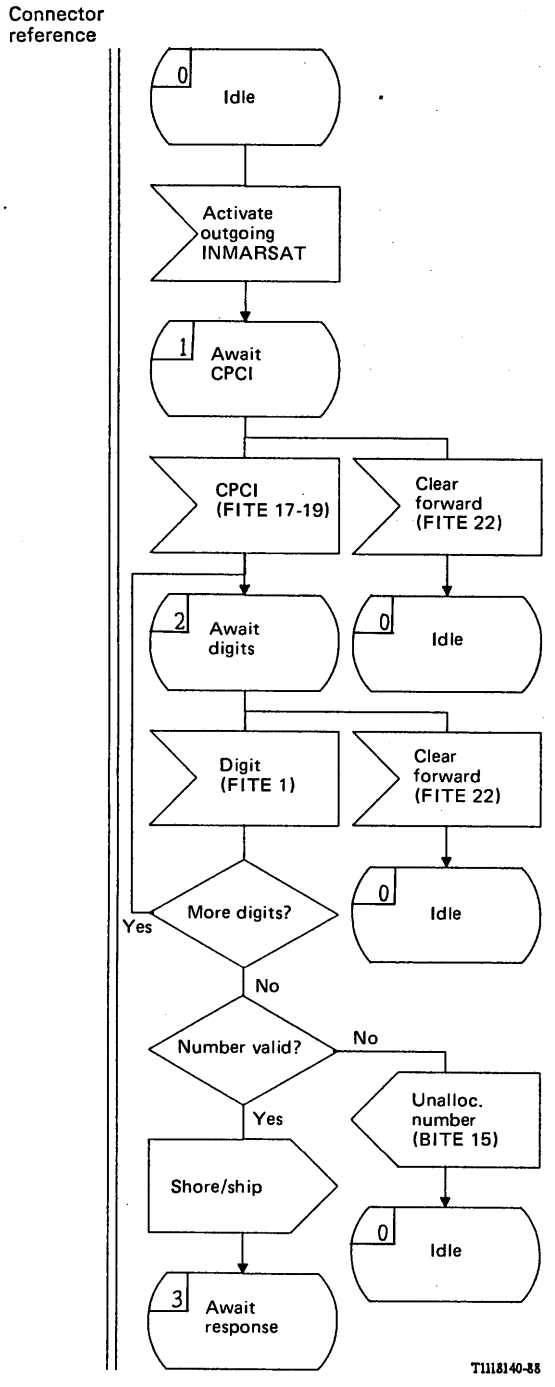


FIGURE 2/Q.1112 (sheet 1 of 3)

Logic procedures for outgoing INMARSAT Standard B signalling (shore to ship calls)

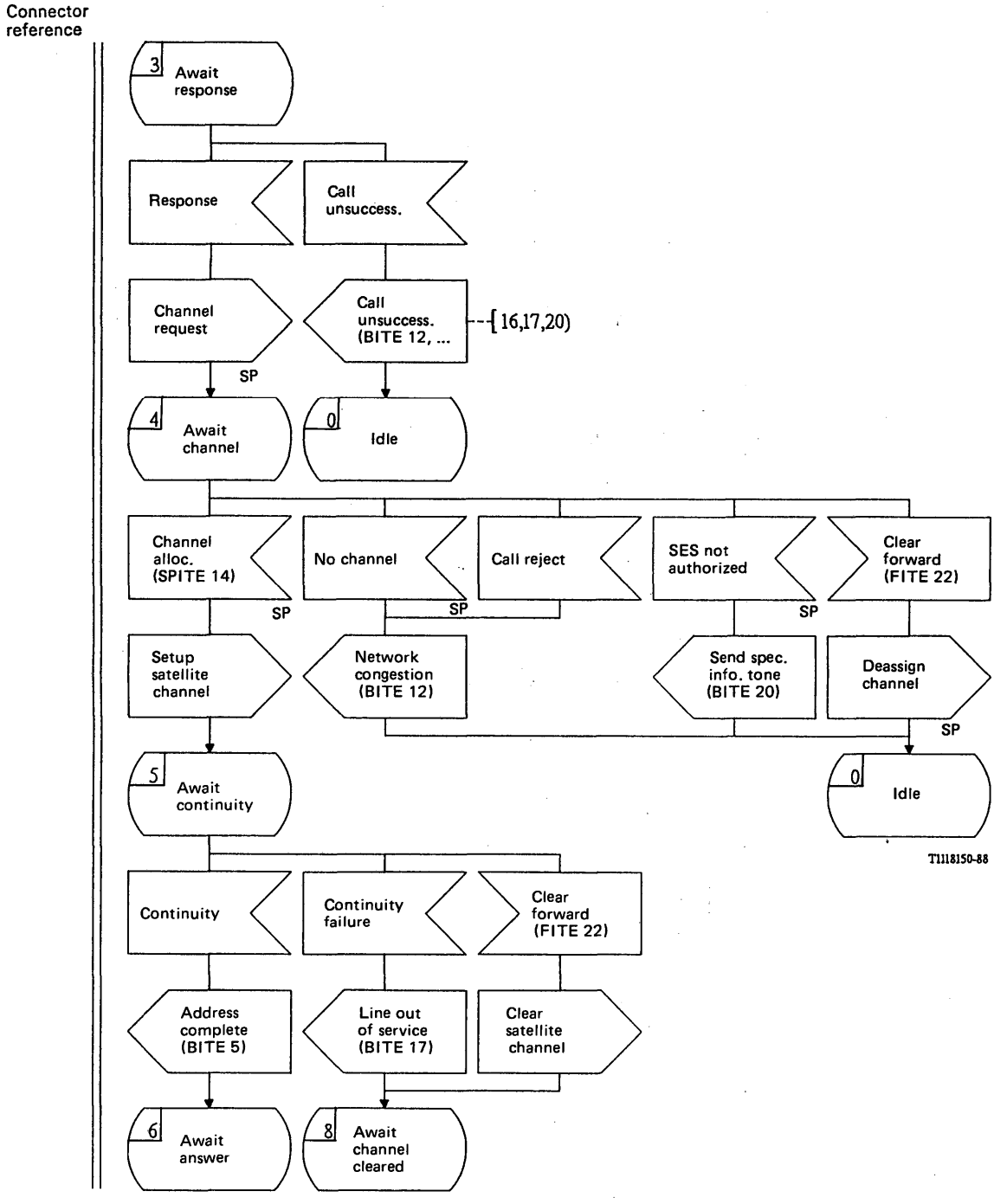


FIGURE 2/Q.1112 (sheet 2 of 3)

Logic procedures for outgoing INMARSAT Standard B signalling (shore to ship calls)

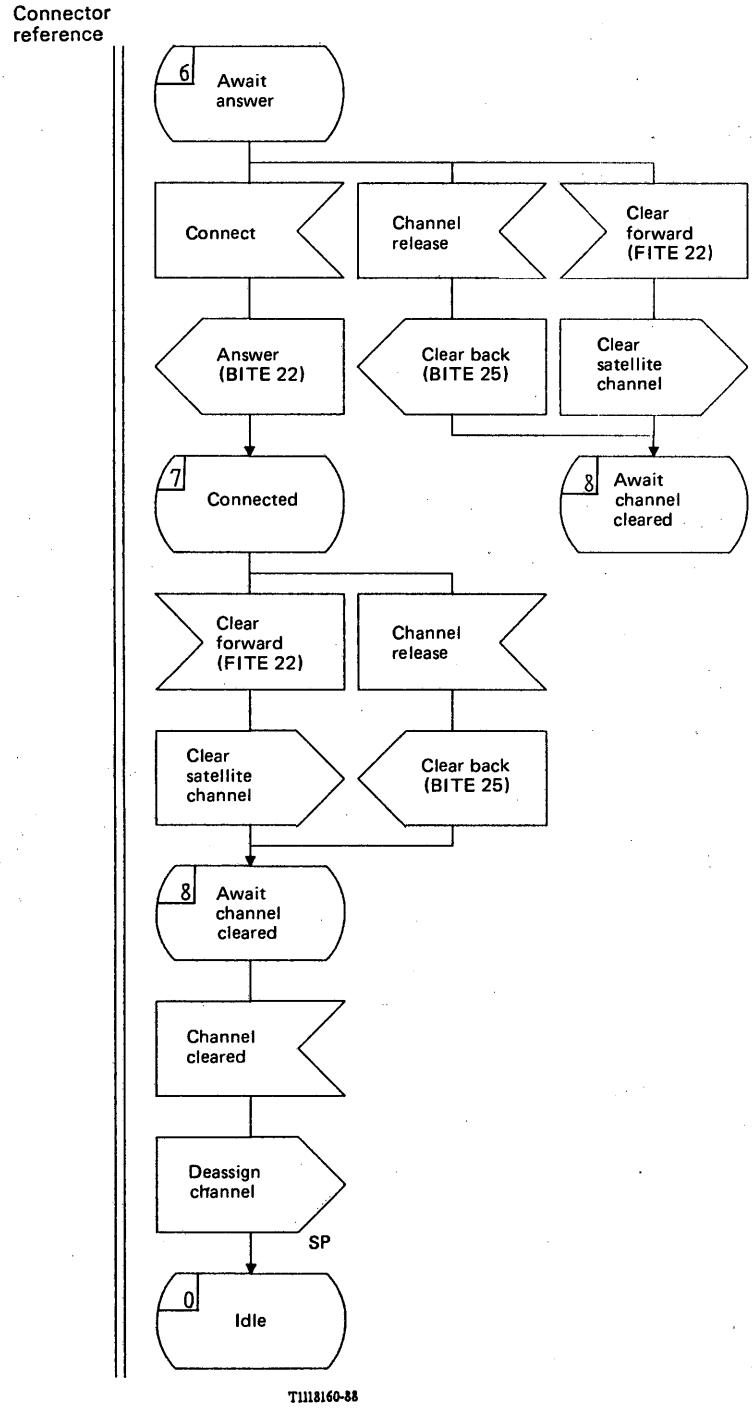


FIGURE 2/Q.1112 (sheet 3 of 3)

Logic procedures for outgoing INMARSAT Standard B signalling (shore to ship calls)

5 Interworking of incoming INMARSAT to outgoing INMARSAT

5.1 Figure 3/Q.1112 contains the procedures for interworking between incoming and outgoing procedures of INMARSAT Standard-B signalling system.

These procedures may also apply for interworking with the INMARSAT Standard-B and Standard-A systems.

5.2 The interworking procedure supervises the answer time (timer t1). The value of timer t1 is two to four minutes in compliance with Recommendation Q.118, § 4.3.1.

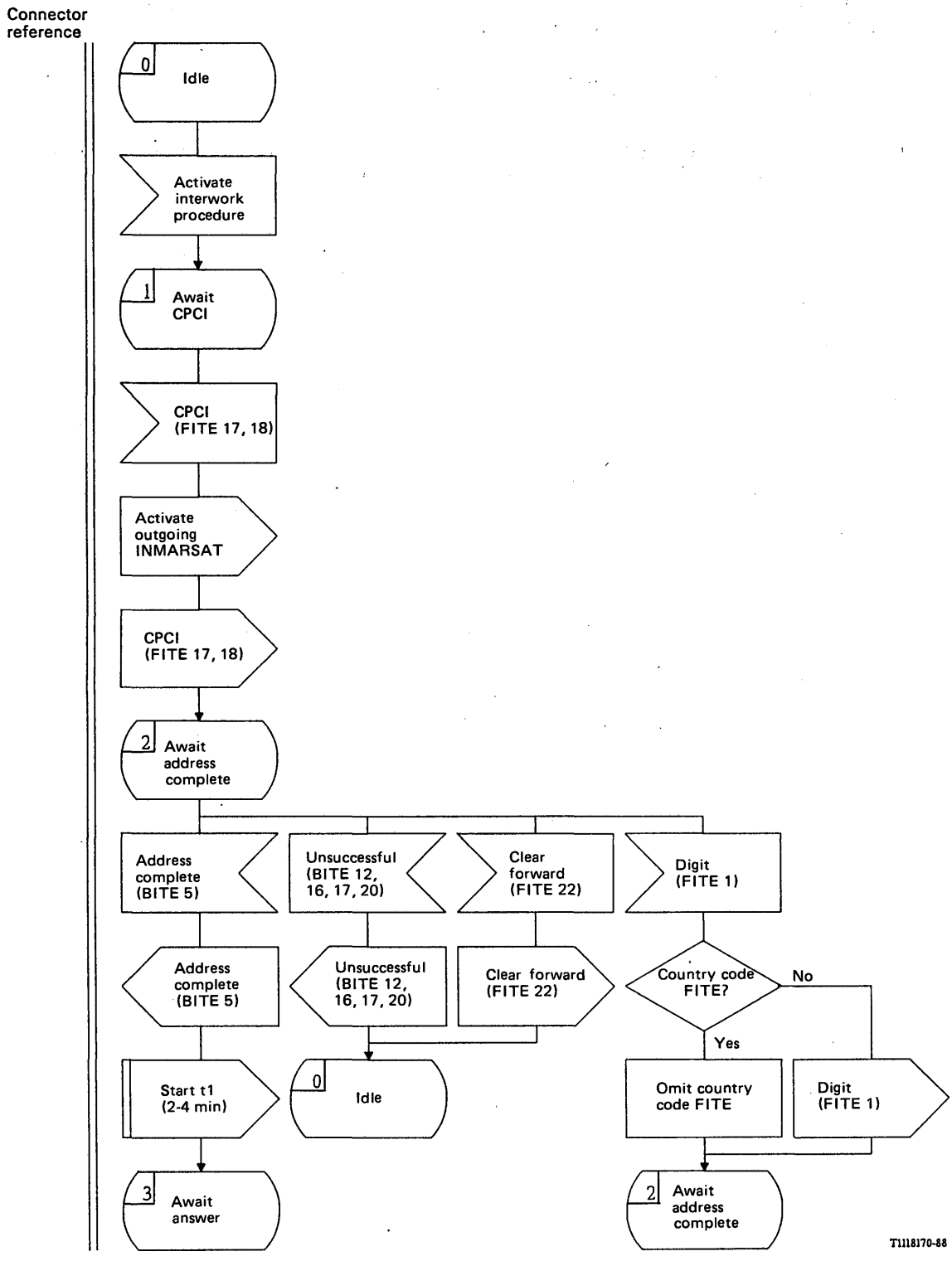


FIGURE 3/Q.1112 (sheet 1 of 2)

Interworking of INMARSAT Standard B System with itself

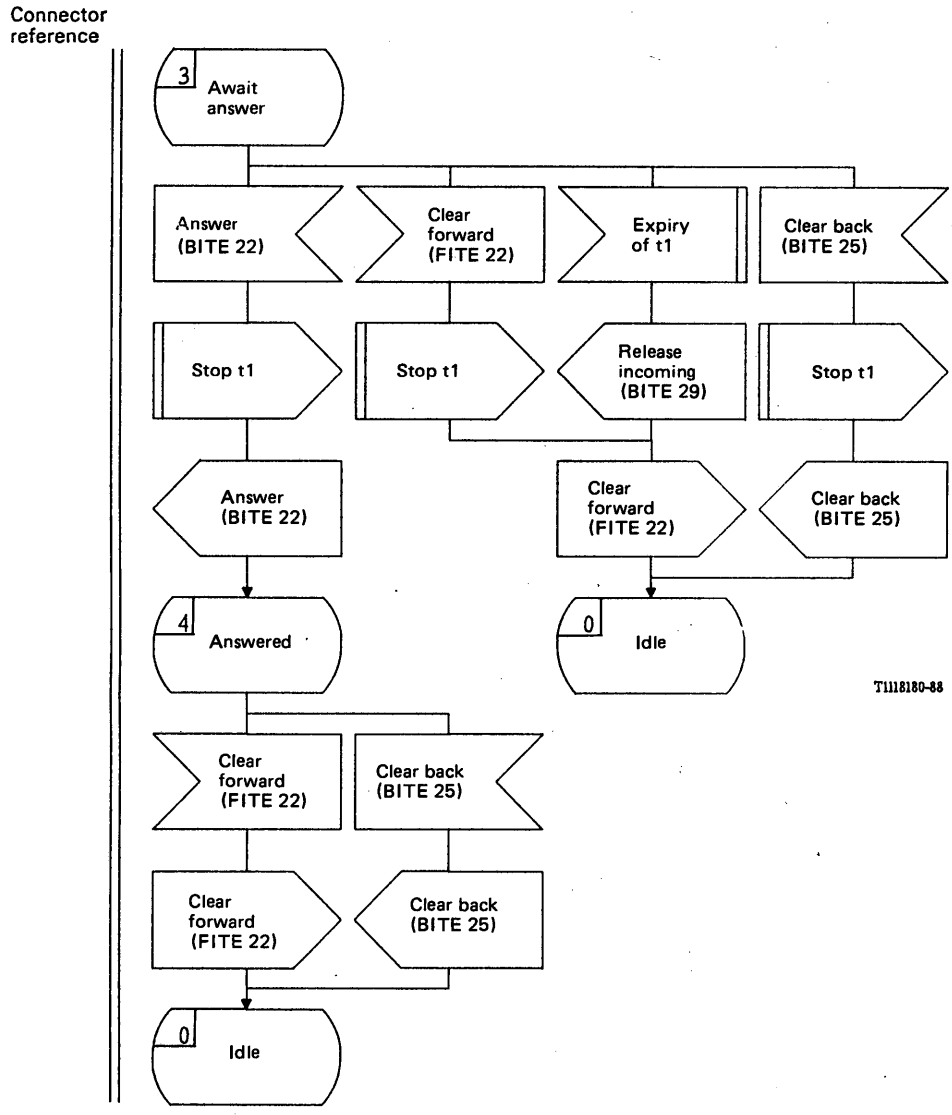


FIGURE 3/Q.1112 (sheet 2 of 2)

Interworking of INMARSAT Standard B System with itself

6 Interworking of Signalling System R2 to outgoing INMARSAT

6.1 Figure 4/Q.1112 contains the procedures for interworking of Signalling System R2 to INMARSAT Standard-B signalling system.

6.2 The ringing tone towards the calling subscriber of the fixed network is intitiated by the interworking procedure. The tone should have characteristics in accordance with Recommendation Q.35.

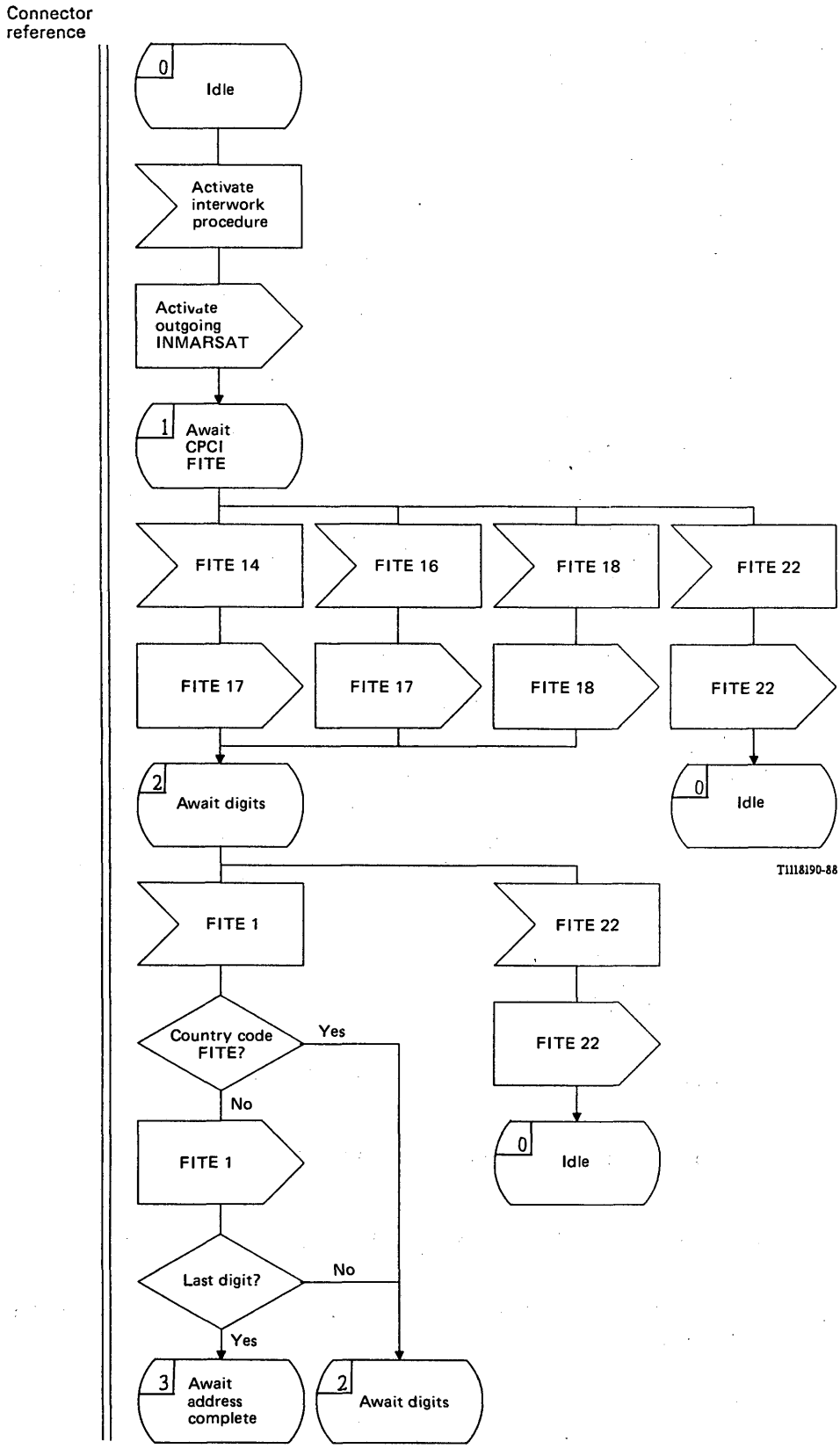


FIGURE 4/Q.1112 (sheet 1 of 2)

Interworking of Signalling System R2 to INMARSAT Standard B System

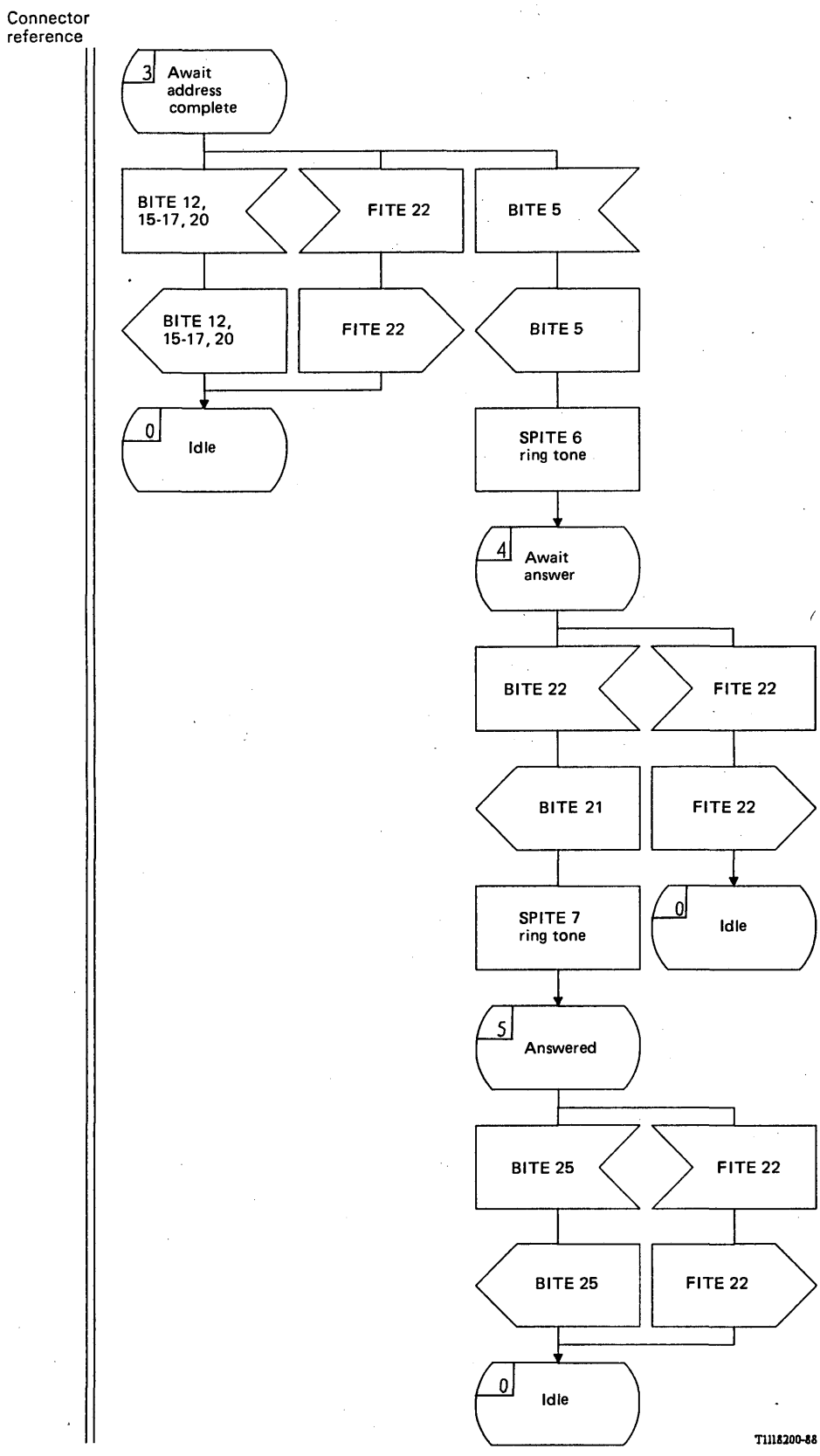


FIGURE 4/Q.1112 (sheet 2 of 2)

Interworking of Signalling System R2 to INMARSAT Standard B System

7 Interworking of incoming INMARSAT to Signalling System R2

7.1 Figure 5/Q.1112 contains the procedure for interworking of Signalling System R2 to INMARSAT Standard-B signalling system.

7.2 If the call is destined to a country whose ISC has direct connection to the MSSC (result of SPITE 22, transit connection following?), the country code not included indication (FITE 2) is provided to the outgoing Signalling System R2 procedure. This indication is followed by an echo-suppressor indicator (FITE 4 or FITE 5). FITE 4 is used when an incoming echo control device is not required for the call (e.g. data call); otherwise FITE 5 should be used.

For calls requiring a transit ISC the country code indicator FITE 7 or FITE 8 should be used. FITE 7 is used when an incoming echo control device is not required at the remote end and FITE 8 when such a device is to be inserted.

See also Recommendation Q.1111 for control of echo control devices.

7.3 The interworking procedure supervises the answer time and the clear-back time (timers t1 and t2, respectively).

Timers t1 and t2 take values as follows:

t1 = two to four minutes, Recommendation Q.118, § 4.3.1

t2 = one to two minutes, Recommendation Q.118, § 4.3.2.

When timer t1 expires, a forced release message is returned to the incoming INMARSAT procedure (BITE 29). When timer t2 expires, a clear-back message is sent to the incoming INMARSAT procedure (BITE 25).

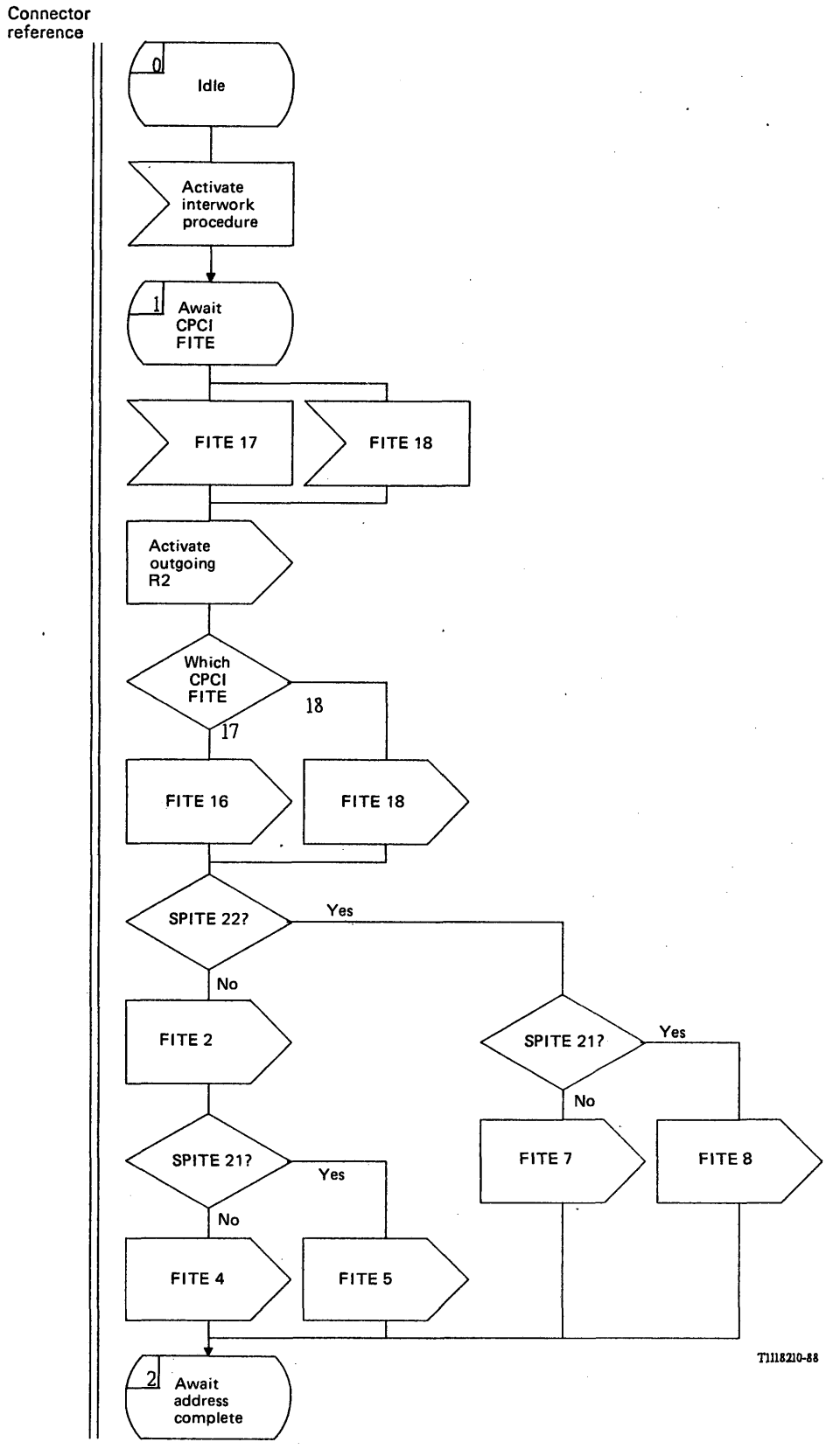


FIGURE 5/Q.1112 (sheet 1 of 3)

Interworking of INMARSAT Standard B System to Signalling System R2

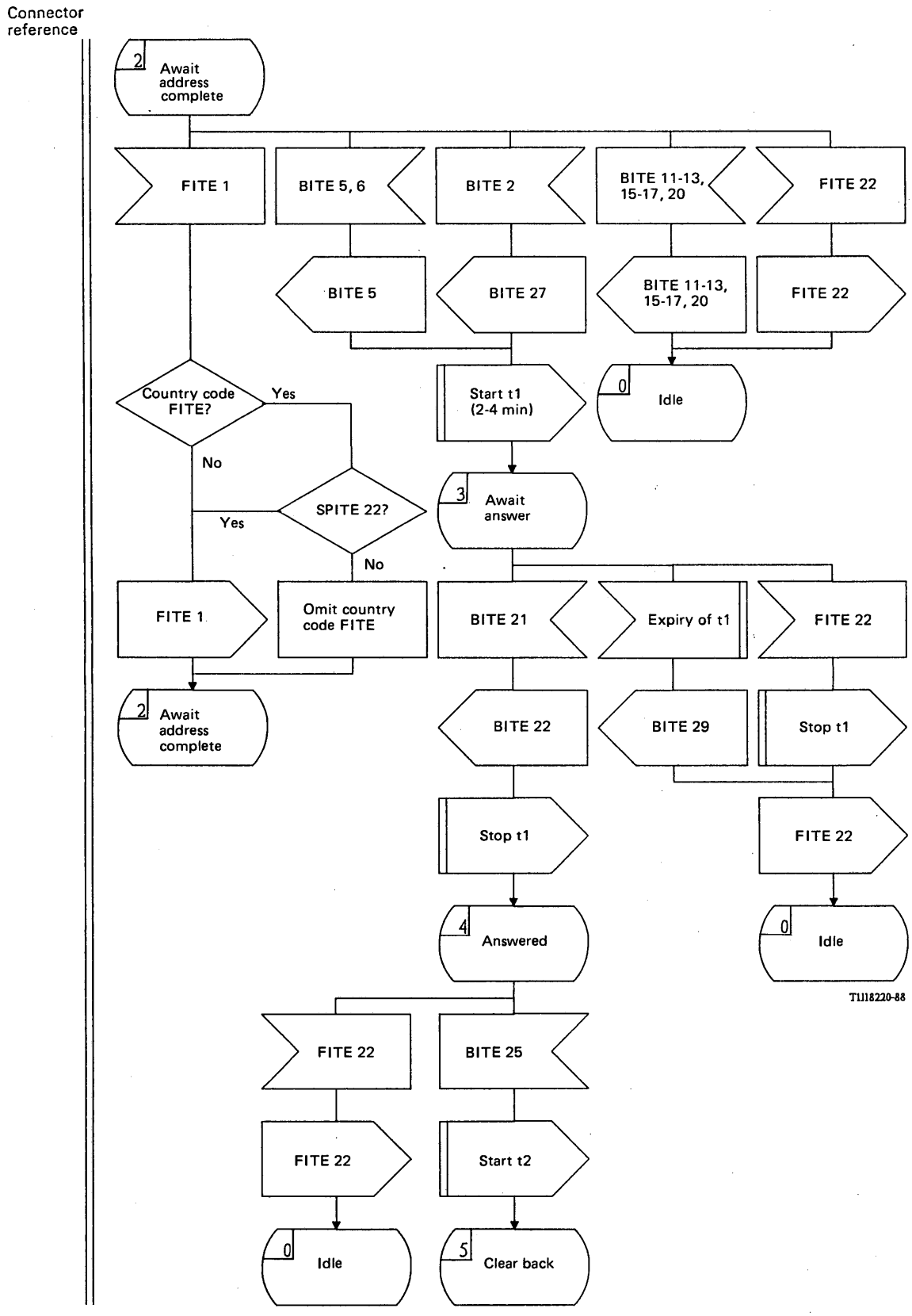


FIGURE 5/Q.1112 (sheet 2 of 3)

Interworking of INMARSAT Standard B System to Signalling System R2

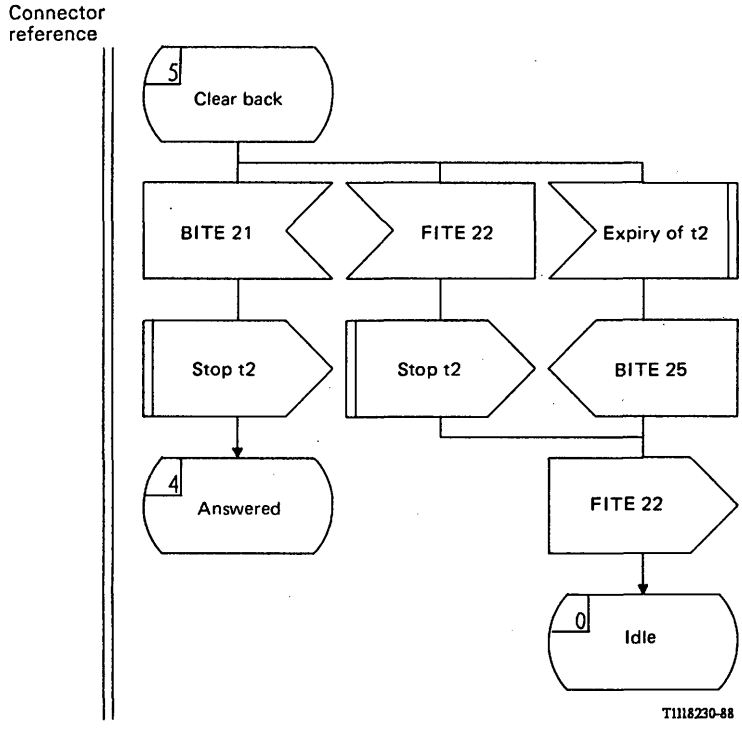


FIGURE 5/Q.1112 (sheet 3 of 3)

Interworking of INMARSAT Standard B System to Signalling System R2

8 Interworking of Signalling System No. 7 TUP to outgoing INMARSAT

8.1 Figure 6/Q.1112 contains the procedures for interworking of Signalling System No. 7 TUP to INMARSAT Standard-B signalling system.

8.2 Activation of the outgoing INMARSAT procedure takes place when a continuity indicator (FITE 24 or FITE 25) is received from Signalling System No. 7. Any digits received during this time are stored by the interworking procedure and then provided to the outgoing INMARSAT procedure when continuity has been indicated.

8.3 The ringing tone towards the calling subscriber of the fixed network is initiated by the interworking procedure. The tone should have characteristics in accordance with Recommendation Q.35.

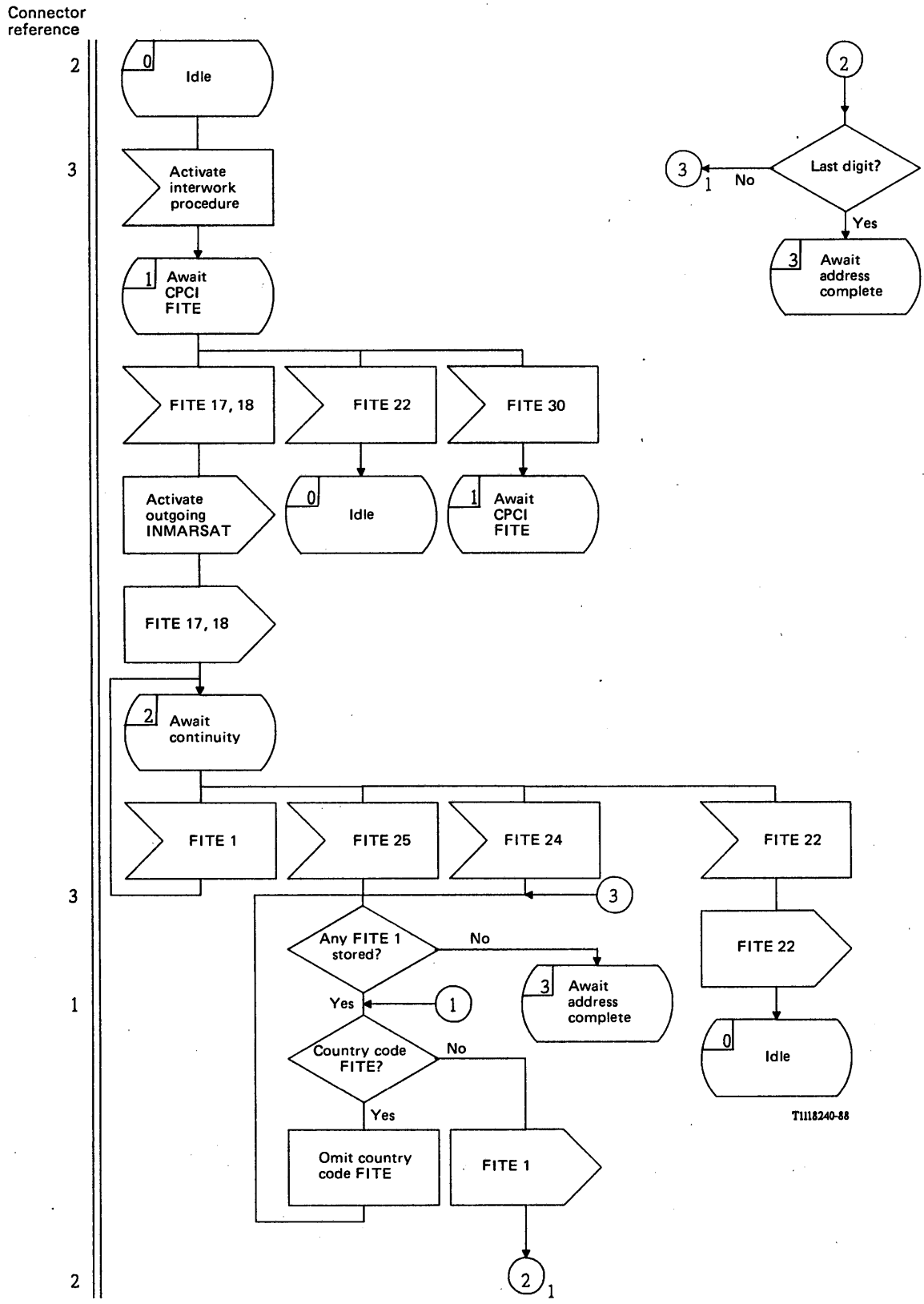


FIGURE 6/Q.1112 (sheet 1 of 2)

Interworking of Signalling System No. 7 TUP of INMARSAT Standard B System

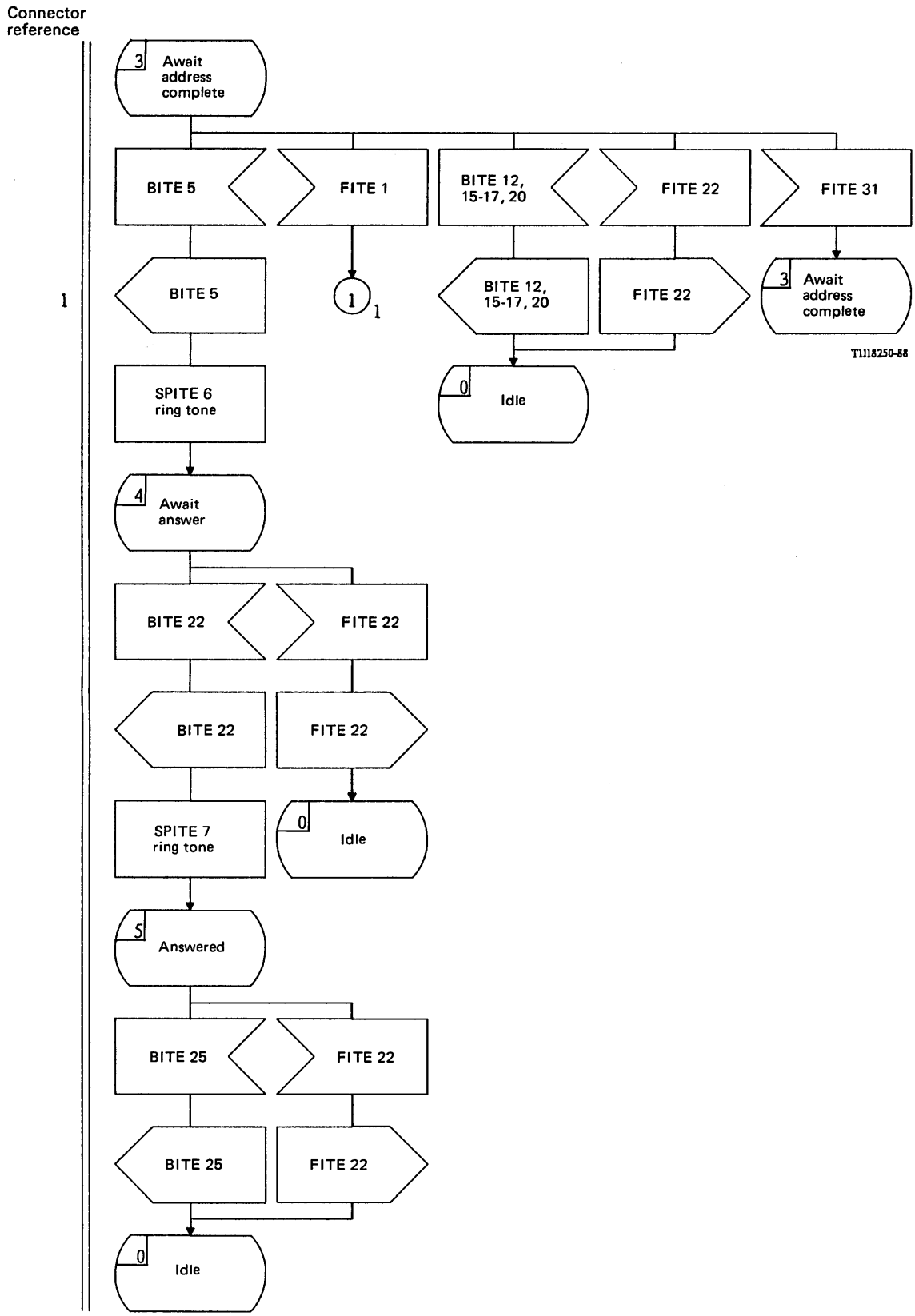


FIGURE 6/Q.1112 (sheet 2 of 2)

Interworking of Signalling System No. 7 TUP of INMARSAT Standard B System

9 Interworking of incoming INMARSAT to Signalling System No. 7 TUP

9.1 Figure 7/Q.1112 contains the procedures for interworking of incoming INMARSAT Standard-B signalling system to Signalling System No. 7 TUP.

9.2 The interworking procedure provides the following information to the outgoing Signalling System No. 7 procedure in order to initialize the information elements of the initial address message.

- continuity check required or not required (FITE 25 or FITE 26);
- one satellite link included (FITE 21);
- country code indicator: FITE 2 if the call is destined for a country whose ISC has direct connections to the MSSC and FITE 3 in all other cases;
- echo control indicator: FITE 4 when an echo control device is not required and FITE 5 when such a device is required at the incoming end.

9.3 The interworking procedure supervises the answer time and the clear-back time (timers t1 and t2, respectively).

Timers t1 and t2 take values as follows:

t1 = two to four minutes, Recommendation Q.118, § 4.3.1

t2 = one to two minutes, Recommendation Q.118, § 4.3.2.

When timer t1 expires, a forced release message is returned to the incoming INMARSAT procedure (BITE 29). When timer t2 expires, a clear-back message is sent to the incoming INMARSAT procedure (BITE 25).

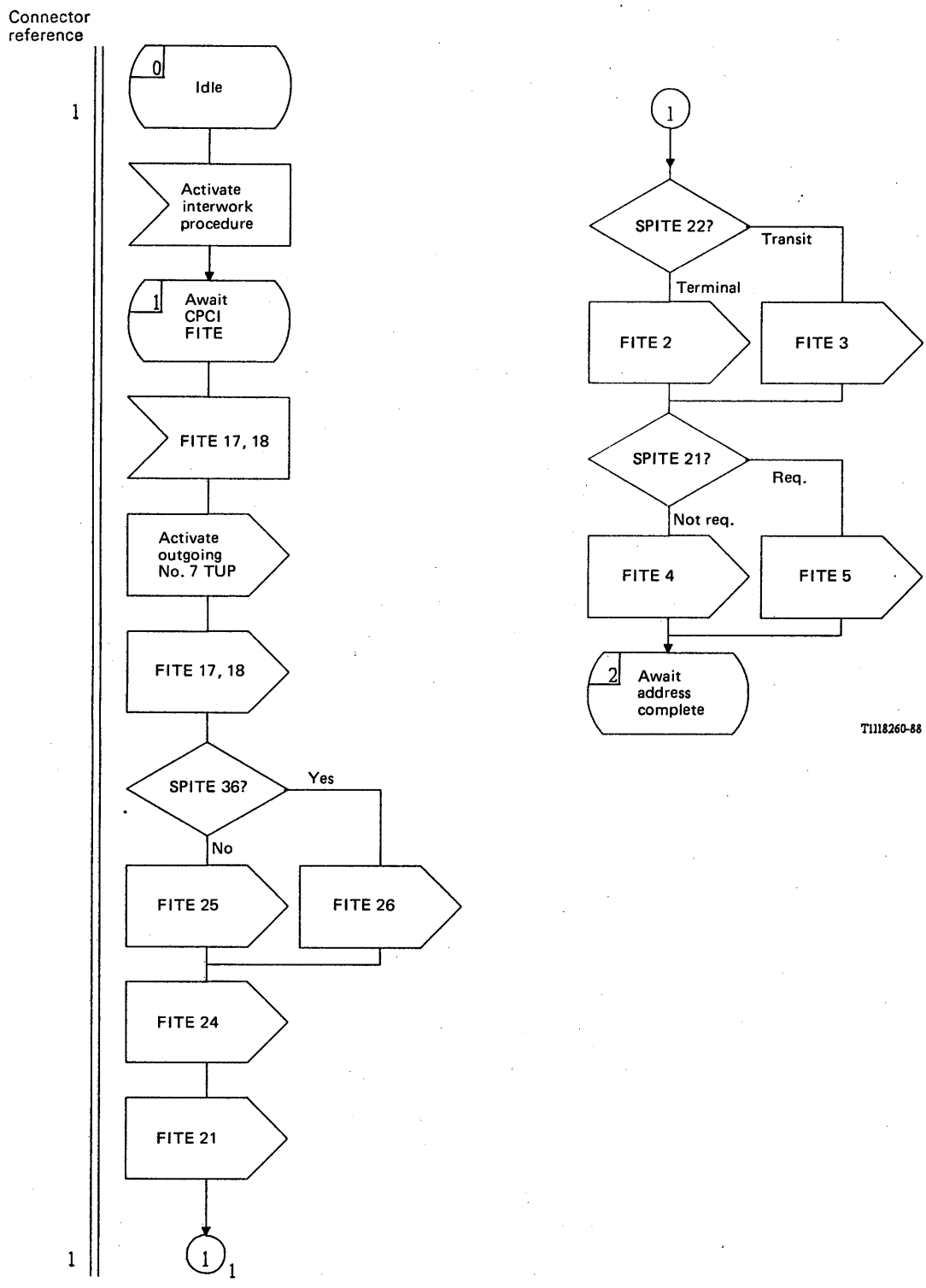


FIGURE 7/Q.1112 (sheet 1 of 3)

Interworking of INMARSAT Standard B System to Signalling System No. 7 TUP

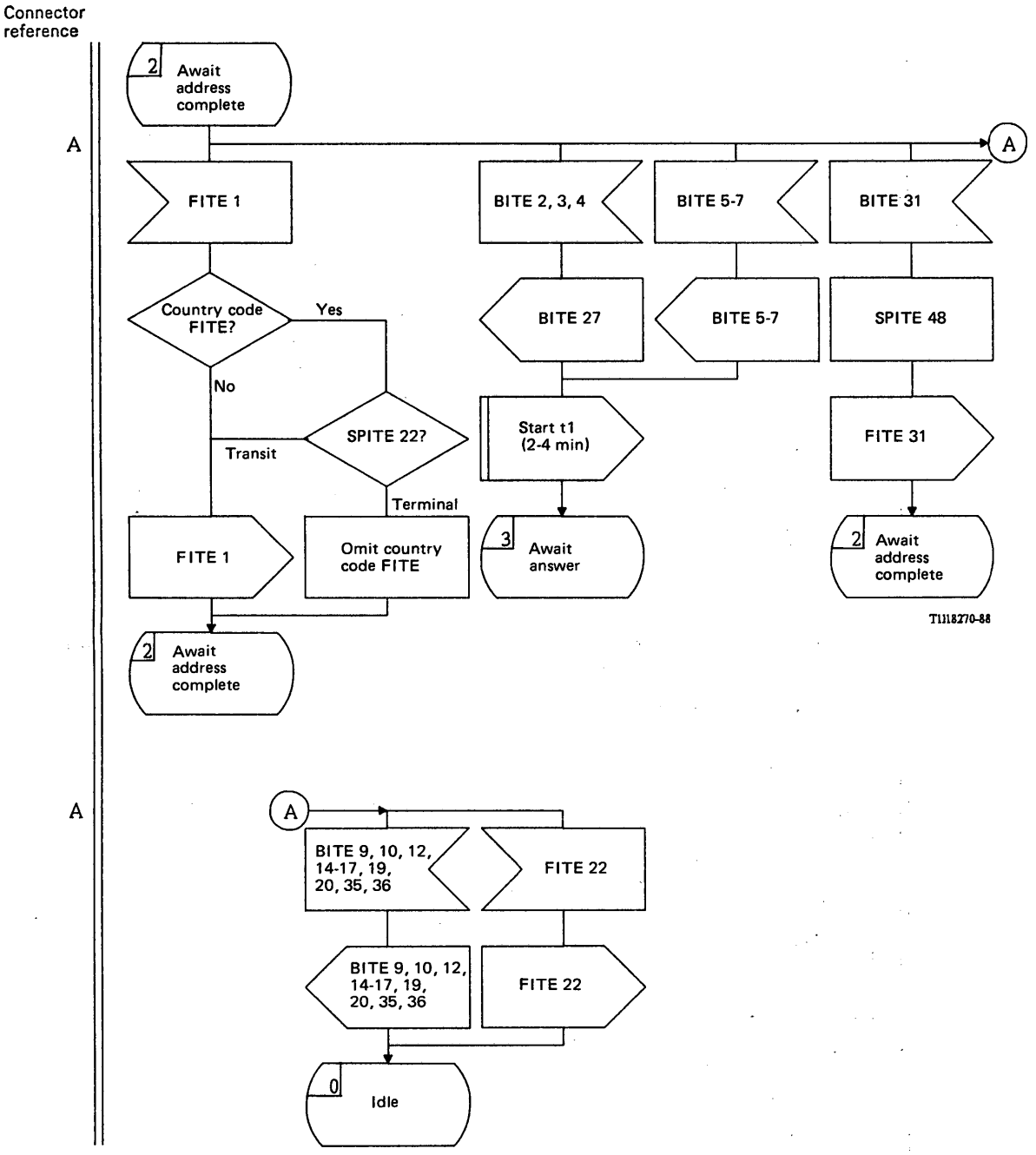


FIGURE 7/Q.1112 (sheet 2 of 3)

Interworking of INMARSAT Standard B System to Signalling System No. 7 TUP

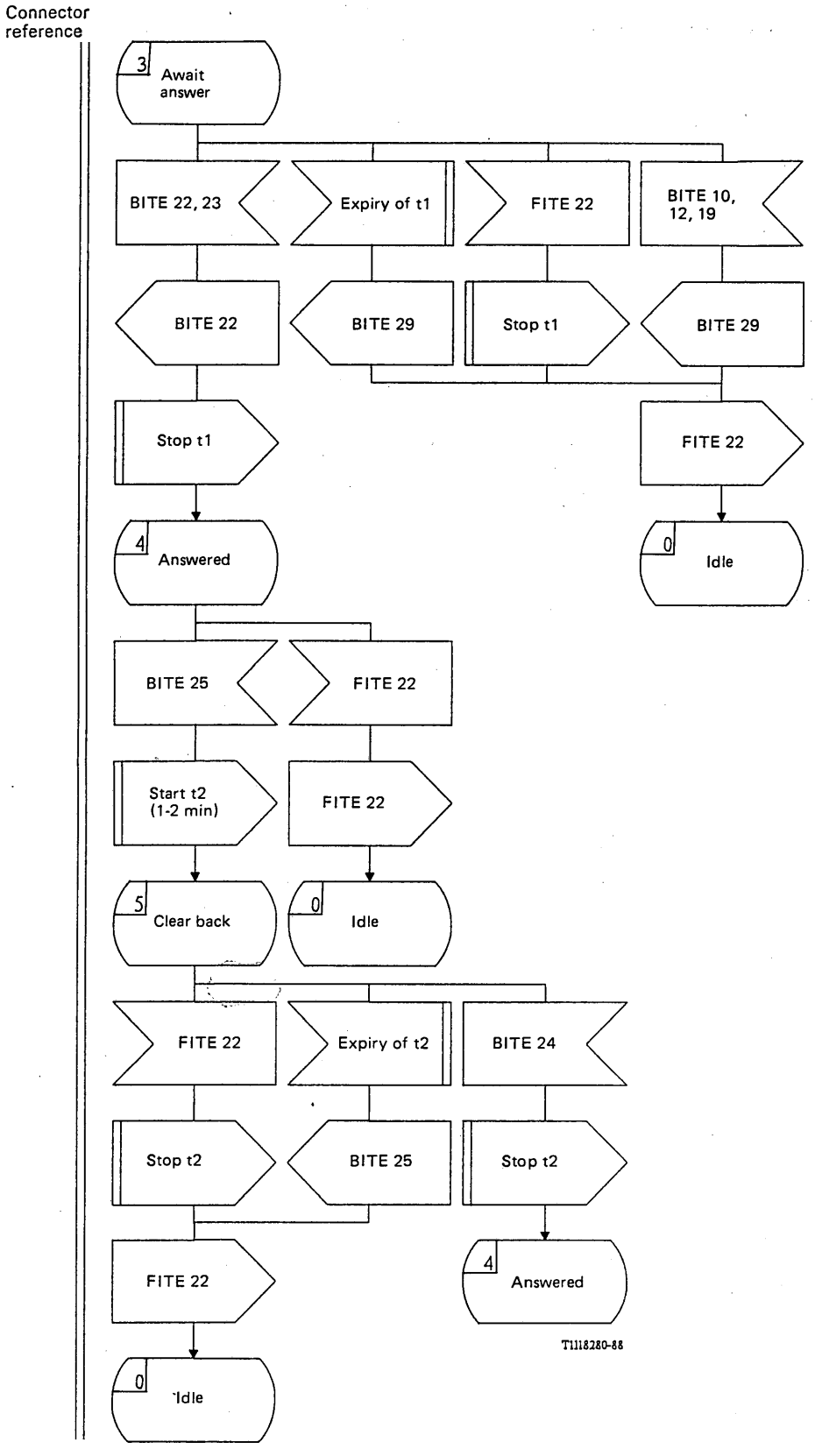


FIGURE 7/Q.1112 (sheet 3 of 3)

Interworking of INMARSAT Standard B System to Signalling System No. 7 TUP

10 Interworking of Signalling System No. 7 ISUP to outgoing INMARSAT

For further study.

11 Interworking of incoming INMARSAT to Signalling System No. 7 ISUP

For further study.

12 Interworking of Signalling System No. 5 to outgoing INMARSAT

Figure 8/Q.1112 contains the procedures for the interworking of Signalling System No. 5 to the INMARSAT Standard-B signalling system.

13 Interworking of incoming INMARSAT to Signalling System No. 5

Figure 9/Q.1112 contains the procedures for the interworking of INMARSAT Standard-B signalling system to Signalling System No. 5.

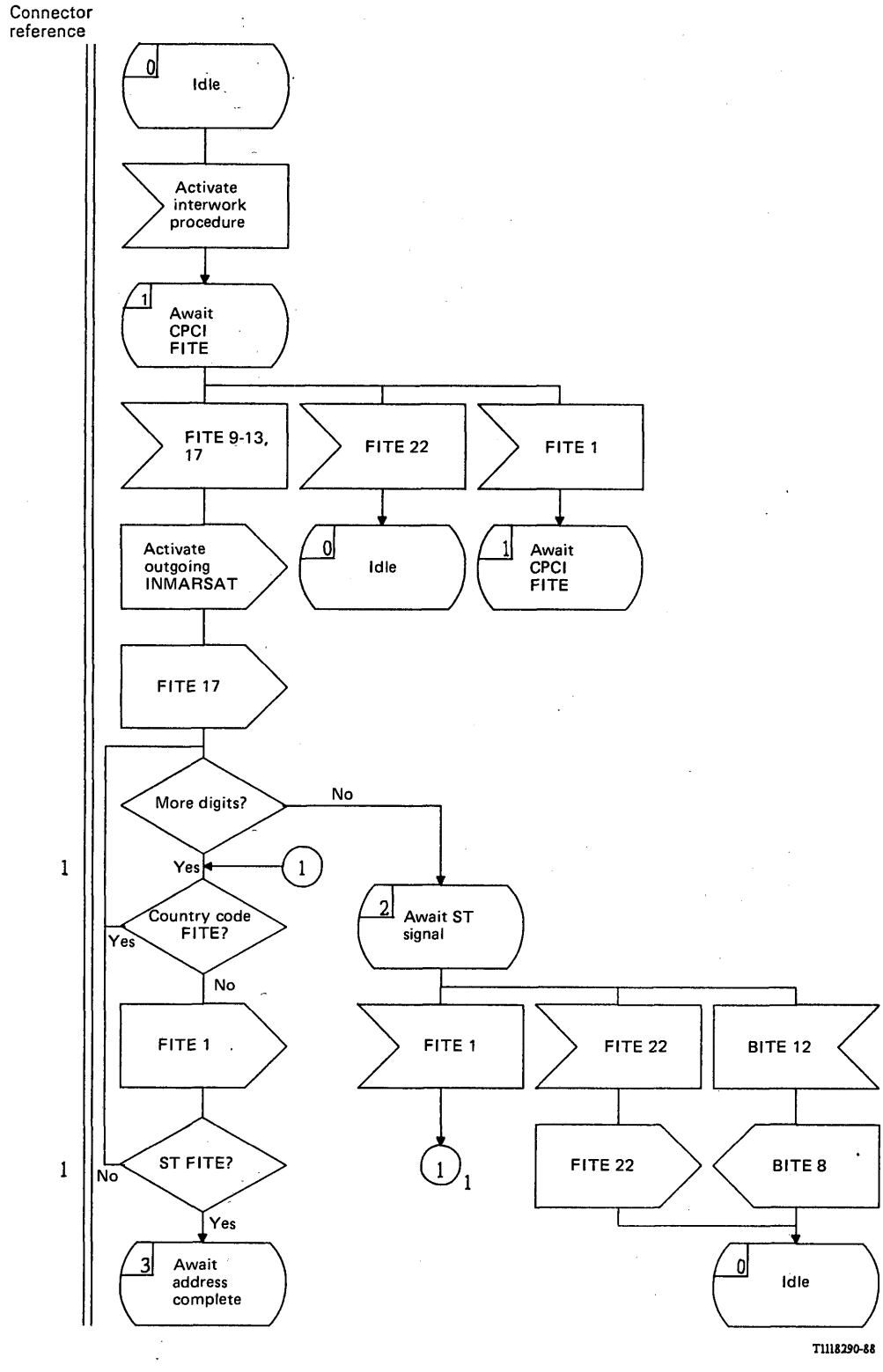


FIGURE 8/Q.1112 (sheet 1 of 2)

Interworking of Signalling System No. 5 to INMARSAT Standard B System

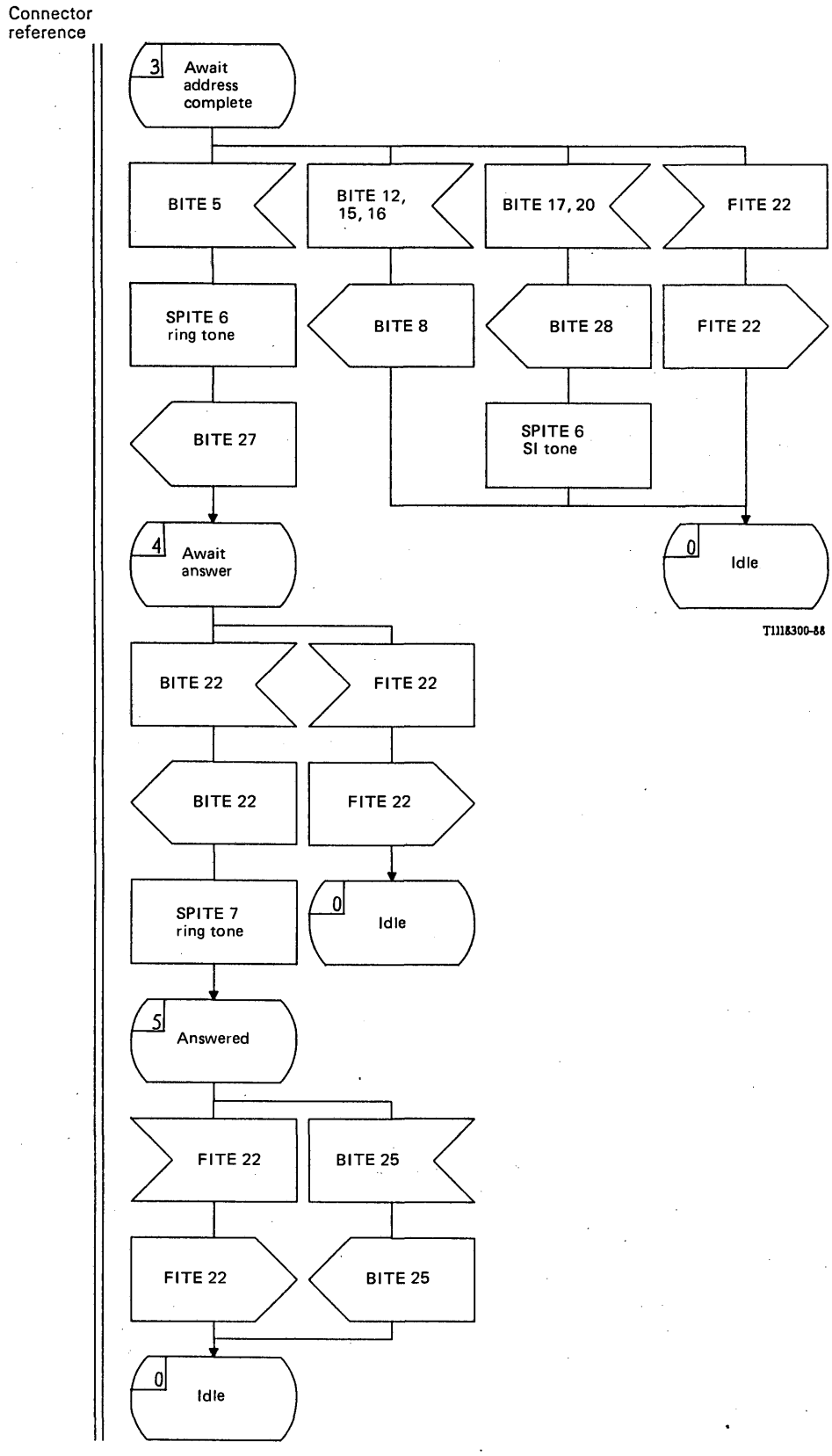


FIGURE 8/Q.1112 (sheet 2 of 2)

Interworking of Signalling System No. 5 to INMARSAT Standard B System

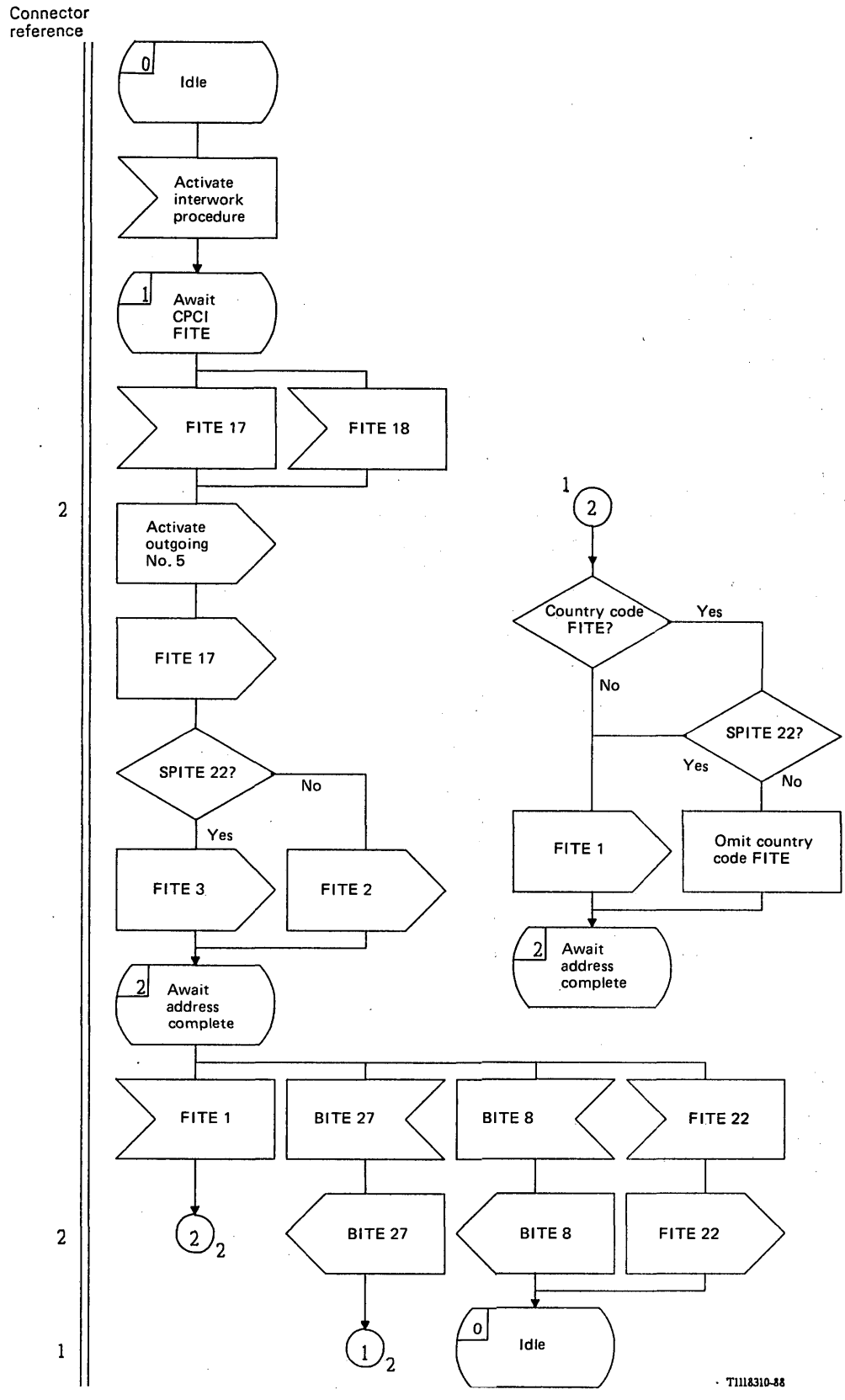


FIGURE 9/Q.1112 (sheet 1 of 3)

Interworking of INMARSAT Standard B System to Signalling System No. 5

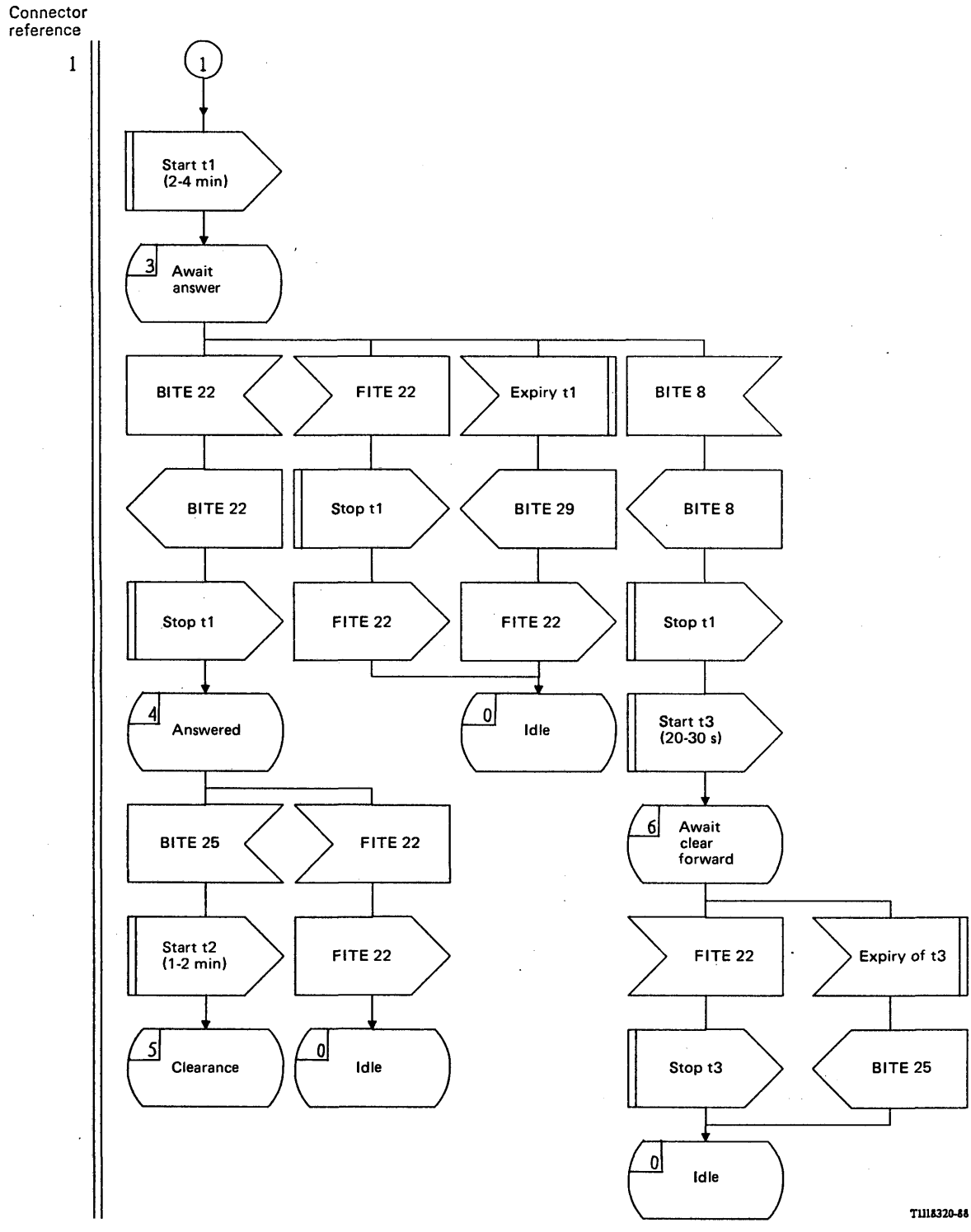


FIGURE 9/Q.1112 (sheet 2 of 3)

Interworking of INMARSAT Standard B System to Signalling System No. 5

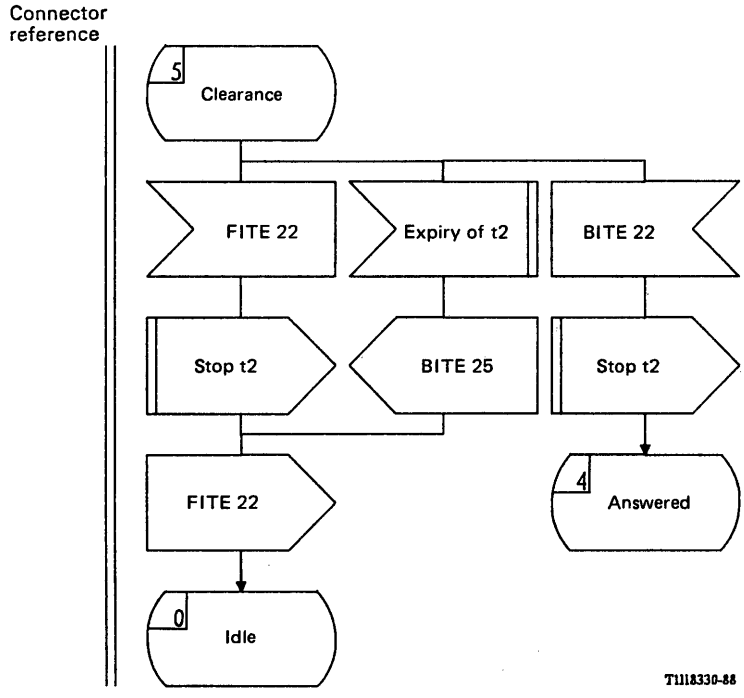


FIGURE 9/Q.1112 (sheet 3 of 3)

Interworking of INMARSAT Standard B System to Signalling System No. 5

SECTION 3

INTERWORKING WITH THE INMARSAT AERONAUTICAL MOBILE-SATELLITE SYSTEM

Recommendation Q.1151

INTERFACES BETWEEN THE INMARSAT AERONAUTICAL MOBILE-SATELLITE SYSTEM AND THE INTERNATIONAL PUBLIC SWITCHED TELEPHONE NETWORK/ISDN

1 General

1.1 This Recommendation provides information on the services offered in the INMARSAT aeronautical mobile-satellite system and describes the requirements for connection to and interworking with the public networks. Special terminology for this Recommendation is defined in Recommendation Q.1100. Detailed interworking procedures are set out in Recommendation Q.1152.

1.2 As well as connection to public networks, the aeronautical system is required to be able to interwork with existing specialized private networks. In implementing all interworking cases, regard should be paid to the open systems interconnection referenced model (X.200-Series of Recommendations) and to ISDN services and signalling methods (I-Series of Recommendations), with a view to uniformity in user procedures and formats and to achieving generally applicable facilities.

1.3 Within the constraint of the need to operate as economically as possible, the preferred interworking cases are with the ISDN and with those parts of the international telephone network employing common channel signalling. If one of these is not available or accessible at the ISC to which an aeronautical ground earth station (GES) is connected then another signalling system from the Q-Series of Recommendations should be used.

1.4 The use of the ISDN will offer both improvement in quality and more flexibility in service. It will be possible to supply either voice or data over the same network with the ability to change from one to the other under control of the aircraft earth station (AES) terminal.

2 Service capabilities

A general description of the INMARSAT aeronautical system is contained in Appendix I.

2.1 *Channel capabilities*

2.1.1 The system provides circuit-mode single channel per carrier (SCPC) channels at a range of information bit rates, including at least the following:

19 200 bit/s; 9600 bit/s; 8000 bit/s; 4800 bit/s; 2400 bit/s

Channels for other information bit rates, such as 64 000 bit/s, may be defined in the future.

2.1.2 The system provides demand assigned forward (ground to air) TDM channels and return (air to ground) random access and (reservation) TDMA channels, at a range of bit rates. Although the following bit rates include housekeeping overheads, they are indicative of the information bit rates provided:

300 bit/s; 600 bit/s; 1200 bit/s; 2400 bit/s; 6300 bit/s.

Channels for other bit rates may be defined in the future.

2.2 *Bearer capabilities*

2.2.1 The following bearer services on SCPC channels, with the following information transfer attributes as defined in Recommendation I.211, may be supported:

a) speech (initially at 9.6 kbit/s); transcoding to 64 kbit/s PCM should take place at the GES;

b) circuit mode audio service (initially at 9.6 kbit/s), suitable for voice and other signals occupying the same bandwidth; transcoding to 64 kbit/s PCM should take place at the GES;

c) virtual call bearer service at any of the bit rates defined in 2.1.1 above, with rate adaptation in the GES to 64 kbit/s using, for example, flow control and flag stuffing;

d) digital data, circuit mode interworking with the ISDN should take place as defined in Recommendation X.30 for data terminals designed to Recommendation X.21, and Recommendation X.32 for data terminals designed to Recommendation X.25.

2.2.2 The following bearer services on TDM, TDMA and RA channels may be supported:

a) virtual call bearer service - interworking with the ISDN should take place as defined for interworking between PSPDNs and the ISDN.

2.3 *Teleservices*

Teleservices, when supported, should be in accordance with Recommendation I.212. It is to be observed that not all teleservices of ISDN may be supported with bearer services that can be provided on SCPC or TDM/TDMA channels operating at the available information bit rates.

3 Interworking scenarios

Three interworking scenarios can be envisaged for the interface between the MSSC and the fixed networks.

3.1 The first scenario is shown in Figure 1/Q.1151. The MSSC public network interface is to the PSTN only, with all data services, and some voice services, handled via private networks.

3.2 Figure 2/Q.1151 shows the situation where an ISDN exists and the MSSC has an interface to it. Interworking with the PSTN is acheived via the ISDN. Interworking with PDN's may be by direct interface with the PDN or via the ISDN, as in the case of the PSTN.

In this scenario interworking with the ISDN supports speech, 3.1 kHz audio and data services as indicated in 2.2.1. Other bearer services as indicated in 2.2.2 may require interworking with PDNs.

3.3 The third scenario is shown in Figure 3/Q.1151. The MSSC interfaces to the ISDN, which provides data services as well as voice, although some voice and data services may still use private networks.

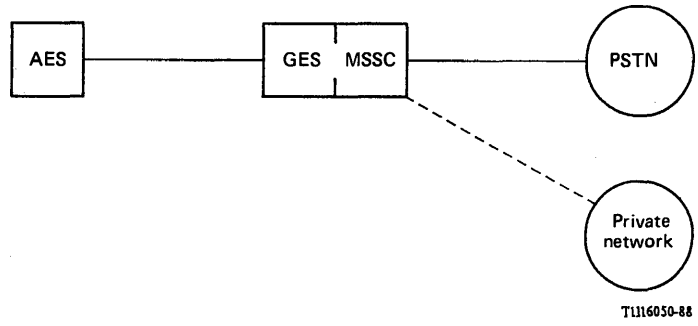


FIGURE 1/Q.1151

Interworking scenario with PSTN interface

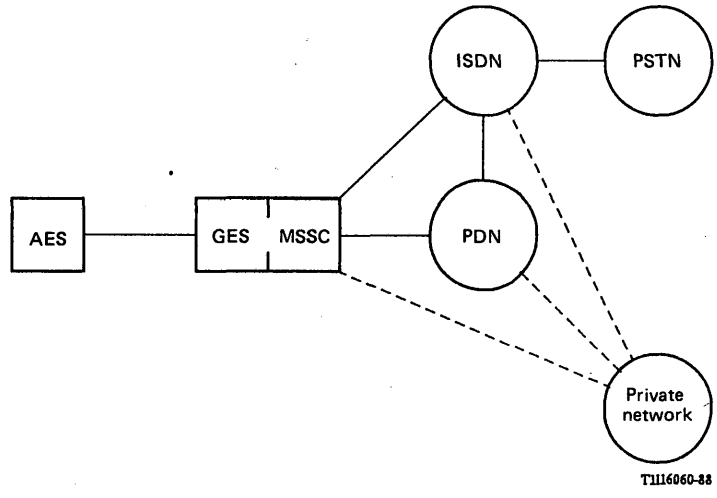


FIGURE 2/Q.1151

Interim interworking scenario with interfaces to ISDN and other fixed networks

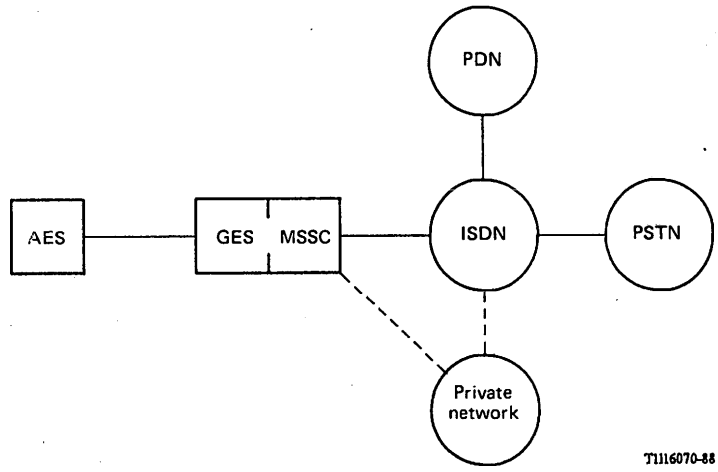


FIGURE 3/Q.1151

Interworking scenario with ISDN interface only

4 Connection interface requirements

4.1 *General*

This section identifies the information that must be available at the interfaces between the AES and the MSSC and between the MSSC and the fixed network, principally for the connection of services identified in § 3.

4.2 *MSSC-network interface*

For ISDN connections ISUP should be used for message transfer. For non-ISDN or where ISUP is not available, TUP would be preferred.

If information transport between MSSCs over the fixed network is required, it is suggested that the procedures of the SCCP is used. Detailed interworking procedures are defined in Recommendation Q.1152.

4.3 *AES-MSSC interface*

Prior to and during call initiation the signalling channel functions may be provided by one or more common control channels.

A signalling capability should always be available during conversation in case it is needed for call clearing, call control, or for call management purposes. During a call the signalling channel may be multiplexed with the traffic channel at a lower bit rate so as to conserve radio channel capacity.

The multiplexed signalling channel or TDM/TDMA/RA channels may be used for bearer services such as connectionless data services, or connection oriented data services not requiring the establishment of a traffic channel.

The traffic channel should be used for bearer services such as:

- speech;
- circuit mode data services;
- packet mode data services;
- voice band data services.

4.4 *Calling procedures air-to-ground*

4.4.1 *Passenger telephony operation*

a) The equipment for passenger telephony may consist of the following:

- the AES;
- cabin telephone equipment consisting of a fixed piece of equipment and a handset, which may be "cordless".

The fixed cabin telephone equipment should be provided with a credit card reader.

b) When a passenger wants to make a call, the typical sequence of events would be as follows:

i) key-in seat number;

ii) when this is accepted, insert credit card; and

iii) when this is accepted, remove handset and return to seat.

c) At the cabin telephone location, if a credit card which corresponds to the recognized card format is inserted into the equipment, the handset shall be released after validation of the check bits and expiry date. In the event that either of these checks fail, the card shall be returned and the handset not released. Upon obtaining the handset the customer returns to his seat and can commence making one or more telephone calls.

d) Where telephones and associated credit card readers are located at the passengers' seats, a somewhat different procedure may apply. However, the procedure will still involve reading the credit card, validating the check bits and checking expiry date, before making calls.

4.4.2 *Crew telephony operation*

For this case, credit card validation procedures are not required. Crew will have access to special telephone services and networks, according to requirements and procedures developed by the industry. The capabilities will include at least the following:

a) access to the full public telephone network as for passengers, but without the need for a credit card (billing would be direct to the aircraft operator);

b) access to specialized voice services via private networks, with or without address digits;

c) ability to preempt an existing (passenger) call if necessary to make AES voice circuit equipment, a satellite channel or GES voice circuit equipment available;

d) ability to seize the next available AES voice circuit equipment, but without clearing any calls in progress.

4.5 *Calling procedures, ground-to-air*

4.5.1 Selected fixed network users should be able to access aircraft automatically by using the aircraft ID in the address digits. Operator connected access may also be available.

4.5.2 The numbering plan to enable a PSTN subscriber to call the AES is defined in Recommendation E.215.

5 Routing requirements

5.1 *Ground originated calls*

The country code 87S should be analysed at all transit centres where the call may either be routed on a circuit containing a satellite link or on a circuit not containing a satellite link. The latter circuit should always be chosen (see Recommendation Q.14).

5.2 *Aircraft originated calls*

If the signalling system provided between the MSSC and the terrestrial network contains signals which may be used to indicate that one satellite link is included, such signals should be used.

If the signalling system does not contain such signals, the outgoing ISC should avoid forwarding the call on an outgoing circuit which includes a satellite link. If, however, the signalling system employed between the outgoing ISC and the next ISC in the connection contains such signals, the outgoing ISC should insert the required information. The outgoing ISC could base its procedure upon incoming route identification.

APPENDIX I

(to Recommendation Q.1151)

INMARSAT aeronautical mobile-satellite system description

I.1 *Introduction*

The aeronautical satellite system is a mobile communications system intended for use by aircraft in flight. It can provide voice communications services and a range of data communications services.

I.1.1 The major elements of the aeronautical satellite system as described in this document are as follows (see also Figure I-1/Q.1151):

a) *space segment*, in particular the satellite communications transponders and associated frequency bands assigned for use by the aeronautical satellite system;

b) *aircraft earth stations (AES)* which are in accordance with the relevant technical requirements, and which interface with the space segment at L-band for communications with ground earth stations, and which interface in the aircraft with data equipment and with crew and passenger voice equipment;

c) *aeronautical (ground) earth stations (GES)* which interface with the space segment (at C-band and L-band) and with the fixed networks, and which are operated in accordance with the relevant technical and operational requirements for communications with AESs; for the "Initial System" GESs will operate to their own essentially independent networks; and

d) *network coordination stations (NCS)* located at designated earth stations, for the purpose of allocating satellite channels, and also for system control and monitoring; NCSs are planned to be introduced at a later stage as part of the "Enhanced System".

I.1.2 The aeronautical system is made up of independent communications networks for each satellite ocean area, each network comprising the operational satellite and associated ground control facilities, the AESs and GESs operating within that area, and an NCS. The system design permits GESs to establish communications on a stand-alone basis with AESs without the intervention of the NCS, except in cases of satellite channel shortage.

I.1.3 Each AES is equipped with a capability to receive a medium rate forward channel transmitted from a GES with a transmission rate of 600 bit/s carrying signalling and data messages in packet form.

I.1.4 Each AES is equipped to transmit a return carrier in burst mode at a transmission rate of either 600 bit/s or 1200 bit/s controlled by signalling messages received via the forward 600 bit/s channel. This dual capability is required to enable some advantage of the variations in aircraft antenna pattern and in spacecraft receiver sensitivity, which will be encountered during a flight, to be taken.

I.1.5 AESs may also be equipped with pairs of transmit/receive voice channel equipment and data channel equipment for higher bit rates.

I.1.6 Each GES is equipped with at least the following data-only transmission capabilities:

a) one 600 bit/s transmitter for the forward channel;

b) four 600 bit/s receivers for the slotted random access channels (this is the minimum to be provided for diversity protection against interference, and burst re-collisions); and

c) a receiver for its 600 bit/s forward channel and for the forward channels of each other GES working to the same satellite.

I.1.7 At the GES owner's option, GESs may also be equipped with:

a) pairs of transmit/receive voice channel equipment;

b) 600 bit/s receiver(s) for a Reservation TDMA channel(s), or 600 bit/s and 1200 bit/s receiver(s) for Reservation TDMA channel(s); and

c) additional data channel equipment for the same or higher bit rates.

I.1.8 The system provides for voice communications by means of the voice channels. Signalling and user data communications is carried on the medium rate (600/1200 bit/s) data channels. This signalling and user data is formatted into fixed length signal units of either 96 bits (12 octets) or 152 bits (19 octets), which are combined as necessary to support various message sizes according to user requirements.

I.2 *System evolution*

I.2.1 *General*

I.2.1.1 The capabilities of the system will evolve with time, due to the progressive development of each of the four major elements identified in § I.1.1 above, i.e. space segment, AES, GES and NCS. Although some of the evolutionary steps of one element are inevitably linked with those of other elements, in general the system concept is to allow the individual elements to evolve independently. The pressures which are expected to lead to this evolution include traffic growth, market awareness, new applications and new technology.

I.2.1.2 The use of narrow-band channels (generally single channel per carrier) and software programmable channel units (modems, etc.) are the principal requirements to achieve the required flexibility, to efficiently utilize a variety of satellite parameters, take advantage of future advances in voice coding technology, allow the aircraft installation to match the services required, and provide a smooth growth path from an initial start-up system through increasing levels of traffic.

I.2.2 *Space segment evolution*

I.2.2.1 Within the aeronautical system operational timeframe, it is anticipated that the satellite types of INMARSAT's first generation space segment still in service will comprise MARECS (leased from the European Space Agency) and INTELSAT-V MCS satellites (Maritime Communications Sub-System, leased from the International Telecommunications Satellite Organization). Satellite tracking, telecommand, telemetry and ranging services are included in the leasing arrangements with ESA and INTELSAT, with TT&C stations linked to satellite control centres (SCCs) at Darmstadt (Federal Republic of Germany) and Washington DC respectively. The SCCs are in turn linked to the INMARSAT Operations Control Centre (OCC) in London.

I.2.2.2 The aeronautical system will also operate with and take advantage of the improved performance of the (second generation) INMARSAT-2 satellites, now on order.

I.2.3 *AES evolution*

I.2.3.1 Two types of aircraft antenna are defined, one with a minimum gain of 0 dBi over its coverage area, the other with a minimum gain of 12 dBi over its coverage area. In the initial system, AESs with the 0 dBi antenna are limited to medium rate data services (see § I.2.4.2), while AESs with the 12 dBi antenna can obtain multi-channel voice service as well as data services at higher bit rates.

I.2.3.2 Irrespective of the antenna gain, each AES is required to be equipped with a bit rate switchable data channel unit. The minimum capability is to provide for both 600 bit/s and 1200 bit/s transmission rates (300 bit/s and 600 bit/s information rate, less overheads) and this will suffice for the initial two or three years. Additional, higher bit rates will be needed in the future and these could be provided for in the initial AES design, or be achieved by a software upgrade in a programmable channel unit, or by replacement of a plug-in card.

I.2.3.3 In operation, the bit rate in use by the AES for data services is determined by signalling from the ground. When commencing service with a given GES, an AES goes through a "log-on" procedure, using the 600 bit/s transmission rate channels assigned for system management (and possibly other) functions. In this log-on procedure, the AES gives its class of equipment provision, and the GES measures the signal level received from the AES if needed, to determine whether a higher bit rate could be supported. From this information the GES assigns working channels for further signalling and data transactions with the AES.

I.2.3.4 Since the other elements of the system will evolve with time, the AES capabilities have been defined in a way which provides adequate service levels in the start-up phases, but which can take advantage of improved performance in the other elements as they become available, without requiring any significant replacement or upgrade of components. Specifically, the AES is specified with a linear high power amplifier (HPA) with a power output of 40 Watts, and a family of digital channels is defined which are all mutually consistent and compatible.

This makes it feasible to use a single programmable channel unit (using digital signal processor (DSP) microprocessor chips) to implement a suitable selection of channel types from the family, and allow for additional or alternative channel types in the future if required, by software upgrade. The linear characteristic of the HPA permits matching the evolution of space segment characteristics, providing progressively greater numbers of voice channels with higher performance spacecraft, and also allowing the separation of services in different GESs if required in the future (such as dedicated GESs for air traffic services (ATS)).

I.2.3.5 It may be anticipated that the service requirements and technology applied to them on aircraft will develop independently of satellite communications. Examples of this type of development are data applications such as for monitoring of equipment health, and the progressive reduction of digital bit rate needed to provide voice service of a given quality. This system makes specific provision for evolution in voice coding, and by adopting a layered approach, along the lines defined in the Open System Interconnection (OSI) model, facilitates its use for as yet unforeseen data applications. In addition, there is ample provision of spare codes in the critical signalling fields, so that if enhancements become necessary they can be implemented by software upgrades.

I.2.3.6 Although the AES is specified to use a linear HPA, the offset QPSK modulation method is used in the higher bit rate channels in order to make operation with a hard limiting linear (e.g. Class C) HPA feasible. This will permit the development of single-channel AES equipment suitable for general aviation aircraft, when a demand develops.

I.2.4 *GES evolution*

I.2.4.1 The aeronautical GES has been defined so it can be produced as a compatible add-on to an existing standard coast earth station in the INMARSAT system. While this type of sharing is not essential, it may enable some economies to be achieved particularly in the start-up phase of the system, and where both services are carried by the same satellite.

I.2.4.2 As new satellites become available and traffic grows, the data transmission bit rates which can be supported, and need to be supported, will increase. To achieve this, additional data channel units, and/or higher bit rate channel units, will need to be provided at the GESs. The system can operate exclusively with data channel bit rates of 600 bit/s, and this may be sufficient in the initial stage. However, higher bit rates in the return direction (air-to-ground) can be supported even from a 0 dBi antenna, except at edge of coverage with existing (first generation) spacecraft, and will be able to be supported globally with INMARSAT-2 satellites. Thus the provision of higher bit rate channel units by the late 1980s will be appropriate, to provide for growing traffic and to minimize data service message delays. Depending on demand, it may also be appropriate to provide data channel units for interworking with aircraft fitted with 12 dBi antennas. Since all the channels form a compatible family, the possibility exists of using a common hardware unit for all these channels, differing only in software.

I.2.4.3 To take advantage of evolution in voice coding technology, it may be anticipated that a point will be reached when the voice coding rate and algorithm used in the initial system will be considered inappropriate, at least for new aircraft installations. A decision to adopt new voice coding rate will be practicable, the main requirement being that GESs wising to interwork with all aircraft will need to operate two sets of channel units and associated voice codecs. As for data, the channel unit hardware could be common, although the voice codecs may be of different designs.

I.2.5 *NCS evolution*

I.2.5.1 The function of the NCS is to manage a common pool of satellite voice channels, and to assign them on demand to individual GESs for the duration of one call. In a system with small capacity and multiple GESs the random distribution of traffic across GESs necessitates the provision of a common pool managed by an NCS, for efficiency reasons. When traffic is low in the initial start-up phase, operation with only individual pools of channels at each GES will be satisfactory, but as additional GESs come into service the NCS will become essential.

I.2.5.2 In the initial system operating without an NCS, communication between GESs is still required to allow aircraft to call or be called via more than one GES. This communication is achieved by using a forward channel from each GES; the channel could be the one also designated for system management functions, or a separate, lower powered channel. In any case the implementation should be arranged so as to facilitate a changeover to a separate interstation link and the provision of an NCS, in the long term.

I.3 *Channel configuration*

I.3.1 *General*

I.3.1.1 The basic transmission characteristics of the family of aeronautical system channels are given in Table I-1/Q.1151. The channel bit rates have been selected to facilitate their implementation using a single programmable channel unit and to provide future flexibility. While this may not be practicable now for the highest bit rates in the table, future implementations may be able to take advantage of this structure.

TABLE I-1/Q.1151

Channel transmission characteristics summary

Bearer rate (bit/s)	Channel rate (bit/s)	Channel spacing (kHz)	Modulation
19 200	28 000	22.5	0-QPSK
9 600	21 000	17.5	0-QPSK
9 600	14 000	12.5	0-QPSK
8 000	12 600	12.5	0-QPSK
4 800	7 200	7.5	0-QPSK
2 400	6 000	5.0	0-QPSK
2 400[a)]	4 800	5.0	0-QPSK
1 200[a)]	2 400	5.0	DECPSK
600[a)]	1 200	5.0	DECPSK
300[a)]	600	5.0	DECPSK

[a)] Less overheads.

I.3.2 *Channel naming*

In order to simplify references to the various channel formats included in the system, each individual format has been assigned a designation as follows (see also Figure I-1/Q.1151):

a) *P-Channel*

Packet mode time division multiplex (TDM) channel, used in the forward direction (ground-to-air) to carry signalling and user data; the transmission is continuous from one GES; a P-channel being used for system management functions is designated Psmc, while a P-channel being used for other functions is designated Pd;

b) *R-Channel*

Random access (slotted Aloha) channel, used in the return direction (aircraft-to-ground) to carry some signalling and user data, specifically the initial signals of a transaction, typically request signals; an R-channel being used for system management functions is designated Rsmc, while an R-channel being used for other functions is designated Rd;

c) *T-Channel*

Reservation Time Division Multiple Access channel, used in the return direction only; the receiving GES reserves time slots for transmissions requested by AESs, according to message lengths and priority;

d) *C-Channel*

Circuit-mode single channel per carrier (SCPC) voice/data channel, used in both forward and return directions; the use of the channel is controlled by assignment and release signalling at the start and end of each call.

I.3.3 *Forward error correction coding*

The majority of channel types use Forward Error Correction (FEC) coding consisting of a convolutional encoder of constraint length k=7 and an 8-level soft decision Viterbi decoder; the FEC coding rate is either 3/4 or 1/2; the rate 3/4 code is derived by puncturing the rate 1/2, k = 7 convolutional code.

I.4 *Link layer formats and protocols*

I.4.1 *General*

All signalling and user data messages are formatted into signal units of length either 96 bits (12 octets) or 152 bits (19 octets). The extended length signal units (19 octets) are only used on the R-channel, whereas the standard length signal units (12 octets) are used on all channels.

More complex messages (including user data) can be carried by a sequence of several signal units. Longer messages generated in a user application will be broken into message fragments in the network layer, compatible with the maximum size, before being presented for transmission via the link layer; the use of these signal units applies to signalling and user data transactions on the sub-band channel of the voice/data channel as well as the P-, R- and T-Channels.

I.4.2 *Basic signal unit concepts*

I.4.2.1 A message that can be accommodated in a single signal unit is formatted into a "Lone Signal Unit" (LSU). Longer messages are formatted into more than one signal unit, of which the first is an "Initial Signal Unit" (ISU) followed by one or more "Subsequent Signal Units" (SSU).

I.4.2.2 Each signal unit includes 16 check bits (the last two octets) for error detection, these being calculated from the preceding octets of the signal unit using the polynomial : $x^{16} + x^{12} + x^5 + 1$ for generation (see Recommendation X.25, Section 2.2.7). The undetected error rate on the sub-band C-channel, under nominal worst case conditions is typically less than one in 10^{10} signal units. The undetected error rate on P- and R-channels is expected to be much less than this.

I.4.2.3 At the receiver for any channel, the check bits for each received signal unit are calculated, and if there is a mismatch with the received check bits the signal unit is discarded. Recovery from lost and corrupted signal units is handled either by a Reliable Link Service function, or by the relevant signalling logic procedures.

I.5 *Aircraft earth station management*

I.5.1 Every GES maintains an up-to-date status table of AESs which have logged into the GES, and has an inter-GES and GES-NCS signalling facility, so that every GES shall be able to set up calls to and from any AES operating to the same satellite, and to manage AESs in the handover process.

I.5.2 Every AES logs-on to a GES of its choice for entering into the Aeronautical system and logs-out as part of terminating its operation in the system. When an AES requires a change in its log-in GES, accessing satellite or accessing spot beam of a satellite, the AES follows a handover procedure resulting in a smooth transition.

I.6 *Telephone services*

I.6.1 *General*

I.6.1.1 Telephone services are provided using a pair of C-channels (one in each direction) assigned from a pool held by the GES, or by the NCS from a common pool. The function of the NCS is to make C-channel assignments in response to requests from GESs (when the latter runs out of frequencies) on a call-by-call basis.

I.6.1.2 In the ground-to-air direction, all telephone calls may go to a single answering point on the aircraft, or may be addressed to specific answering points. In the initial system at least, for commercial aircraft, access will be restricted to a very limited number of callers for operational and practical reasons. This restriction will be imposed in the GES, or elsewhere, at the discretion of the GES owner.

I.6.1.3 In the air-to-ground direction, calls may be made by crew or passengers, with several types of service provided. The primary service capabilities include:

a) passenger telephony;

b) crew general telephony; and

c) crew ATC voice.

I.6.2 *Call set-up/termination for air-to-ground calls*

I.6.2.1 The basic sequences for air-to-ground telephone call set-up are shown in Figures I-2/Q.1151 to I-5/Q.1151, covering various cases including use of an NCS.

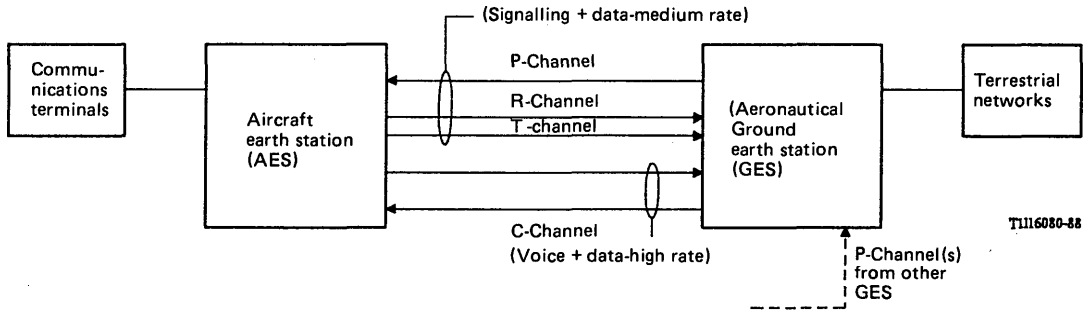
I.6.2.2 From the point of view of the AES, all the cases are the same, with the AES receiving the called number (and in the case of passenger calls the credit card data) prior to starting the request process. An initial request is sent using the R-channel to the GES where the AES is logged in, and a channel assignment is received on the corresponding P-channel. The communications channel is then set up, tested using signals on the sub-band data channel, and the called party address (plus the credit card number if applicable) is transmitted via the sub-band data channel.

I.6.2.3 If the air-to-ground call is to the log-on GES (Figure I-2/Q.1151), then all the access request and channel assignment transactions are carried via the R- and P-Channels only. However, if the call is to a GES other than the one where the AES logged-on (Figure I-3/Q.1151), then the log-on GES forwards the access request (from the AES) to the called GES (designated "other" GES in Figure I-3/Q.1151) over the interstation link. The called GES allots a channel, if available, from its pool and transmits the channel assignment information over the interstation link. The log-on GES then forwards the information to the AES over the P-Channel. The corresponding signalling sequences for air-to-ground call set-up using the NCS are shown in Figures I-4/Q.1151 and I-5/Q.1151, the former representing the case of a call addressed to a log-on GES and the latter showing a call addressed to a GES other than the one where the AES has logged-on.

In the former case (Figure I-4/Q.1151), the log-on GES, on receipt of an access request from the AES, sends a Request for Assignment message over the interstation link to the NCS, whereupon the NCS responds by sending a channel assignment to the requesting GES over the same interstation link. The GES sends this channel assignment to the AES over the P-Channel.

In the case of a call addressed to "other" GES, the procedure is similar to the above, with the addition of the log-on GES as an intermediary between the AES and "other" GES. After the call is cleared, the GES to which the channel is assigned by the NCS (i.e the "other" GES), sends the channel release information to the NCS over the interstation link. The transaction is completed by the NCS sending an acknowledgement to the GES.

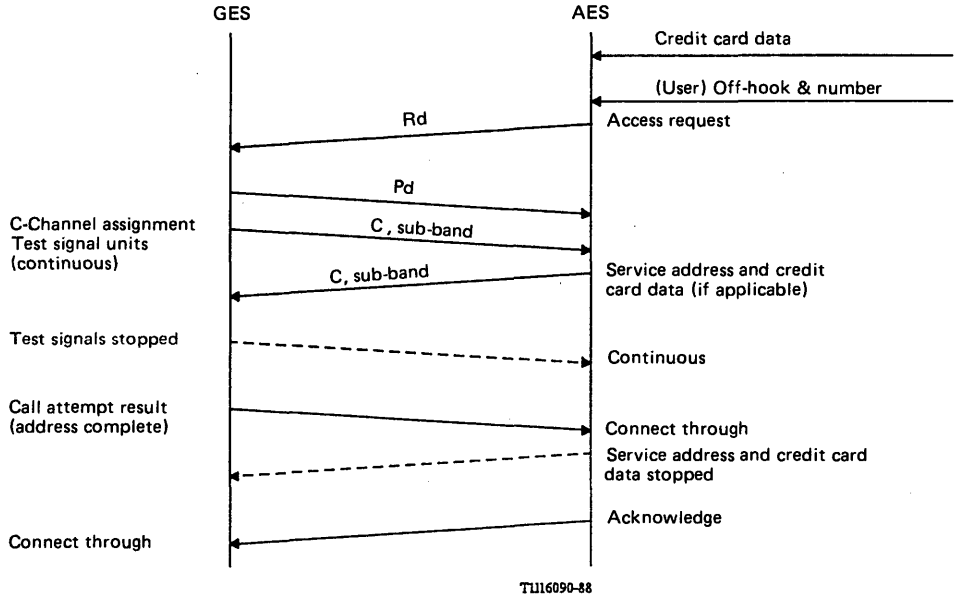
In the normal case, when the call is ended both parties will replace their handsets (abnormal cases are covered in Figure I-6/Q.1151 and Recommendation Q.1152). The on-hook condition of the telephone in the AES initiates a series of channel release signals on the sub-band C-Channel. When one of these is received in the GES, it responds with a matching series of channel release signals. The GES monitors the carrier to confirm that it stops. If the AES is logged-on to another GES, the channel release signal is sent to the log-on GES via the appropriate interstation link.



P-Channel: Packet mode channel
R-Channel: Slotted random access (ALOHA) channel
C-Channel: Circuit mode channel
T-Channel: Reservation TDMA channel

FIGURE I-1/Q.1151

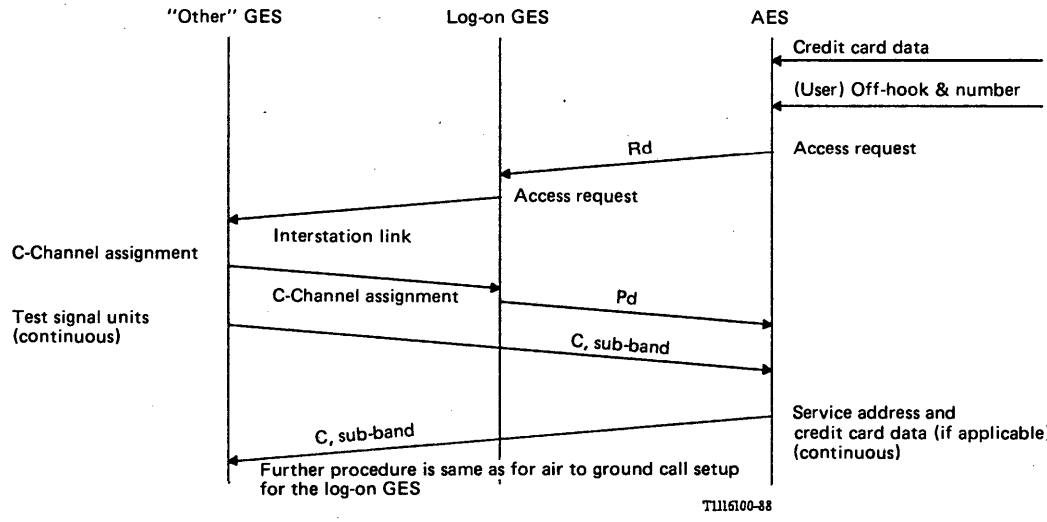
Aeronautical network configuration



Rd: see § I.3.2
Pd: see § I.3.2

FIGURE I-2/Q.1151

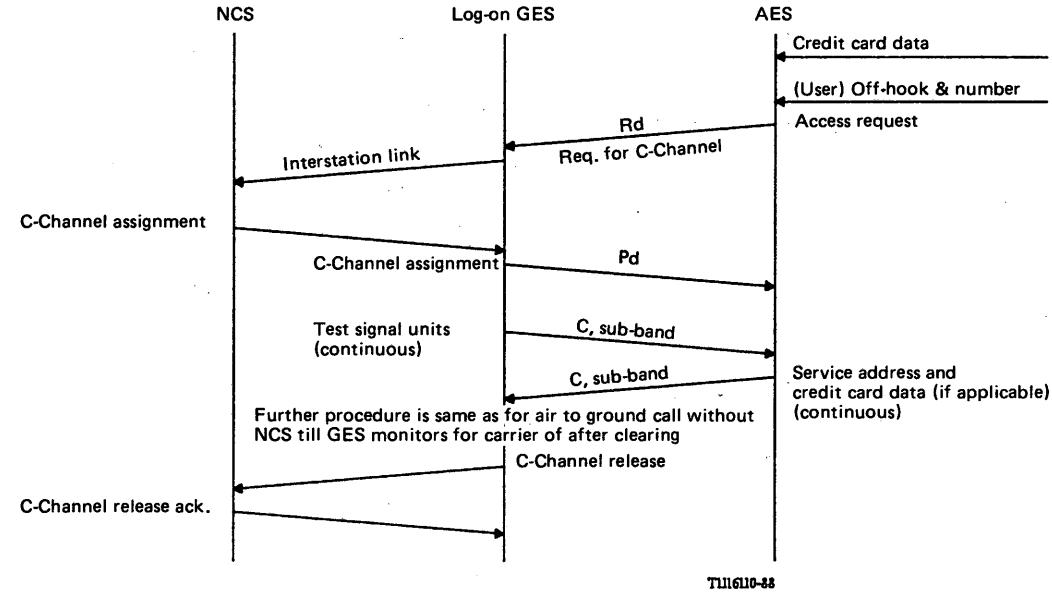
Air to ground telephone cal set-up sequence



Rd: see § I.3.2
Pd: see § I.3.2

FIGURE I-3/Q.1151

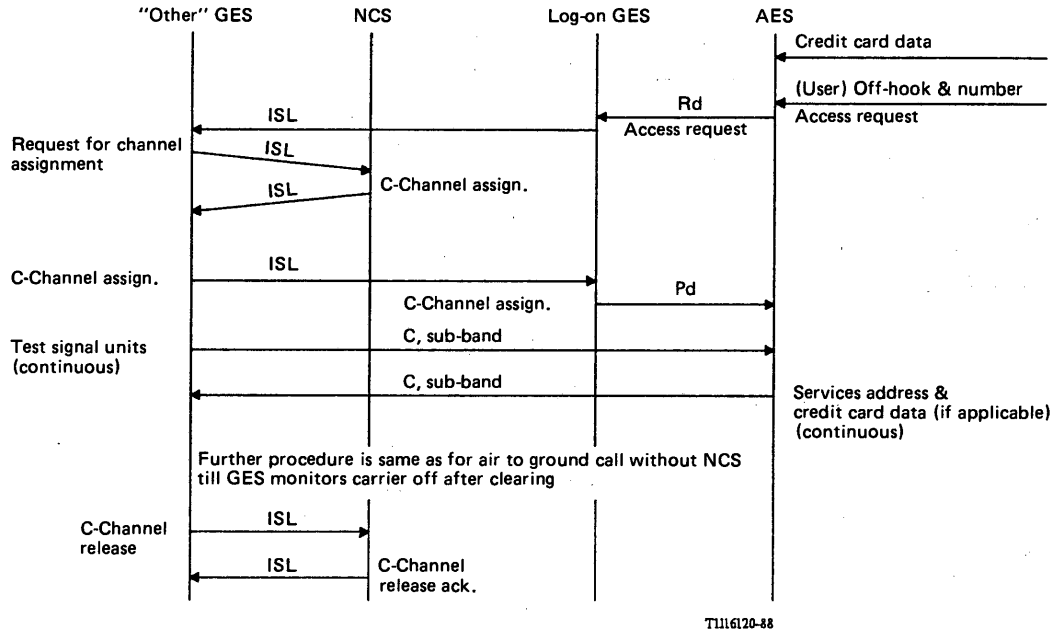
Air to ground telephone call set-up sequence to other GES



Rd: see § I.3.2
Pd: see § I.3.2

FIGURE I-4/Q.1151

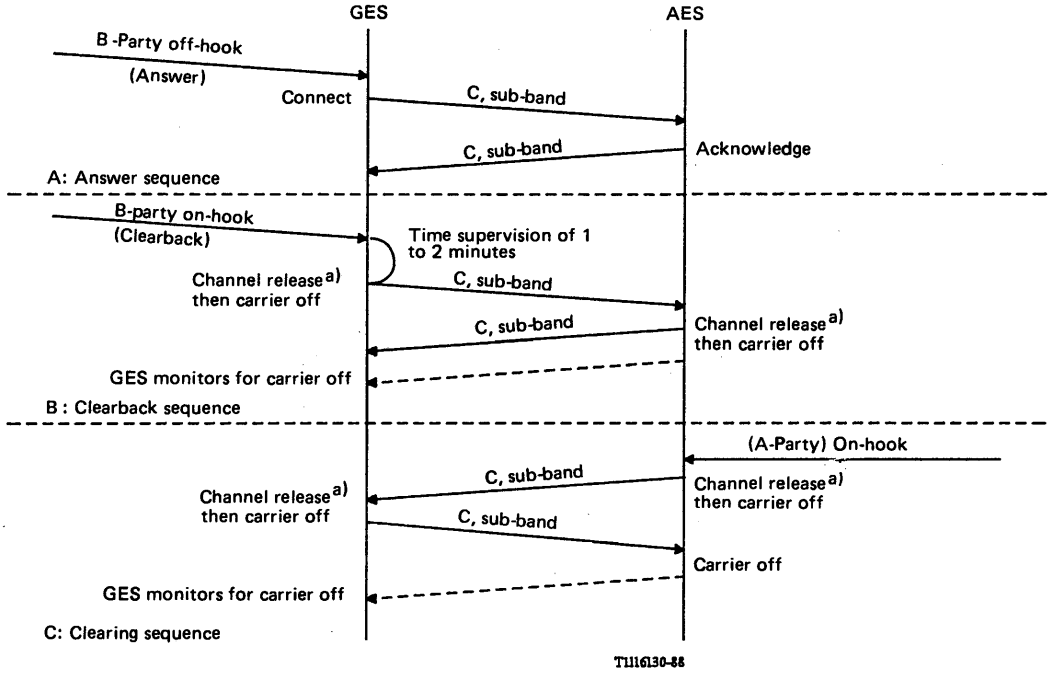
Air to ground telephone call set-up sequence (overflow mode)



ISL Interstation link
Rd: See § I.3.2
Pd: See § I.3.2

FIGURE I-5/Q.1151

Air to ground telephone call set-up sequence to other GES (overflow mode)



a) Repeated 6 times.

FIGURE I-6/Q.1151

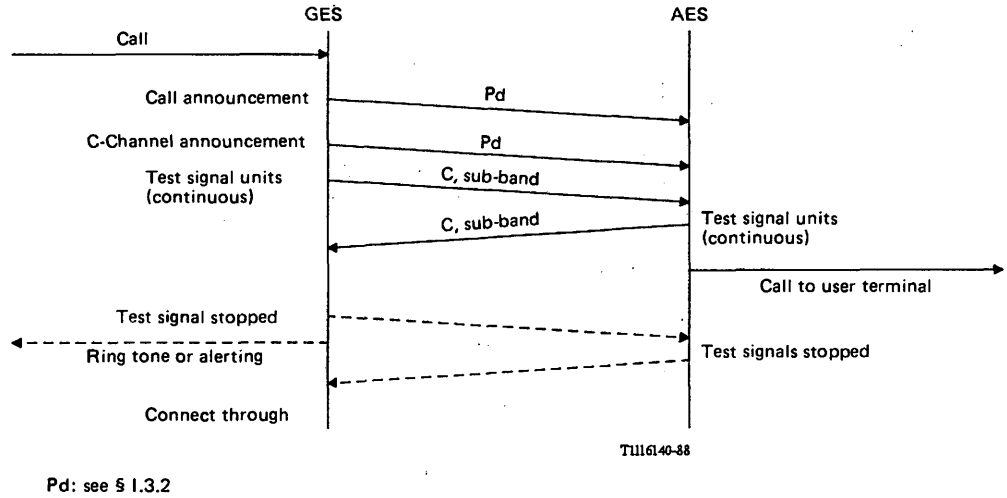
Air to ground telephone call user switchhook signalling

I.6.3 *Channel set-up/termination for ground-to-air calls*

I.6.3.1 The sequences for ground-to-air telephone call set-up are shown in Figures I-7/Q.1151 to I-10/Q.1151 covering various cases, including use of an NCS.

I.6.3.2 From the viewpoint of the AES, all the cases are similar with the GES sending the call announcement and channel assignment information to the AES over the P-Channel. After the channel assignment information is transferred to the AES, the continuity check for proper channel set-up and the eventual channel release functions of the satellite link, are carried out using signals on the sub-band C-Channel.

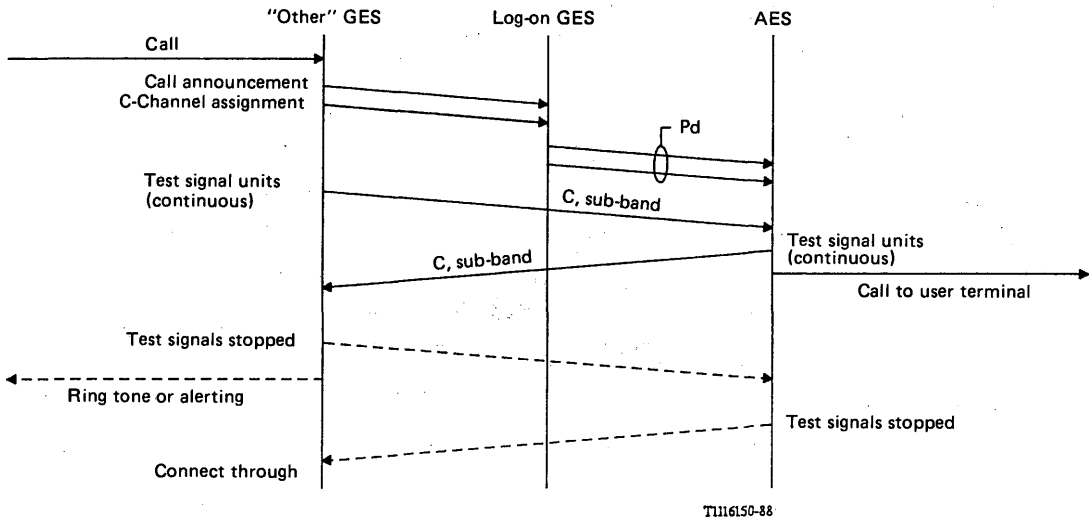
I.6.3.3 In the case of a call from a log-on GES to an AES (Figure I-7/Q.1151) the only channel used prior to setting up the call is the P-Channel. However, if the call is from a GES other than where the AES has logged-on (Figure I-8/Q.1151) the originating GES ("other" GES) sends the call announcement and channel assignment information to the log-on GES over the interstation link. The log-on GES then forwards this information to the AES over the P-channel. The signalling sequences for the cases where the call-originating GES does not have a channel in its allocated pool are shown in Figures I-9/Q.1151 and I-10/Q.1151, the former showing the case of a call originating from a log-on GES and the latter representing a call origination from a GES other than the one to which the AES has logged-on. In both cases the interstation link between the NCS and the call originating GES is used to obtain a channel from the NCS pool. After the call is cleared, the GES from which the call has originated, sends the channel release information to the NCS, which the NCS acknowledges. The procedure for call clearing (illustrated in Figure I-11/Q.1151) is initiated by the terrestrial network sending a clear forward signal, whereupon the GES sends a sequence of channel release signals on the sub-band C-Channel. On receipt of one of these, the AES responds with a series of channel release signals, and ceases its carrier. When the GES detects the end of the AES carrier, it returns the channel to the pool.



Pd: see § I.3.2

FIGURE I-7/Q.1151

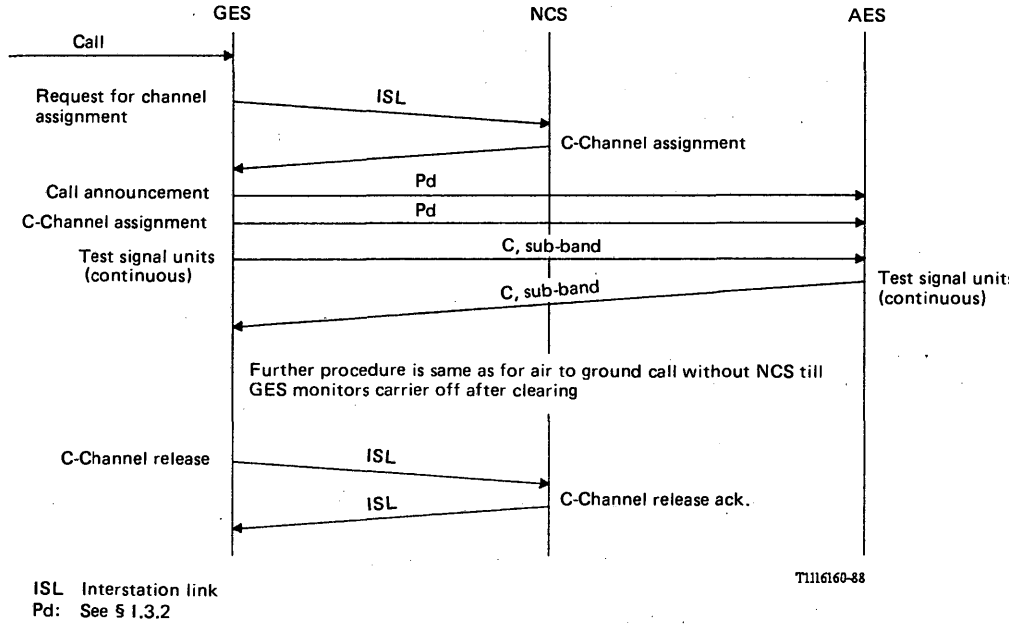
Ground to air telephone call set-up sequence



Pd: see § I.3.2

FIGURE I-8/Q.1151

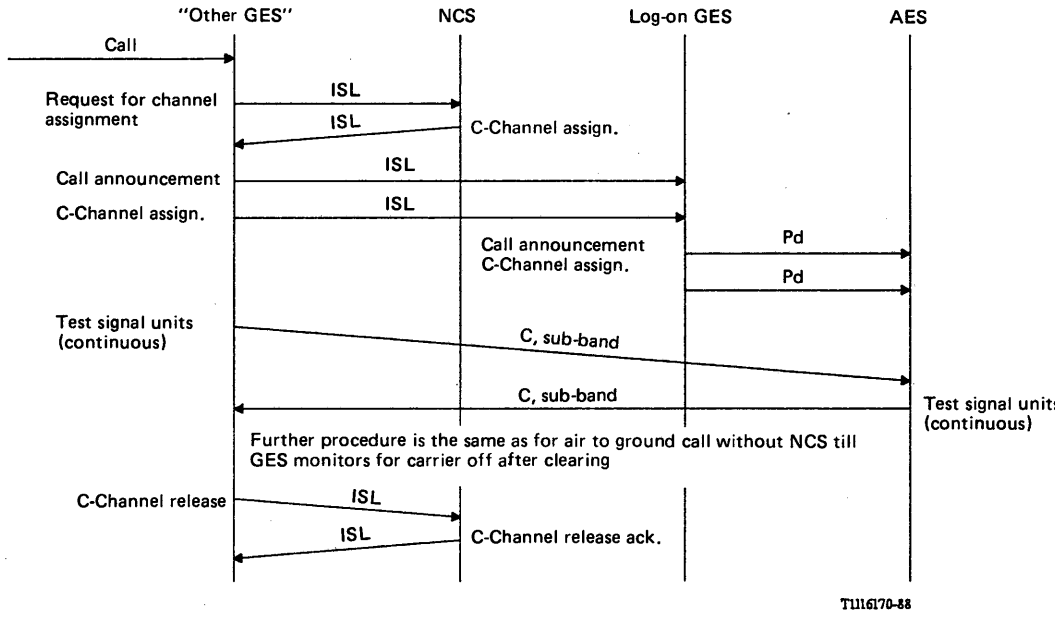
Ground to air call set-up sequence via other GES



ISL Interstation link
Pd: See § I.3.2

FIGURE I-9/Q.1151

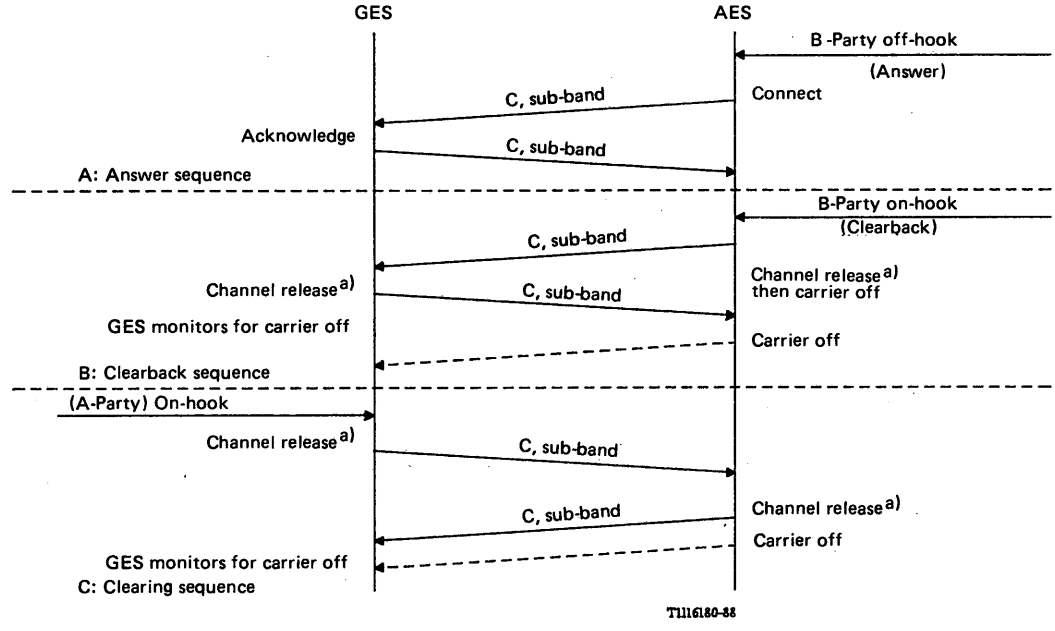
Ground to air telephone call set-up sequence (overflow mode)



ISL Interstation link
Pd: see § I.3.2

FIGURE I-10/Q.1151

Ground to air telephone call set-up sequence via other GES (overflow mode)



a) Repeated 6 times.

FIGURE I-11/Q.1151

Ground to air telephone call user switchhook signalling

I.6.4 *Supervisory signalling*

I.6.4.1 After call set-up, all subsequent supervisory functions are normally performed by means of sub-band signalling on the C-Channel.

I.6.4.2 Continuity checking of the satellite voice channel is done by means of test packets transmitted on the sub-band of the C-Channel.

I.6.4.3 Sub-band signalling on the C-Channel is also used for answer/clearing signals, and to provide additional signalling capacity for potential future use in interworking with the terrestrial ISDNs.

I.6.4.4 Terrestrial network audible tones (ringing, busy, congestion, etc.) are passed to the AES in-band over the voice channel for air-to-ground calls. In the case of ground-to-air calls, the MSSC should return call progress and call failure causes to the terrestrial network by means of appropriate signals, from the signalling system in use. When required (due to the inadequacy of the signalling system in use), the MSSC should also generate audible tones back into the terrestrial network to the calling party.

Addendum - The recent change in the INMARSAT aeronautical signalling system definition allows cause information to be carried in the channel release signal, thereby making it unnecessary to send the call attempt result signal for unsuccessful call cases. The contents of this appendix have not been updated accordingly.

PROCEDURES FOR INTERWORKING BETWEEN INMARSAT AERONAUTICAL MOBILE-SATELLITE SYSTEM AND THE INTERNATIONAL PUBLIC SWITCHED TELEPHONE NETWORK/ISDN

1 Introduction

This Recommendation provides the detailed procedures for interworking between the INMARSAT aeronautical system and signalling systems of the public fixed network. For a brief description of the INMARSAT aeronautical system, see Appendix I to Recommendation Q.1151.

2 Conversion of information elements

Tables 1/Q.1152 and 2/Q.1152 list the signals of the INMARSAT aeronautical system that are relevant for the purpose of interworking with the PSTN/ISDN. The forward interworking telephone events (FITEs) and backward interworking telephone events (BITEs), as defined in Annex A to Recommendations Q.601 to Q.608, that correspond to each of these signals is also provided in the tables.

Tables 3/Q.1152 to 18/Q.1152 give the relationship between signals of the fixed network signalling systems and the INMARSAT aeronautical system.

2.1 *Signalling System R2*

2.1.1 Table 3/Q.1152 gives the relationship between messages in the INMARSAT aeronautical signalling system and forward signals in Signalling System R2 for air-to-ground calls i.e. interworking of INMARSAT aeronautical to Signalling System R2.

Table 4/Q.1152 shows the relationship between forward signals in Signalling System R2 and messages in the INMARSAT aeronautical signalling system for ground-to-air calls. In the comment column actions taken by the MSSC are indicated, in particular for signals of R2 which have no equivalent message in the INMARSAT aeronautical system.

The signal numbers for forward signals of Signalling System R2 are those given in Table A-7 of Annex A to Recommendations Q.601-Q.608.

2.1.2 Table 5/Q.1152 gives the relationship between messages in the INMARSAT aeronautical signalling system and backward signals in Signalling System R2 for ground-to-air calls, i.e. interworking of Signalling System R2 to INMARSAT aeronautical.

Backward signals in Signalling System R2 generated by the MSSC for unsuccessful ground-to-air calls are given in Table 5 *bis*/Q.1152. These signals are not related to any specific message received from the aircraft earth station.

Table 6/Q.1152 gives the relationship between backward signals in Signalling System R2 and messages in the INMARSAT aeronautical signalling system for air-to-ground calls, i.e. interworking of INMARSAT aeronautical to Signalling System R2. The comments column indicates specific actions taken by the MSSC.

The signal number of backward signals of Signalling System R2 are those given in Table A-11 of Annex A to Recommendations Q.601-Q.608.

2.2 *Signalling System No. 7 (TUP)*

2.2.1 Tables 7/Q.1152 and 8/Q.1152 are similar to Tables 3/Q.1152 and 4/Q.1152, respectively, and apply to forward signals in Signalling System No. 7 (TUP).

The signal numbers for forward signals of Signalling System No. 7 (TUP) are those given in Table A-5 *bis* of Annex A to Recommendations Q.601-Q.608.

2.2.2 Tables 9/Q.1152, 9 *bis*/Q.1152 and 10/Q.1152 are similar to Tables 5/Q.1152, 5 *bis*/Q.1152 and 6/Q.1152, respectively, and apply to backward signals in Signalling System No. 7 (TUP).

The signal numbers for backward signals in Signalling System No. 7 (TUP) are those given in Table A-9 *bis* of Annex A to Recommendations Q.601-Q.608.

2.3 *Signalling System No. 5*

2.3.1 Tables 11/Q.1152 and 12/Q.1152 are similar to Tables 3/Q.1152 and 4/Q.1152, respectively, and apply to forward signals in Signalling System No. 5.

The signal numbers for forward signals of Signalling System No. 5 are those given in Table A-4 of Annex A to Recommendations Q.601-Q.608.

2.3.2 Tables 13/Q.1152, 13 *bis*/Q.1152 and 14/Q.1152 are similar to Tables 5/Q.1152, 5 *bis*/Q.1152 and 6/Q.1152, respectively, and apply to backward signals in Signalling System No. 5.

The signal numbers for backward signals in Signalling System No. 5 are those given in Table A-8 of Annex A to Recommendations Q.601-Q.608.

2.4 The relationship between forward and backward signals of Signalling System No. 7 (ISUP) and messages of the INMARSAT aeronautical signalling system is for further study.

TABLE 1/Q.1152

INMARSAT aeronautical - forward signals

FITE No.	Message: info element: value
Ground-to-air calls	
1	Call announcement: AES id: called terminal
17	Call announcement: service: telephone
22	Channel release
Air-to-ground calls	
17	Access request: message type: public/crew voice
18	Access request: message type: crew distress voice
1	Access request: address digits 0,1
1	Service address: address digits 2 ... 17
22	Channel release

Note - Signals required for interworking with Signalling System No. 7 (ISUP) are for further study.

TABLE 2/Q.1152

INMARSAT aeronautical - backward signals

BITE No.	Message: info element: value
Ground-to-air calls	
5	Test
22	Connect
29	Channel release
16	Call attempt result: Cause: User busy
12	Call attempt result: Cause: No channel available
17	Call attempt result: Cause: Destination out of service
Air-to-ground calls	
22	Connect
2	Call attempt result: Address complete
29	Channel release
20	Call attempt result: Cause: Unspecified
16	Call attempt result: Cause: User busy
15	Call attempt result: Cause: Unassigned number
17	Call attempt result: Cause: Destination out of service
12	Call attempt result: Cause: No channel available
14	Call attempt result: Cause: Invalid number format

Note - Signals required for interworking with Signalling System No. 7 (ISUP) are for further study.

TABLE 3/Q.1152

Conversion of forward signals in the INMARSAT aeronautical signalling system to Signalling System R2
Air-to-ground calls

INMARSAT aeronautical signalling system Message: info element: value	Signalling System R2 Signal name: info element	Signal No.
Access request: message type	Calling party's category	
- public voice	- subscriber/operator without forward transfer facility	12
- crew voice	- subscriber/operator without forward transfer facility	12
- crew distress voice	- subscriber/with priority	14
Access requests: address digits 0, 1	Country code indicator (echo suppressor controls)	10
Service address: digits 2 to 17	Address signals/first digit	1
Test: response	Not applicable	
Channel release	Clear forward	16

Note - Signal No. 21, nature of circuit indicator; one satellite circuit in the connection - is generated by the GES, if required.

TABLE 4/Q.1152

Conversion of forward signals in Signalling System R2 to INMARSAT aeronautical signalling system Ground-to-air calls

Signalling System R2 Signal No.	Signal name	INMARSAT aeronautical signalling system Message: info element: value	Comments
1	Address signals	Call announcement: AES identity, called terminal	
2-6	Language digit: I-1 ...5		Interpreted by MSSC
7	Discriminating digit		Interpreted by MSSC
8	Country code indicator outgoing half suppressor required		MSSC will insert echo control device if needed
9	Country code indicator no echo suppressor required		Interpreted by MSSC
10, 11	Country code indicator incoming half echo suppressor required		Interpreted by MSSC
12	Calling party's category, subscriber or operator without forward transfer facility	Call announcement - service: telephone	
13	Calling party's category, data transmission control		Not applicable
14	Calling party's category, subscriber with priority	Call announcement - service: telephone, priority for further study	
15	Calling party's category, operator with forward transfer capability	Call announcement - service: telephone	
16	Clear forward	Channel release	
17	Forward transfer		Not applicable
18	First digit; I-1, I-2 ... I-10		Interpreted by MSSC
19	Reply to A-14; I-1 ... I-10		Not applicable
20	Reply to first A-13; I-13		Not applicable
21	Reply to first A-13; I-14		Not applicable

TABLE 5/Q.1152

Conversion of backward signals in the INMARSAT aeronautical signalling system to Signalling System R2
Ground-to-air calls

INMARSAT aeronautical signalling system Message: info element: value	Signalling System R2 Signal name: info element	Signal No.
Test: response	International, subscriber line free, charge	13
Connect	Answer signal	11
Channel release	Clear back	12
Call attempt result: Cause value:		
- user busy	Subscriber line busy	5
- no channel available	Congestion on the national network	1
- destination out of service	Susbscriber line out of order	10
- others	International; send special info tone	14

TABLE 5 *bis*/Q.1152

Unsuccessful call events and backward signals in Signalling System R2
Ground-to-air calls

INMARSAT aeronautical signalling system Event in INMARSAT system	Signalling System R2 Signal name: info element	Signal No.
Congestion in MSSC	B4 - Congestion	6
Incomplete AES number	B5 - Unallocated number	7
Unallocated AES number	B5 - Unallocated number	7
Continuity test failure	B8 - Subscriber line out of order	10
AES barred for incoming access	B2 - Send special info tone	4
AES absent	B2 - Send special info tone	4
No satellite channel available	B4 - Congestion	6

TABLE 6/Q.1152

Conversion of backward signals in Signalling System R2 to INMARSAT aeronautical Signalling System Air-to-ground calls

Signalling System R2		INMARSAT aeronautical signalling system		Comments
Signal No.	Signal name	Message: info element: value		
1	A4 - Congestion on the national network	Call attempt result:	remote public network, switching equipment congestion	
2	A6 - Address complete, charge, set up speech condition	" :	address complete	
3	A15 - Congestion in an international exchange or at its output	" :	international network, switching equipment	
4	B2 - Send special information tone	" :	remote public network, unspecified	
5	B3 - Subscriber line busy	" :	remote public network, user busy	
6	B4 - Congestion	" :	remote public network, switching equipment congestion	
7	B5 - Unallocated number	" :	remote public network, unassigned number	
8	B6 - Subscriber line free, charge	" :	address complete	
9	B7 - Subscriber line free, no charge	" :	address complete	No charge information, used by MSSC only
10	B8 - Subscriber line out of order	" :	remote public network, destination out of service	
11	Answer	Connect		
12	Clear back	Channel release		Clearback supervision done by MSSC
13	B1-B6 - International, subscriber line free, charge	Call attempt result:	address complete	
14	B9, B10 - International, send special information tone	" :	international network, unspecified	
15	B11-B15 - Congestion	" :	remote public network, switching equipment congestion	

TABLE 7/Q.1152

Conversion of forward signals in INMARSAT aeronautical signalling system to Signalling System No. 7
Air-to-ground calls

INMARSAT aeronautical signalling system Message: information element: values	Signalling System No. 7 Signal name: Information element	Signal No.
Access request: Message type: Public voice/ Crew voice/ Crew distress voice	Calling party's category indicator: Ordinary subscriber/ Ordinary subscriber/ Subscriber with priority	13 13 13 14
Access request: Address digits 0, 1 Service address: Digit 2 to 17	Address signals: Digit 1, 2 ... 0 nature of address indicator, international number	1 3
Test: Response	Continuity check performed on previous circuit	22
Channel release	Clear forward signal	16

Note - Signal No. 5, nature of circuit indicator, one satellite in connection, is generated by the MSSC.

TABLE 8/Q.1152

Conversion of forward signals in Signalling System No. 7 TUP to INMARSAT aeronautical signalling system
Ground-to-air calls

Signalling System No. 7 Signal No.	Signal name	INMARSAT aeronautical signalling system Message: info element: value	Comments
1	Address signals	Call announcement: AES ID, called terminal	
2	Nature of address indicator, national significant number	-	Interpreted by MSSC
3	Nature of address indicator, international number	-	Interpreted by MSSC
4	Nature of circuit indicator, no satellite in connection	-	Ignored by MSSC
5	Nature of circuit indicator, one satellite in connection	-	Ignored by MSSC
6	Echo suppressor indicator, outgoing half-echo suppressor not included	-	MSSC will insert echo control device if needed
7	Echo suppressor indicator, outgoing half-echo suppressor included	-	Interpreted by MSSC
8-12	Calling party's category indicator, language digit	Call announcement: - service: telephone	-

TABLE 8/Q.1152 *(Cont.)*

Conversion of forward signals in Signalling System No. 7 TUP to INMARSAT aeronautical signalling system
Ground-to-air calls

Signalling System No. 7		INMARSAT aeronautical signalling system	Comments
Signal No.	Signal name	Message: info element: value	
13	Calling party's category indicator, ordinary calling subscriber	Call anouncement: - service: telephone	-
14	Calling party's category indicator, calling subscriber with priority	Call announcement - service: telephone, priority for further study	-
15	Calling party's category indicator, data call	-	Not applicable
16	Clear forward	Channel release	-
17	Forward transfer	-	Not applicable
18	Continuity proved	-	Interpreted by MSSC
19	Continuity check failure	Channel release	-
20	Continuity check required on this circuit	-	Interpreted by MSSC
21	Continuity check not required on this circuit	-	Interpreted by MSSC
22	Continuity check performed on previous circuit	-	Interpreted by MSSC
23	Service information	-	Interpreted by MSSC
24	General set-up message	-	Interpreted by MSSC

TABLE 9/Q.1152

Conversion of backward signals in INMARSAT aeronautical signalling system to Signalling System No. 7 TUP
Ground-to-air calls

INMARSAT aeronautical signalling system	Signalling System No. 7	
Message: information element: value	Signal name	Signal No.
Test: Response	AFC: Address complete, subscriber free, charge	4
Connect	ANC: Answer, charge	16
Channel release	CLB: Clear back	19
Call attempt result: Cause value:		
- User busy	SGB: Subscriber busy	12
- No channel available	CGC: Circuit group congestion	8
- Destination out of service	LOS: Line out of service	13
- Others	SST: Send special information tone	14

TABLE 9 *bis*/Q.1152

Unsuccessful events and backward signals in Signalling System No. 7
Ground-to-air calls

INMARSAT aeronautical signalling system Event in INMARSAT system	Signalling System No. 7 Signal name	Signal No.
Congestion in MSSC	SEC: Switching equipment congestion	7
No satellite channel available	NNC: National network congestion	9
Incomplete AES number	ADI: Address incomplete	10
Unallocated AES number	UNN: Unallocated number	11
Continuity test failure	LOS: Line out of service	13
AES barred for incoming access	SST: Send special information tone	14
AES absent	SST: Send special information tone	14

TABLE 10/Q.1152

Conversion of backward signals in Signalling System No. 7 TUP
to INMARSAT aeronautical signalling system
Air-to-ground calls

Signalling System No. 7		INMARSAT aeronautical signalling system	Comments
Signal No.	Signal name	Message: info element: value	
1	ADC: Address complete, charge	Call attempt result: address complete	-
2	ADN: Address complete, no charge	Call result: address complete	No-charge information used by MSSC only
3	ADX: Address complete, coinbox	Call result: address complete	-
4	AFC: Address complete, subscriber free charge	Call result: address complete	-
5	AFN: Address complete, subscriber free no charge	Call result: address complete	No-charge information used by MSSC only
6	AFX: Address complete, subscriber free, coinbox	Call result: address complete	-
7	SEC: Switching equipment congestion	Call result: international network, switching equipment congestion	-
8	CGC: Circuit-group congestion	Call result: international network, no channel available	-

TABLE 10/Q.1152 *(Cont.)*

Conversion of backward signals in Signalling System No. 7 TUP to INMARSAT aeronautical signalling system Air-to-ground calls

Signalling System No. 7 Signal No.	Signal name	INMARSAT aeronautical signalling system Message: info element: value	Comments
9	NNC: National network congestion	Call result: remote public network, switching equipment congestion	-
10	ADI: Address complete	Call result: remote public network, invalid number format	-
11	UNN: Unallocated number	Call result: remote public network, unassigned number	-
12	SGB: Subscriber busy	Call result: remote public network, user busy	-
13	LOS: Line out of service	Call result: remote public network, destination out of service	-
14	SST: Send special information tone	Call result: international network, unspecified	-
15	CFL: Call failure	Call result: international network, unspecified	-
16	ANC: Answer, charge	Connect	-
17	ANN: Answer, no charge	Connect	No charge information used by MSSC
18	RAN: Reanswer	Connect	-
19	CLB: Clearback	Channel release	Clearback supervision done by MSSC
20	GRQ: General request message	-	Interpreted by MSSC
21	Call unsuccessful, access barred	Call attempt result: remote public network, unspecified	-
22	DPN: Call unsuccesful, digital path not provided	-	Not applicable

TABLE 11/Q.1152

Conversion of forward signals in INMARSAT aeronautical signalling system to Signalling System No. 5
Air-to-ground calls

INMARSAT aeronautical signalling system	Signalling System No. 5	
Message: info element: value	Signal name	Signal No.
Access request: message type: - public voice - crew voice - crew distress voice	Discriminating digit 0 Discriminating digit 0 Discriminating digit 0	7 7 7
Access request: address digits 0, 1 Service address: digit 2 to 17	Address digits	1
Test: response	Not applicable	
Channel release	Clear forward	10

TABLE 12/Q.1152

Conversion of forward signals in INMARSAT aeronautical signalling system to Signalling System No. 5
Air-to-ground calls

Signalling System No. 5		INMARSAT aeronautical signalling system	Comments
Signal No.	Signal name	Message: info element: value	
1	Address signals	Call announcement: AES identity, called terminal	
2-6	Language digit: 1 ...5		Interpreted by MSSC
7	Discriminating digit 0	Call announcement: - service: telephone	
8	Start of pulsing signal KP1	-	Interpreted by MSSC
9	Start of pulsing signal KP2	-	Interpreted by MSSC
10	Clear forward	Channel release	Not applicable
11	Forward transfer	-	

TABLE 13/Q.1152

Conversion of backward signals in INMARSAT aeronautical signalling system to Signalling System No. 5
Ground-to-air calls

INMARSAT aeronautical signalling system Message: info element: value	Signalling System No. 5 Signal name	Signal No.
Test: response	Inform that ST has been sent	5
Connect	Answer signal	2
Channel release	Clear back	3
Call attempt result: cause value	Busy flash signal	1
- user busy	Busy flash signal	1
- no channel available	Information tone (Note)	-
- destination out of service	Information tone (Note)	-
- others		

Note - May include appropriate recorded announcement.

TABLE 13 *bis*/Q.1152

Unsuccessful call events and backward signals in Signalling System No. 5
Ground-to-air calls

INMARSAT aeronautical signalling system Event in INMARSAT system	Signalling System No. 5 Signal name	Signal No.
Congestion in MSSC	Busy flash	1
No satellite channel available	Busy flash	1
Incomplete AES number	Information tone (Note)	
Unallocated AES number	Information tone (Note)	
Continuity test failure	Information tone (Note)	
AES absent	Information tone (Note)	
AES barred for incoming access	Information tone (Note)	

Note - May include appropriate recorded announcement.

TABLE 14/Q.1152

Conversion of backward signals in Signalling System No. 5 to INMARSAT aeronautical signalling system Air-to-ground calls

Signalling System No. 5 Signal No.	Signal name	INMARSAT aeronautical signalling system Message: info element: value	Comments
1	Busy - flash	Call attempt result: international network, unspecified	
2	Answer	Connect	
3	Clear back	Channel release	
4	Proceed to send	-	Interpreted by MSSC
5	Inform that ST has been sent	Call attempt result: address complete	

3 Incoming INMARSAT aeronautical logic procedures (Air-to-ground calls)

Figure 1/Q.1112 contains the procedures for the incoming INMARSAT aeronautical signalling system.

This description only includes those aspects of the INMARSAT aeronautical system which have to be implemented for interworking purposes. Internal procedures, such as those required for setting up and clearing satellite channels are not shown. This also applies to pre-emption procedures for assigning channels to distress calls.

The following details should be noted:

3.1 The access request contains information elements for the required service, and the required network, plus two address digits. For some private networks, and/or subscription services on public networks, this information will be sufficient to determine the complete call routing. In all but the most exceptional cases, it will be enough information to select a circuit for onward routing from the MSSC.

3.2 The initial analysis of the request checks that the AES is authorized for the service requested and finds a suitable channel and channel unit, on which to service the call. The call is aborted if the AES is not an authorized user of the INMARSAT system.

3.3 In the cases where all of the required address information is contained in the access request signal unit, an address message is received by the incoming procedure, once continuity of the assigned satellite channel has been successfully tested.

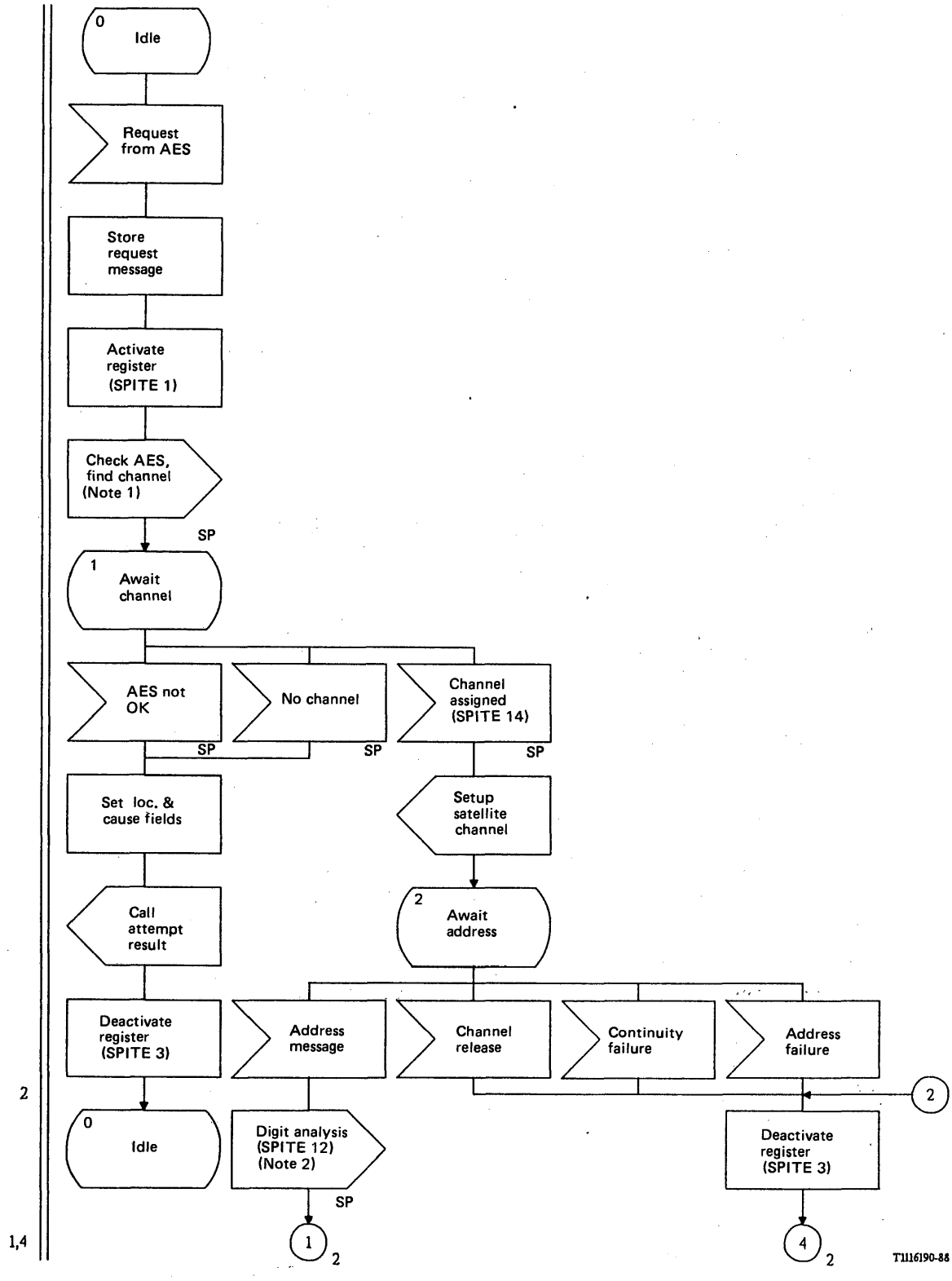
3.4 The called address is analysed to verify its integrity. The satellite channel may be cleared at this point, either if the dialled address is incomplete or if the AES goes on-hook. The call may also be aborted if proper credit card data is not received from the AES.

3.5 The dialled digits are transferred to the interworking procedure, and the answer signal is awaited. The last digit may be withheld until receipt of credit card information. All successful address complete signals are converted to a call attempt result message, with the cause field set to address complete.

3.6 Unsuccessful call event signals (BITEs 9-20) are transferred to the AES by the call attempt result message, with the cause field set appropriately.

3.7 On receipt of the answer signals, the connect message is sent to the AES.

3.8 The call is cleared in the normal way, either on receipt of a release message from the interworking procedure, or an indication of AES on-hook conveyed by means of a channel release message.



Note 1 - Analyze for authorized AES ID, availability of service requested, find a suitable satellite channel and channel unit.

Note 2 - Includes translation of prefixes to the appropriate B-party number, and verification that the number is valid.

FIGURE 1/Q.1152 (sheet 1 of 3)

Logic procedures for incoming INMARSAT aeronautical signalling (air-to-ground calls)

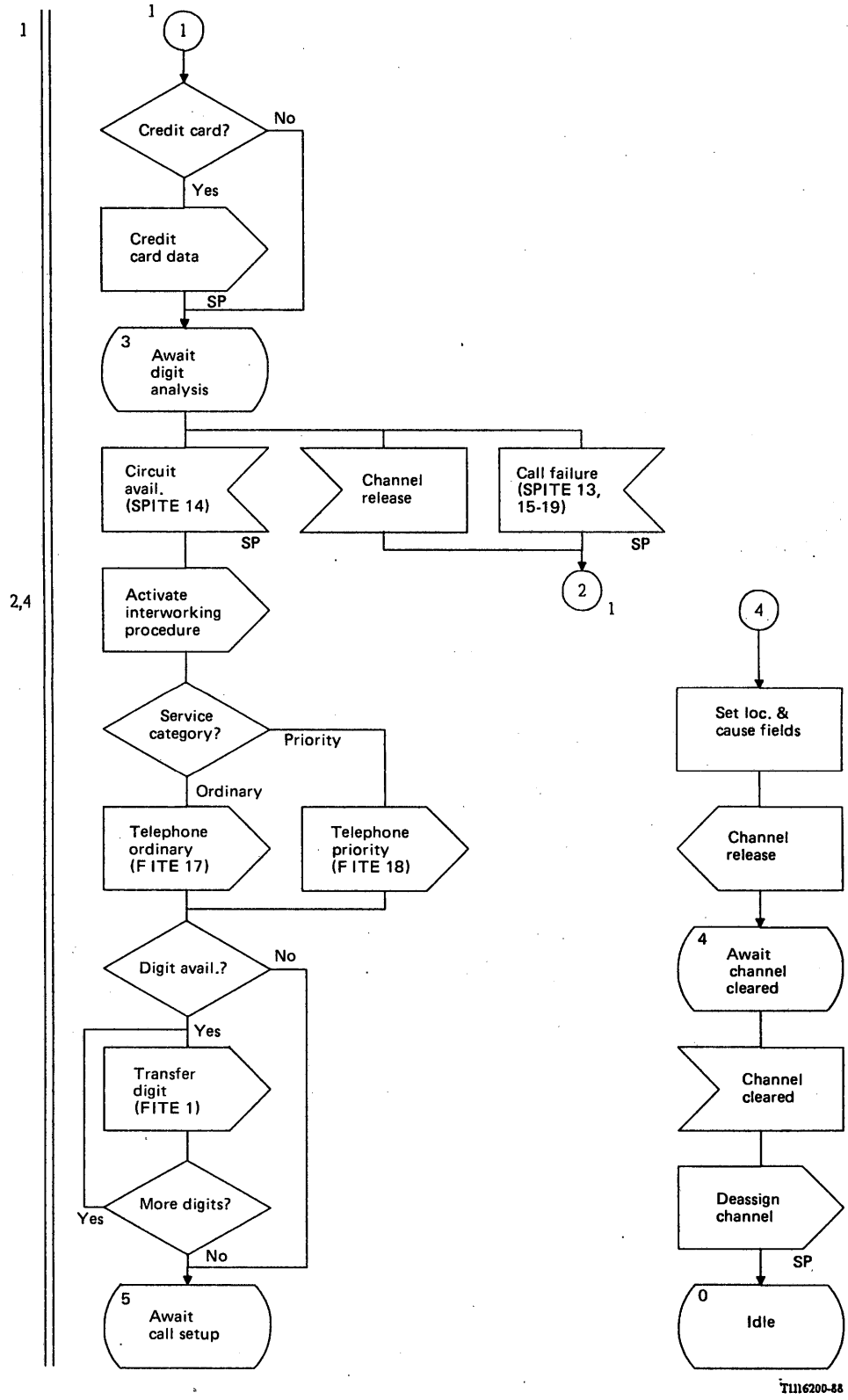


FIGURE 1/Q.1152 (sheet 2 of 3)

Logic procedures for incoming INMARSAT aeronautical signalling (air-to-ground calls)

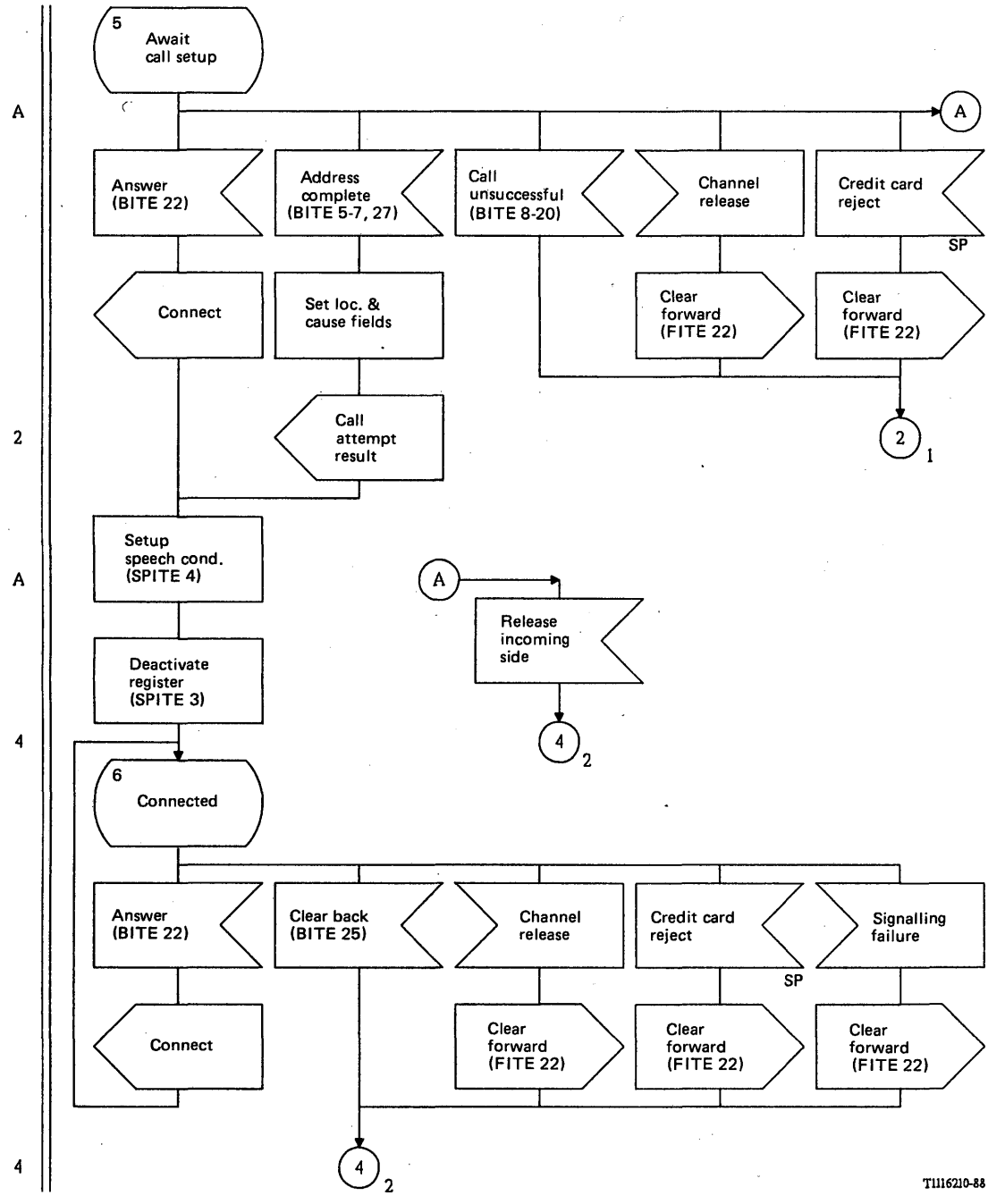


FIGURE 1/Q.1152 (sheet 3 of 3)

Logic procedures for incoming INMARSAT aeronautical signalling (air-to-ground calls)

4 Outgoing INMARSAT aeronautical logic procedures (Ground-to-air calls)

Figure 2/Q.1152 contains the procedures for the outgoing INMARSAT aeronautical signalling system.

This description only includes the aspects of the INMARSAT aeronautical system which have to be implemented for interworking purposes. Internal procedures, such as those required for setting up and clearing satellite channels are not shown. This also applies to pre-emption procedures for assigning channels to distress calls.

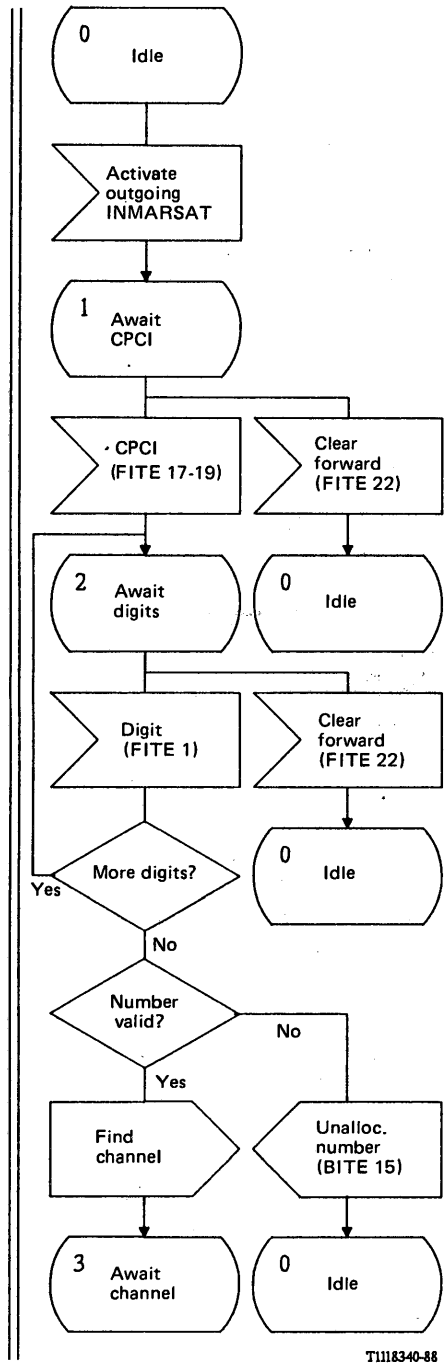
The following details should be noted:

4.1 The outgoing INMARSAT procedure receives the calling party indicator, and address digits from the interworking process. It determines whether the addressed AES is an authorized user and if it is logged on in the same satellite region. BITE 15 is returned to the terrestrial network if the dialled AES number is invalid.

4.2 The MSSC attempts to assign a satellite channel to the call, and tests for continuity of the channel. National network congestion (BITE 12) signal is returned if no channel is available. Appropriate signals are returned to signify continuity failure and AES busy conditions.

4.3 Answer signal is returned when the connect message is received from the AES.

4.4 The call is cleared down in the usual manner, on receipt of either clear forward from the interworking process, or channel release from the AES.



Note - Number valid ? means is the AES in the region of the calling GES; i.e. logged on the same satellite.

FIGURE 2/Q.1152 (sheet 1 of 2)

Logic procedures for outgoing INMARSAT aeronautical signalling (ground-to-air calls)

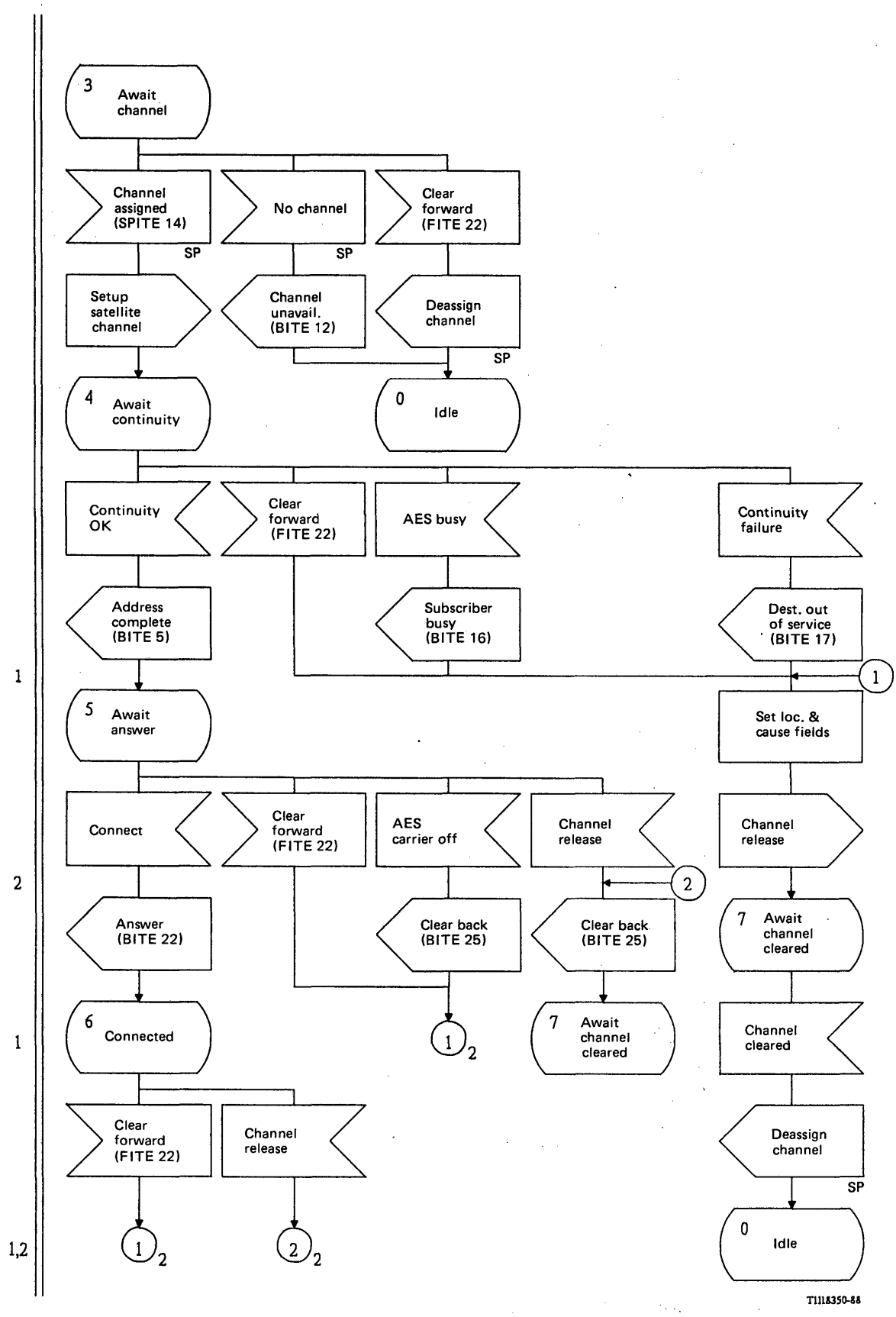


FIGURE 2/Q.1152 (sheet 2 of 2)

Logic procedures for outgoing INMARSAT aeronautical signalling (ground-to-air calls)

5 Interworking of INMARSAT aeronautical signalling system with itself

Figure 3/Q.1152 contains the procedures for interworking between the incoming and outgoing procedures of the INMARSAT aeronautical system. These procedures may also apply for interworking between INMARSAT aeronautical and the Standard-A and Standard-B systems.

The following details should be noted:

5.1 The outgoing INMARSAT aeronautical logic process is activated after receipt of the calling party category information, indicating whether the call is ordinary or priority.

5.2 The called party address, excluding the INMARSAT country code, is transferred to the outgoing process. The process returns to idle on receipt of any unsuccessful BITE or the clear forward FITE.

5.3 The call is cleared as normal, on either clearforward FITE or clearback BITE signals.

5.4 The interworking procedure supervises the answer time (timer t1). The value of the timer is as follows:

t1 = 2 to 4 minutes, as per Recommendation Q.118, § 4.3.1.

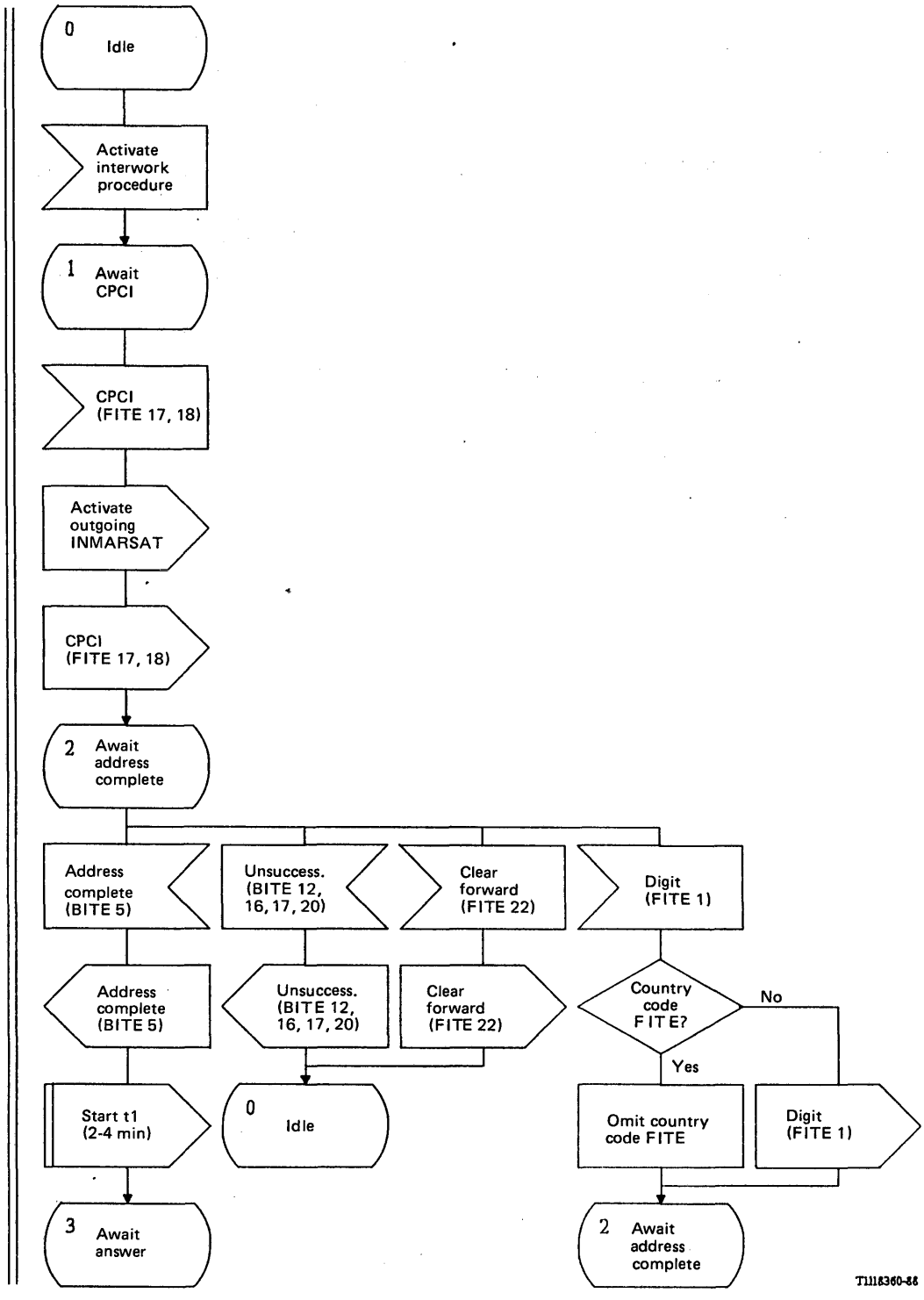


FIGURE 3/Q.1152 (sheet 1 of 2)

Interworking of INMARSAT aeronautical system with itself

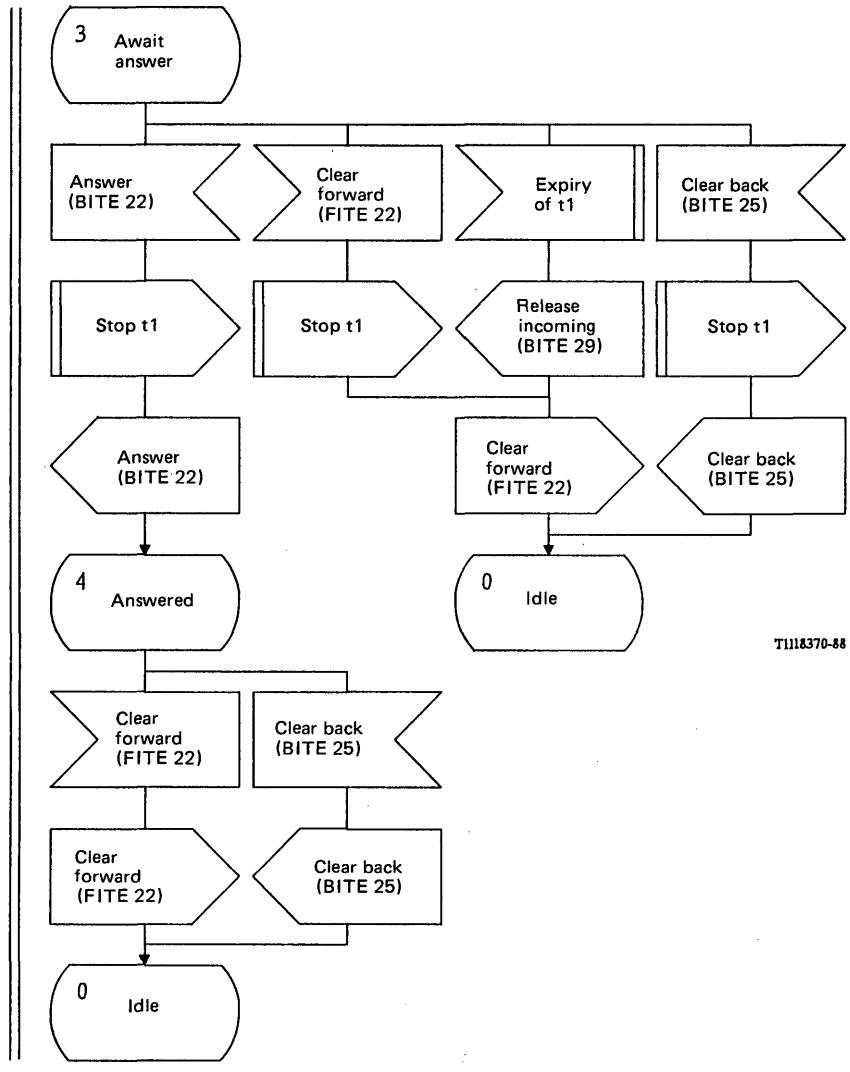


FIGURE 3/Q.1152 (sheet 2 of 2)

Interworking of INMARSAT aeronautical system with itself

6 Interworking of incoming INMARSAT aeronautical to Signalling System R2

6.1 Figure 4/Q.1152 contains the procedures for interworking of INMARSAT aeronautical signalling system to Signalling System R2.

6.2 The interworking procedure supervises the answer time and the clearback time, with timers t1 and t2 respectively. The values of the timers are as follows:

t1 = 2 to 4 minutes, as per Recommendation Q.118, § 4.3.1

t2 = 1 to 2 minutes, as per Recommendation Q.118, § 4.3.2

7 Interworking of Signalling System R2 to outgoing INMARSAT aeronautical

7.1 Figure 5/Q.1152 contains the procedures for interworking of Signalling System R2 to INMARSAT aeronautical signalling system.

7.2 The ringing tone towards the calling subscriber of the fixed network is initiated by the interworking procedure. The tone should have characteristics in accordance with Recommendation Q.35.

8 Interworking of incoming INMARSAT aeronautical to Signalling System No. 7 (TUP)

Figure 6/Q.1152 contains the procedures for interworking of INMARSAT aeronautical signalling system to Signalling System No. 7 (TUP).

The following details should be noted:

8.1 The outgoing Signalling System No. 7 (TUP) is activated only after receipt of calling party category information.

8.2 Signals to inform whether continuity checking is required on the terrestrial link, whether an incoming half-echo suppressor should be inserted, and whether country code digits will be sent along with the called party address, are sent to the ISC. The ISC is also informed that continuity has been proven on the satellite link.

8.3 All address-complete backward signals are transferred through to the outgoing aeronautical procedure. The charge related information is interpreted and used by the MSSC for billing purposes, and a simple address complete message is sent to the AES.

8.4 All unsuccessful call indications received from the ISC are relayed to the INMARSAT system, by means of the call attempt result message with the cause value set appropriately.

8.5 Charge information contained in the answer message is again used by the MSSC for billing purposes.

8.6 Answer and clearback supervision is done by the MSSC with timers t1 and t2 respectively. The values of the timers are as follows:

t1 = 2 to 4 minutes (as per Recommendation Q.118, § 4.3.1)

t2 = 1 to 2 minutes (as per Recommendation Q.118, § 4.3.2)

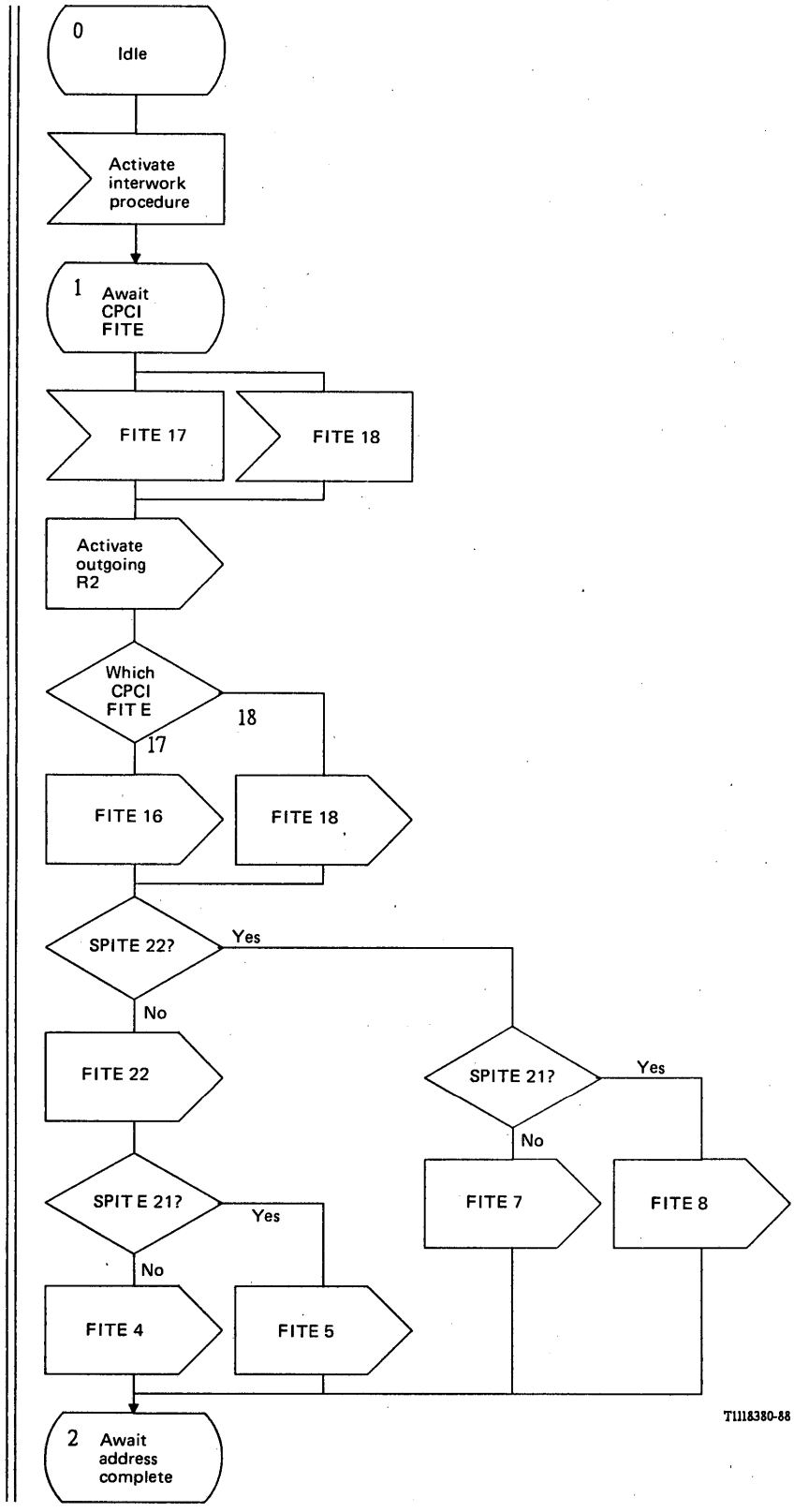


FIGURE 4/Q.1152 (sheet 1 of 3)

Interworking of INMARSAT aeronautical system to Signalling System R2

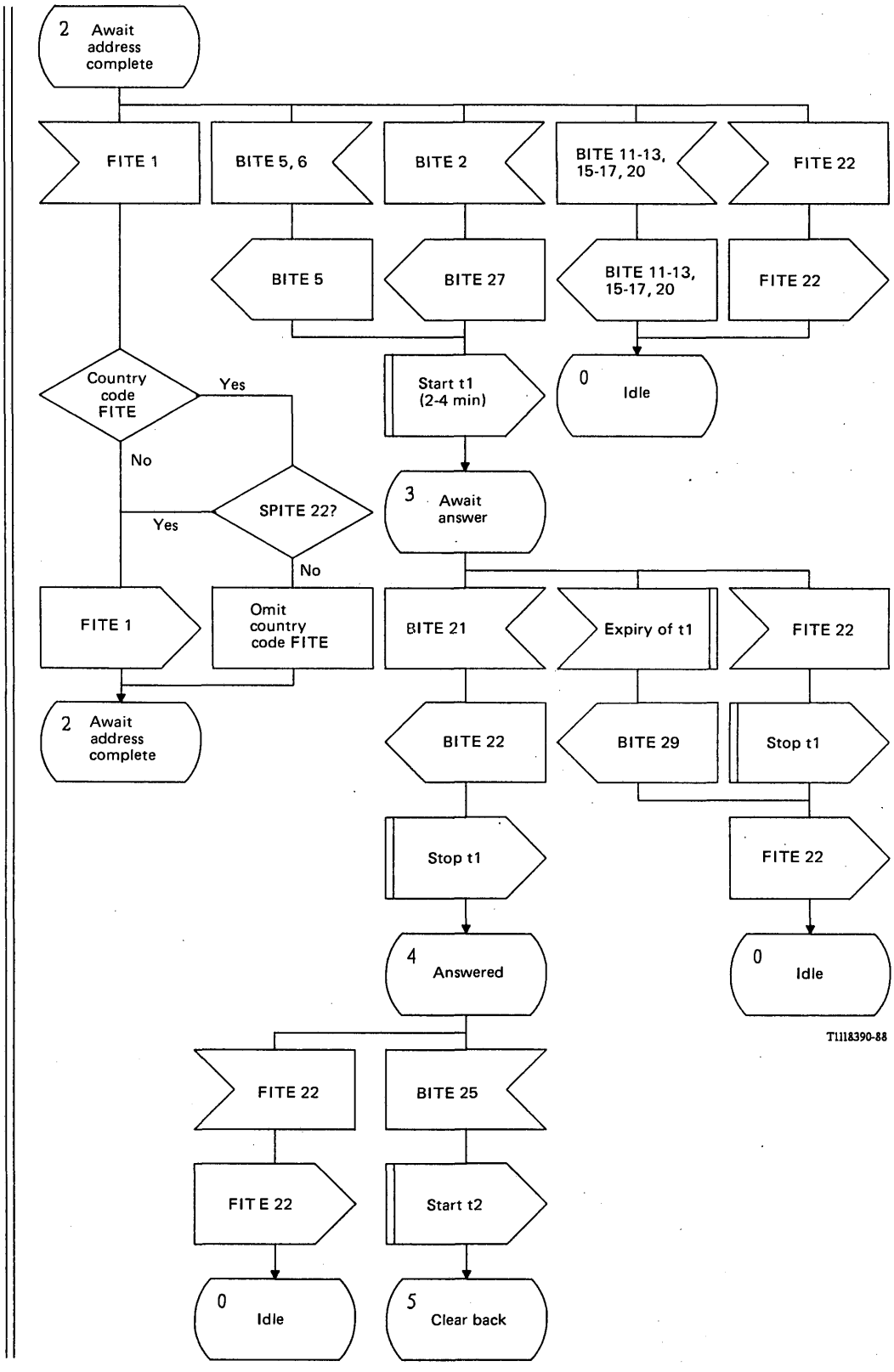


FIGURE 4/Q.1152 (sheet 2 of 3)

Interworking of INMARSAT aeronautical system to Signalling System R2

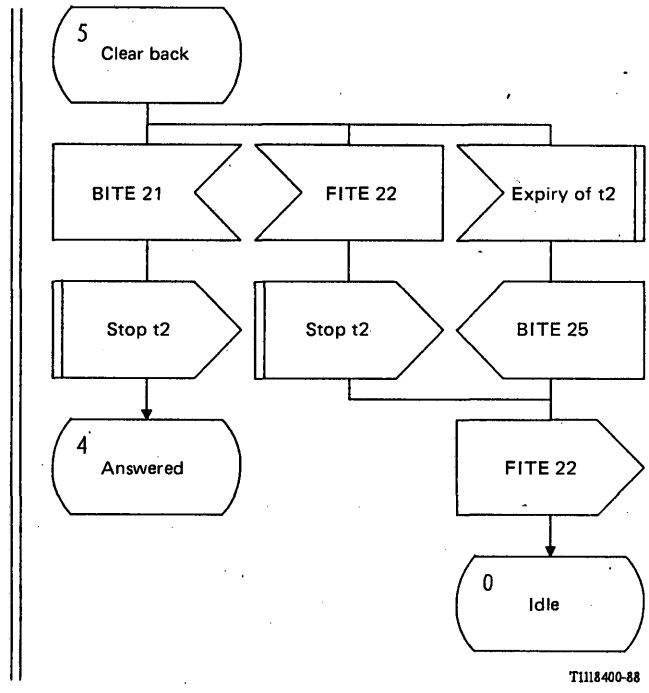


FIGURE 4/Q.1152 (sheet 3 of 3)

Interworking of INMARSAT aeronautical system to Signalling System R2

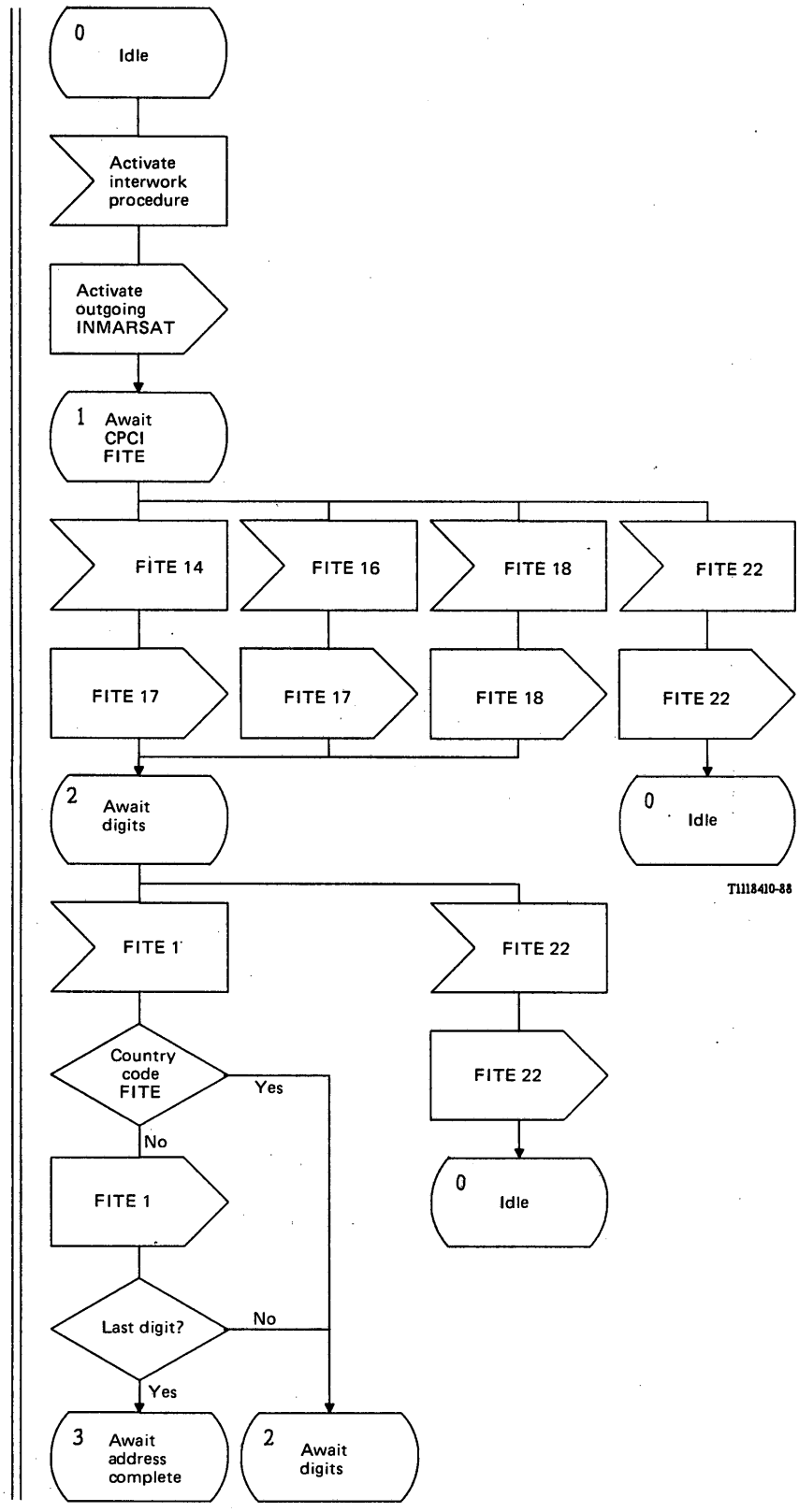


FIGURE 5/Q.1152 (sheet 1 of 2)

Interworking of Signalling System R2 to INMARSAT aeronautical system

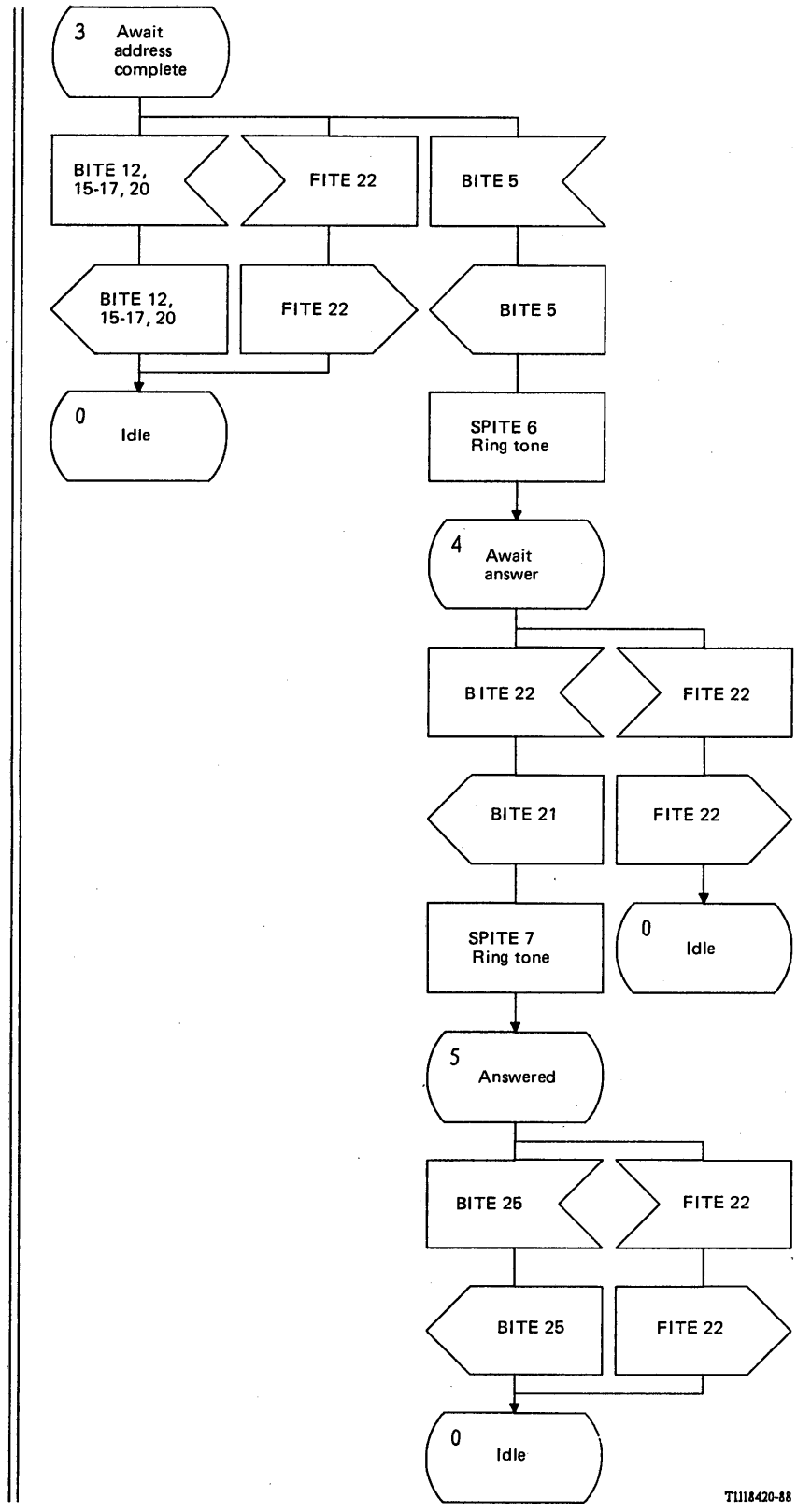


FIGURE 5/Q.1152 (sheet 2 of 2)

Interworking of Signalling System R2 to INMARSAT aeronautical system

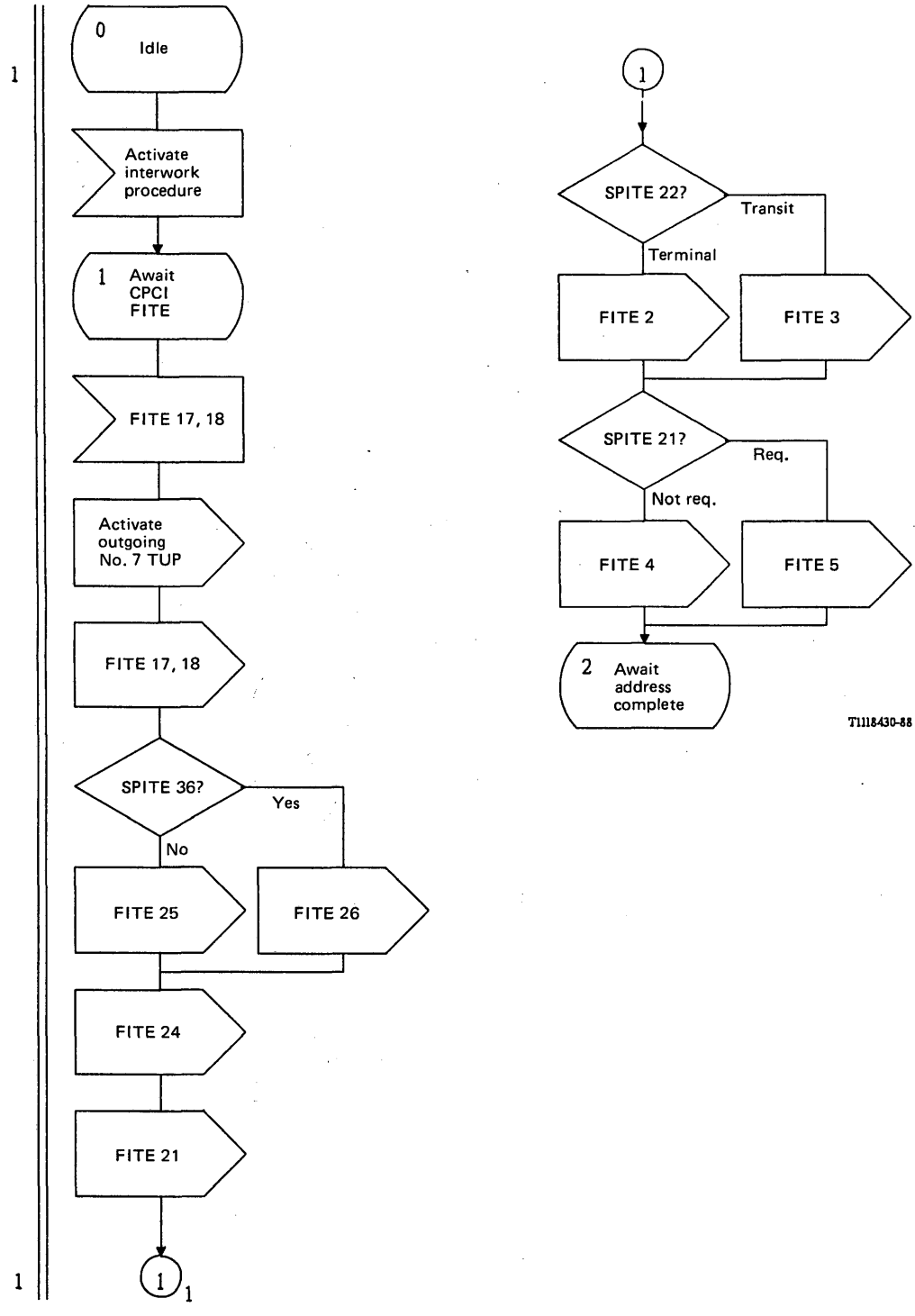


FIGURE 6/Q.1152 (sheet 1 of 3)

Interworking of INMARSAT aeronautical system to Signalling System No. 7 TUP

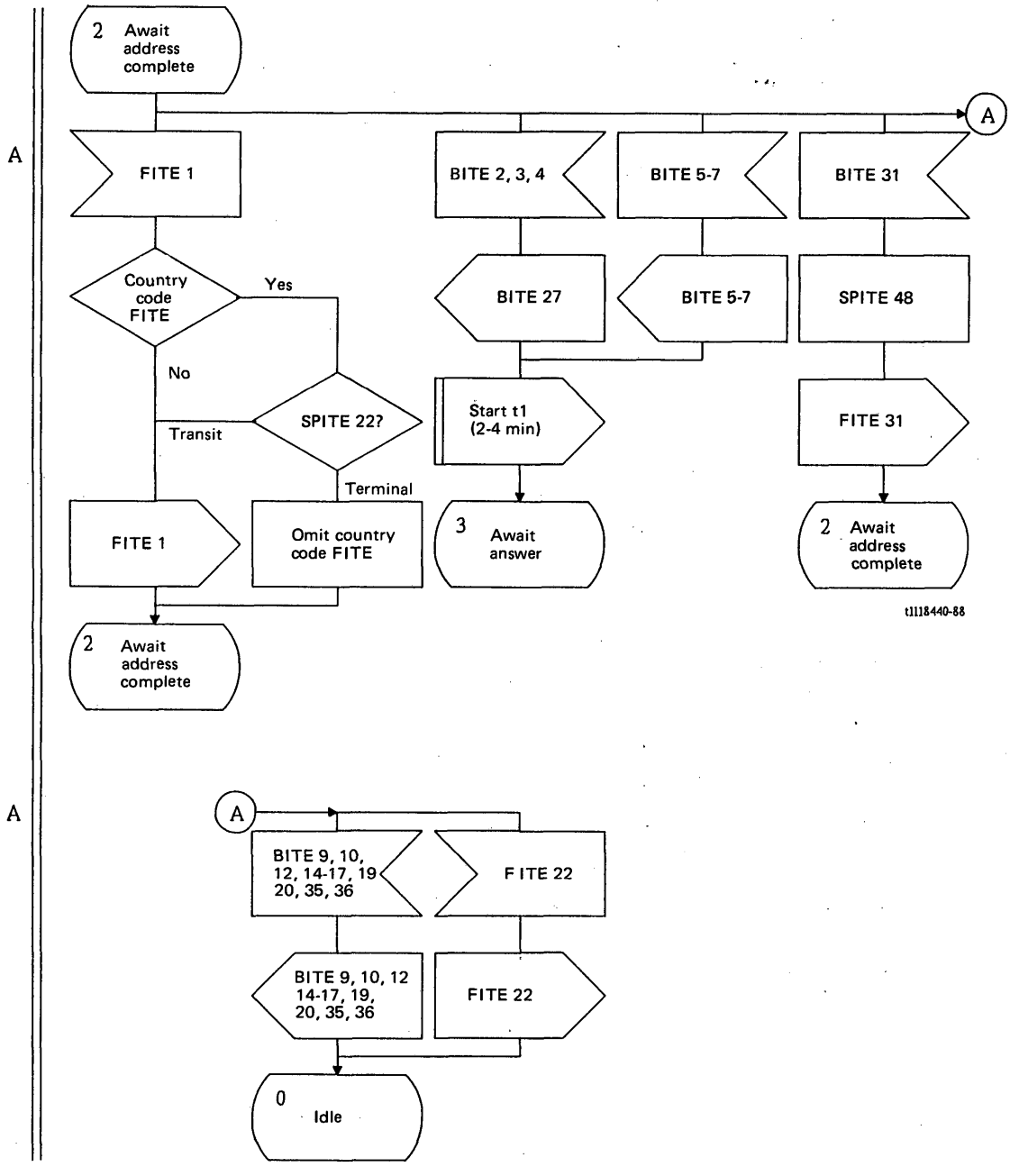


FIGURE 6/Q.1152 (sheet 2 of 3)

Interworking of INMARSAT aeronautical system to Signalling System No. 7 TUP

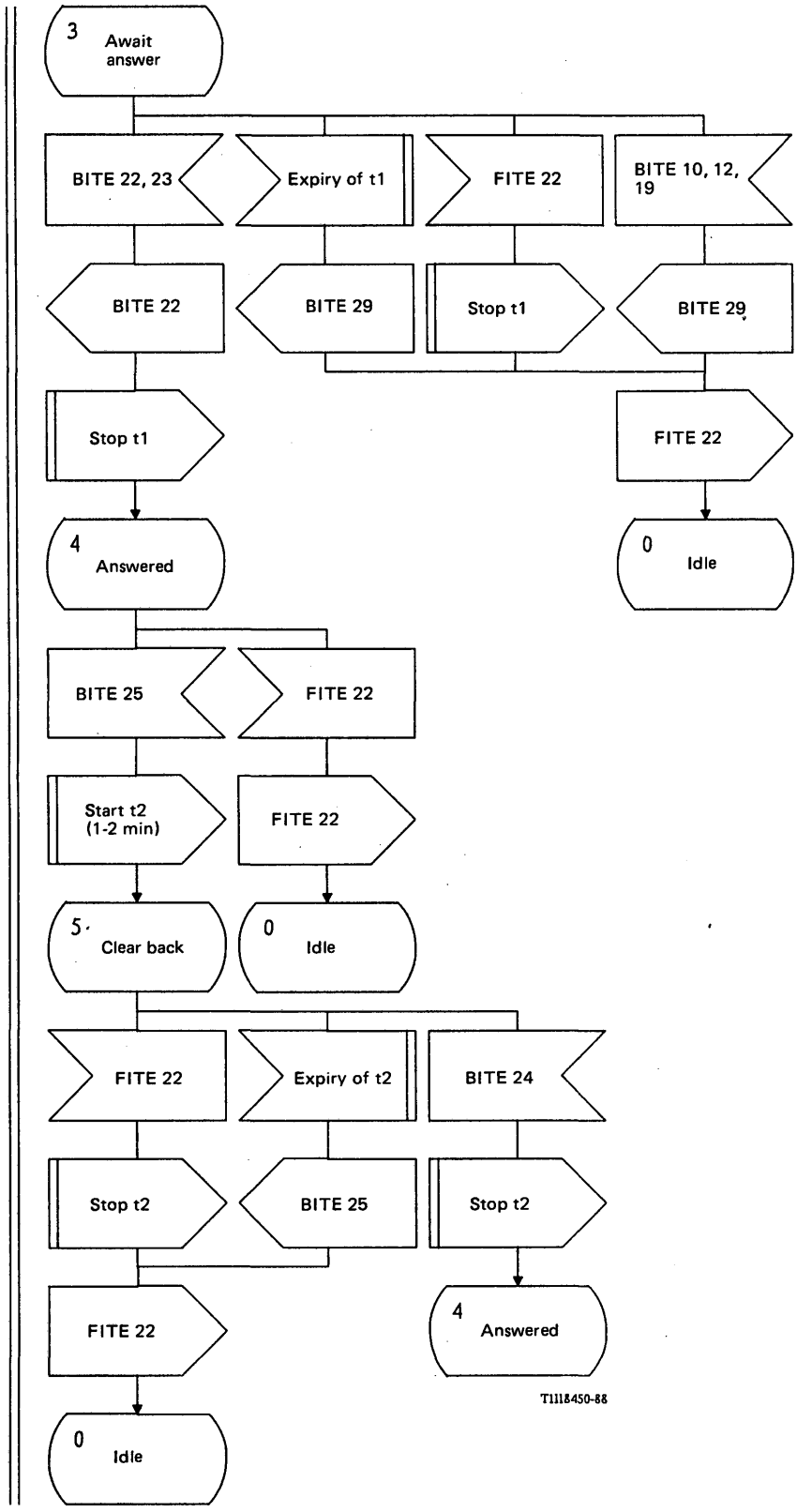


FIGURE 6/Q.1152 (sheet 3 of 3)

Interworking of INMARSAT aeronautical system to Signalling System No. 7 TUP

9 Interworking of Signalling System No. 7 (TUP) to outgoing INMARSAT aeronautical

Figure 7/Q.1152 contains the procedures for interworking of Signalling System No. 7 (TUP) to INMARSAT aeronautical signalling system.

The following details should be noted:

9.1 Calling party category information indicating the nature and priority of the call, is transferred through to the aeronautical system. The operator language indicator is interpreted and used by the MSSC.

9.2 The entire called party address, except the country code digits, are transferred through to the aeronautical system. The outgoing aeronautical logic process determines the validity of the addressed AES, and returns an unsucessful call indication if necessary.

9.3 The call may also be aborted if:

- no satellite voice channels are available;
- the addressed AES subscriber is busy;
- the continuity check is unsuccessful.

9.4 The MSSC returns audible ring tone, as per provisions in Recommendation Q.35, to the terrestrial network. The tone is applied on receipt of the address complete message from the AES, and removed upon receipt of the connect message.

10 Interworking of incoming INMARSAT aeronautical to Signalling System No. 5

Figure 8/Q.1152 contains the procedures for interworking of INMARSAT aeronautical signalling system to Signalling System No. 5.

10.1 The outgoing Signalling System No. 5 procedure is activated after receipt of the calling party category information, in the access request message from the AES.

10.2 Either KP2 or KP1 signal is sent by the MSSC, depending on whether the country code is to be outpulsed or not, respectively.

10.3 The artificial "send-finished" signal, received from the outgoing Signalling System No. 5 procedure is interpreted as an address complete condition to convey back to the AES.

10.4 The "busy-flash" signal (unsuccessful call) received from the terrestrial network is transferred to the AES by means of the call attempt result message.

10.5 Answer and clearback timeout supervision is done by the MSSC, with timers t1 and t2, respectively. The values of the timers are as follows:

t1 = 2 to 4 minutes (as per Recommendation Q.118, § 4.3.1)

t2 = 1 to 2 minutes (as per Recommendation Q.118, § 4.3.2)

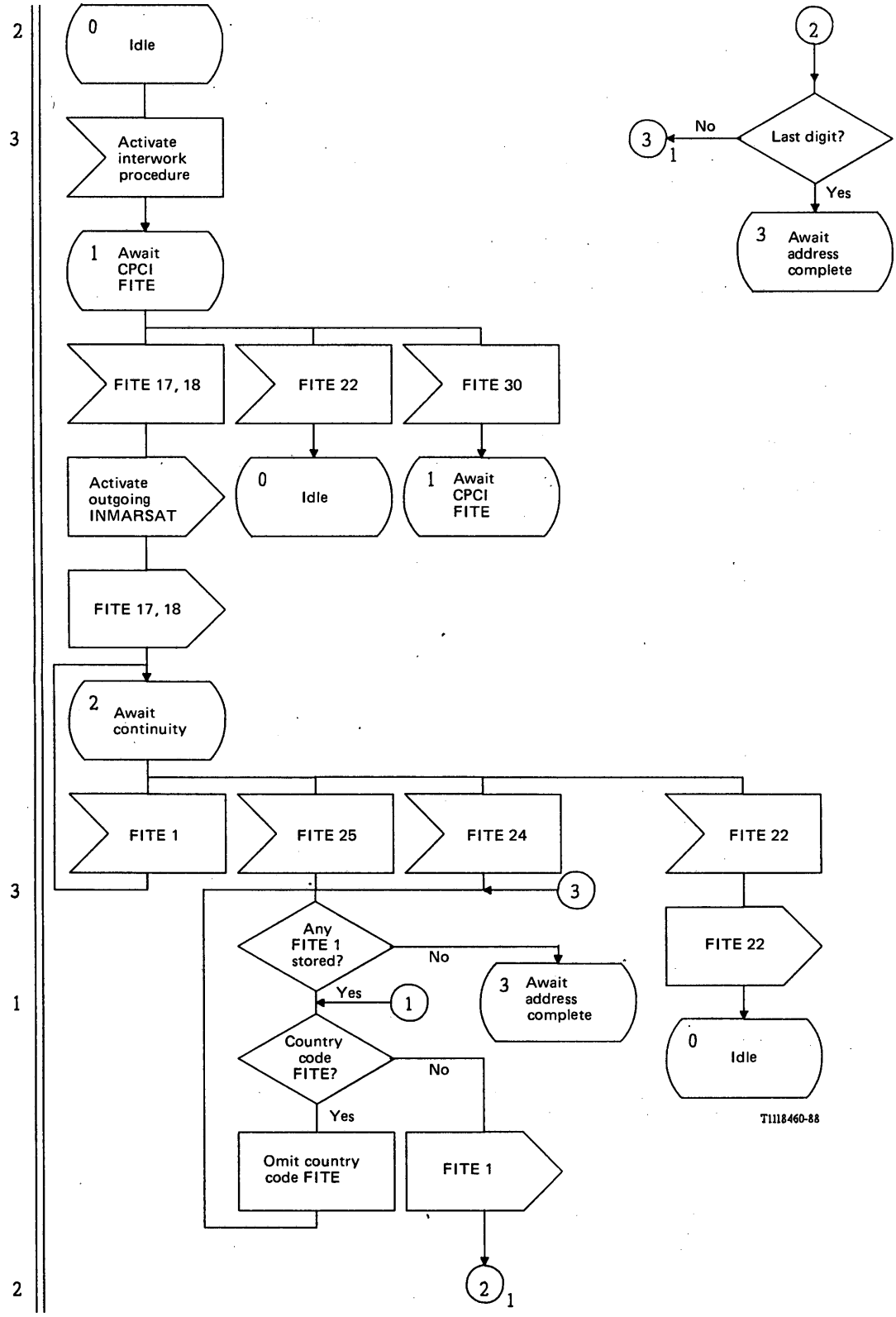


FIGURE 7/Q.1152 (sheet 1 of 2)

Interworking of Signalling System No. 7 TUP to INMARSAT aeronautical system

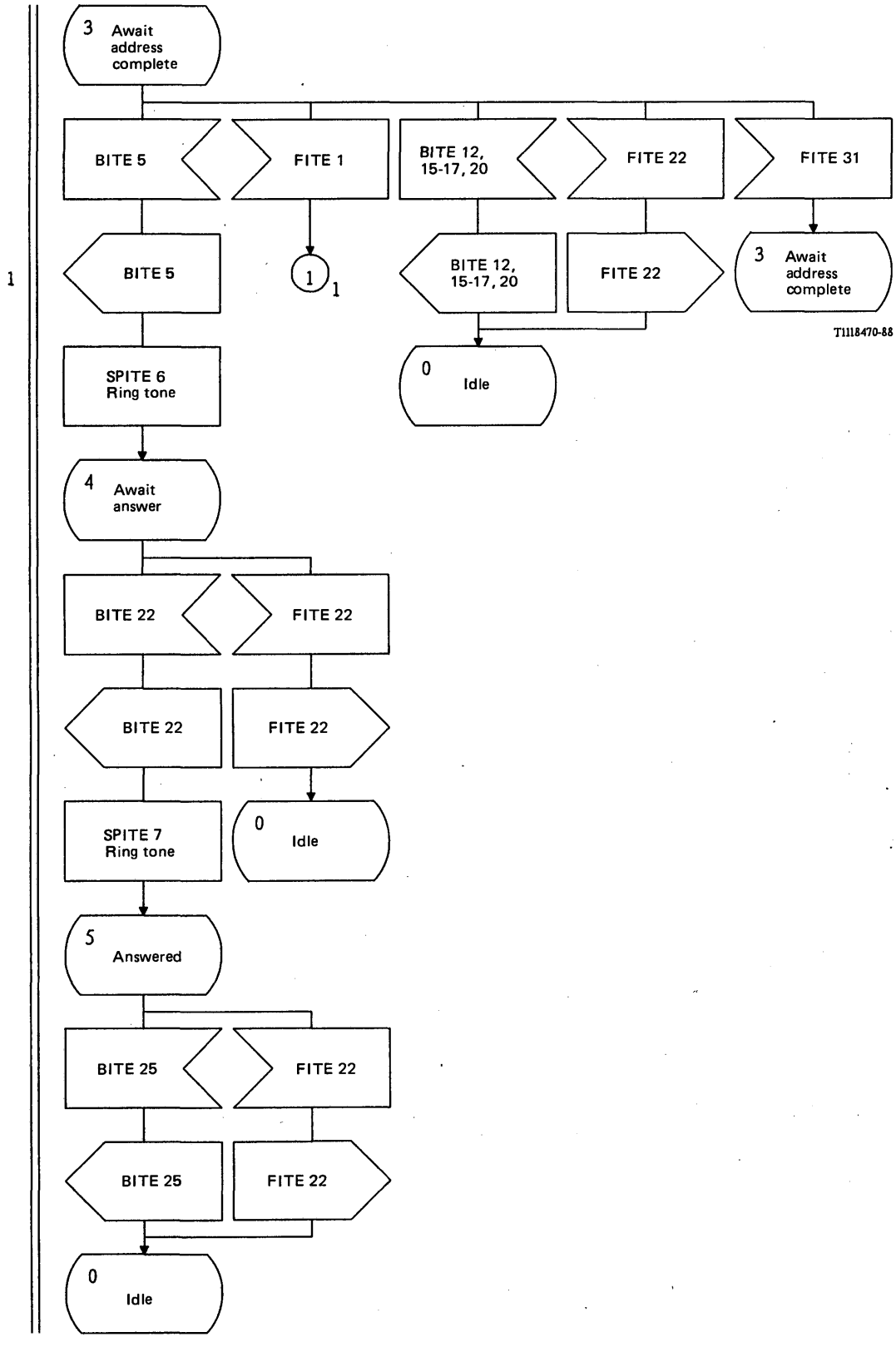


FIGURE 7/Q.1152 (sheet 2 of 2)

Interworking of Signalling System No. 7 TUP to INMARSAT aeronautical system

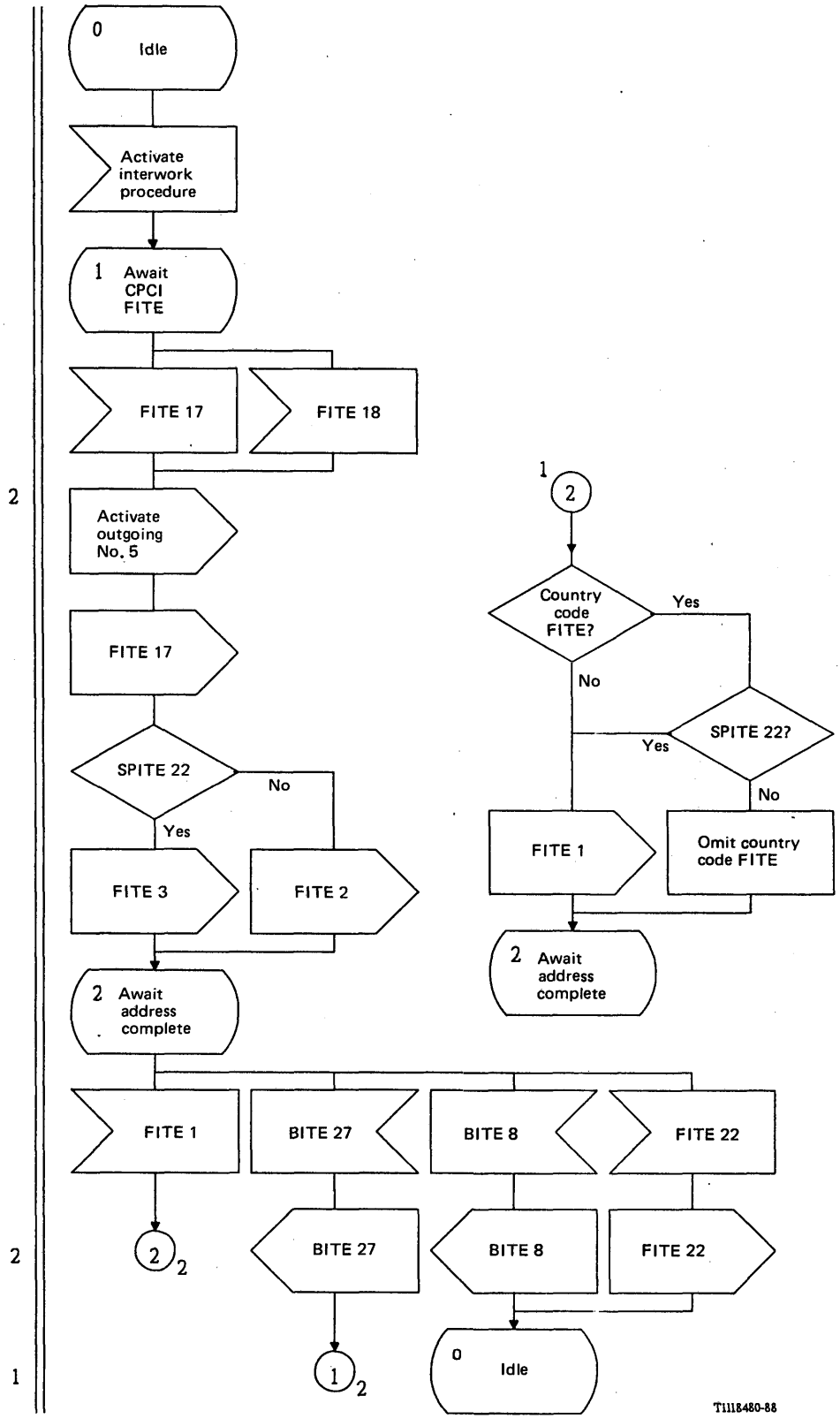


FIGURE 8/Q.1152 (sheet 1 of 3)

Interworking of INMARSAT aeronautical system to Signalling System No. 5

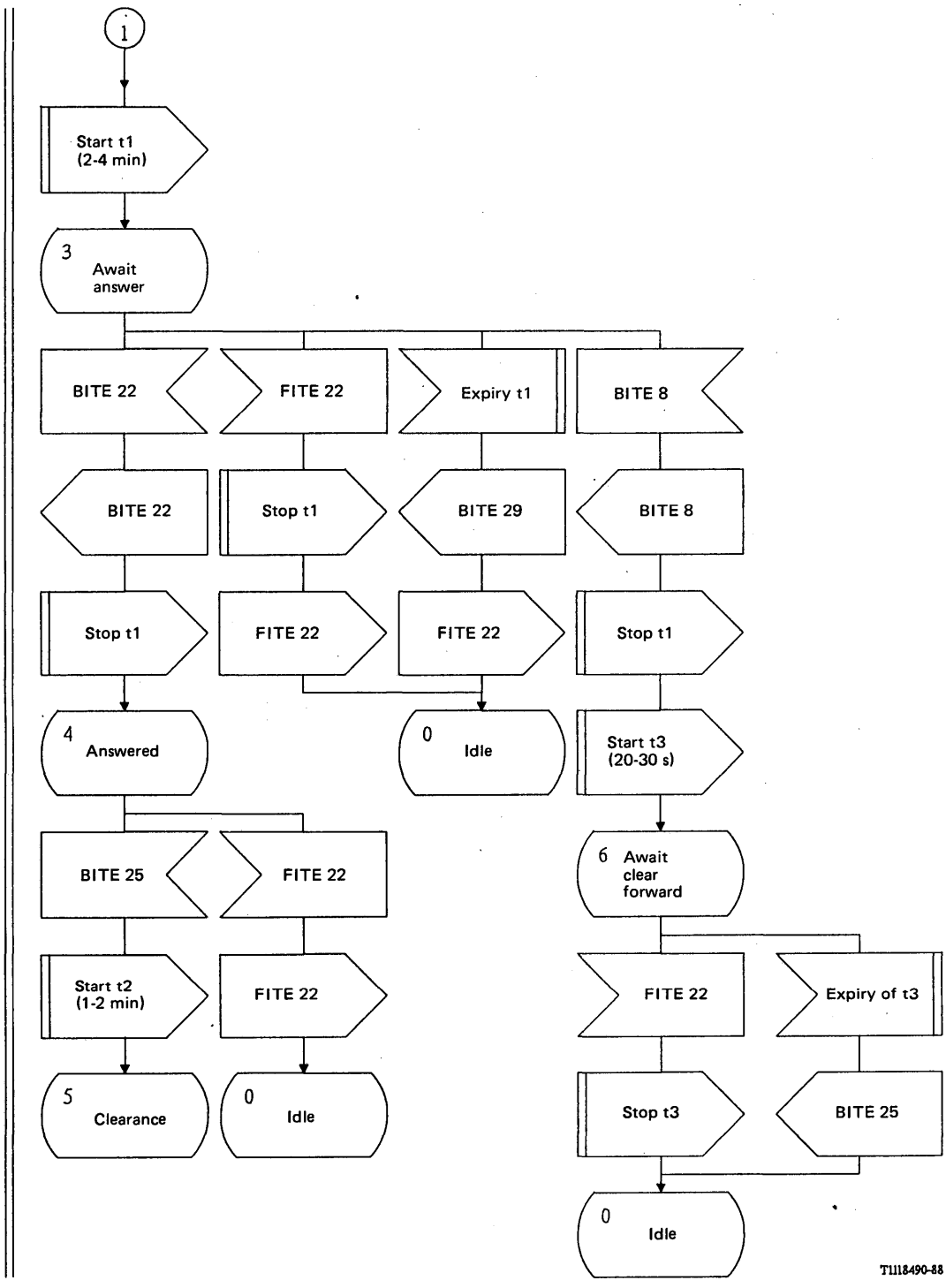


FIGURE 8/Q.1152 (sheet 2 of 3)

Interworking of INMARSAT aeronautical system to Signalling System No. 5

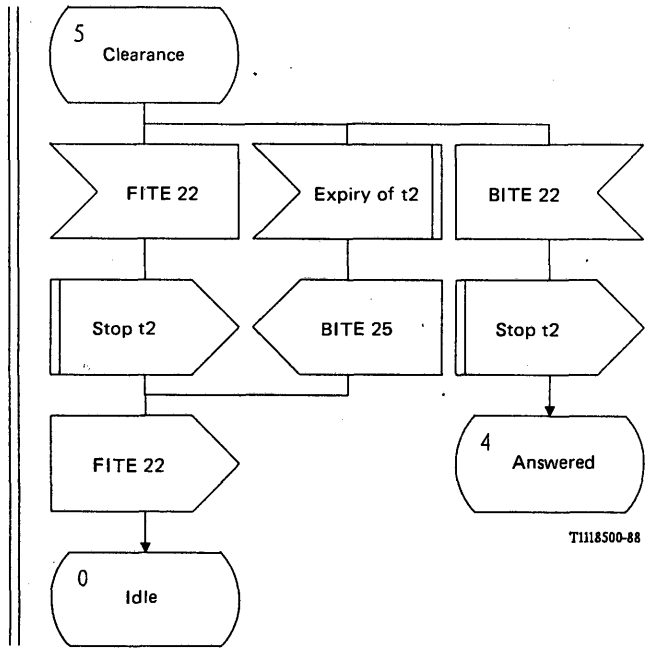


FIGURE 8/Q.1152 (sheet 3 of 3)

Interworking of INMARSAT aeronautical system to Signalling System No. 5

11 Interworking of Signalling System No. 5 to outgoing INMARSAT aeronautical

Figure 9/Q.1152 contains the procedures for interworking of Signalling System No. 5 INMARSAT aeronautical signalling system.

The following details should be noted:

11.1 The KP2 or KP1 signal is received from the MSSC, depending on whether the country code is to be expected along with the called party address or not, respectively.

11.2 The "busy-flash" signal is sent to the ISC if the call cannot be completed for any of the following reasons:

- called AES subscriber is busy;
- no satellite channel is available;
- the continuity check is unsuccessful.

The special information tone is sent back to the ISC, if the call is unsuccessful for any other reasons.

11.3 Answer and clearback signals received from the AES are conveyed through to the terrestrial network as soon as they are received, and there is no timeout supervision required.

Addendum - A recent change in the INMARSAT signalling system definition allows cause information to be carried in the channel release signal, thereby making it unnecessary to send the call attempt result signal for unsuccessful calls. The interworking procedures in this Recommendation do not reflect this change.

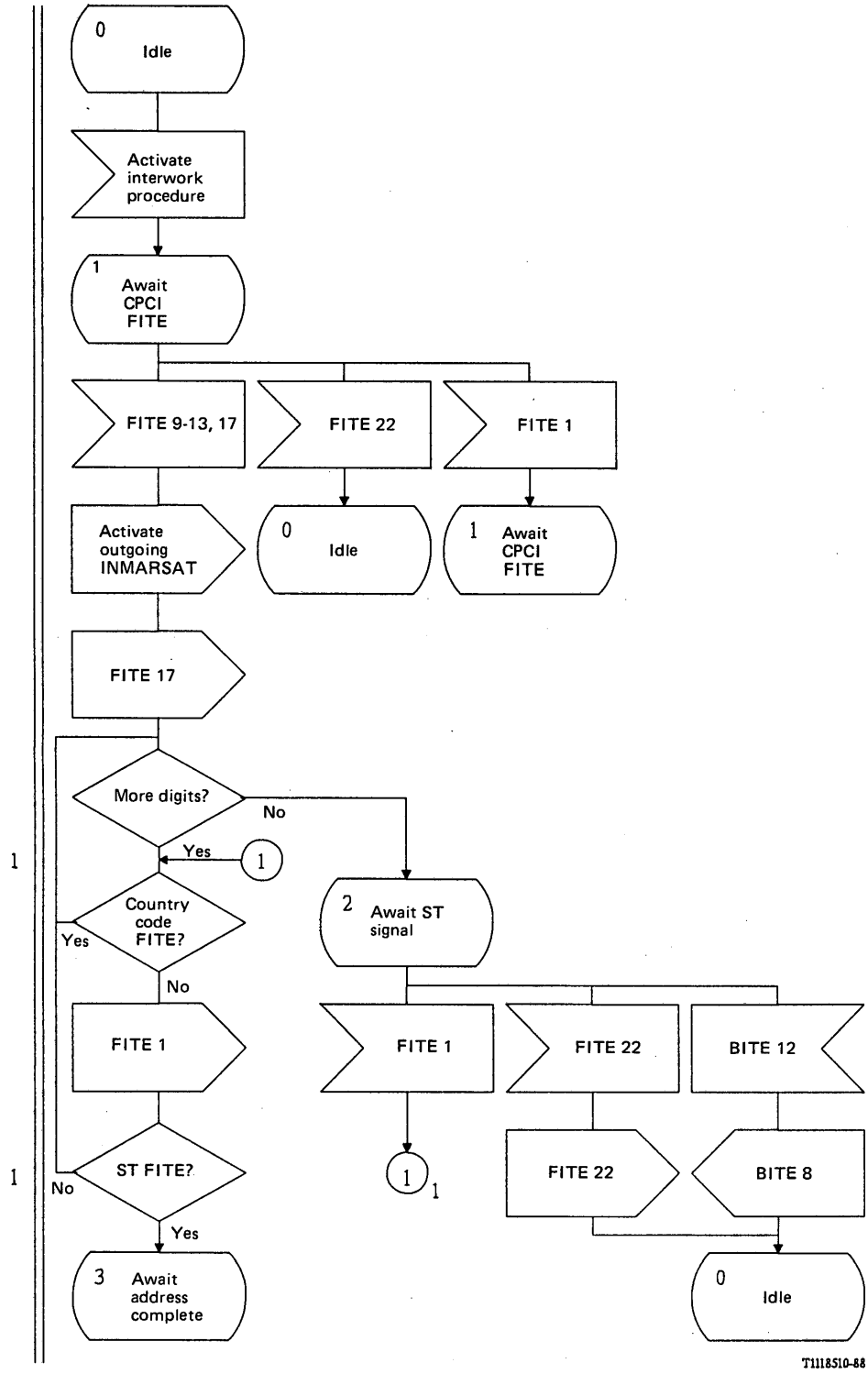


FIGURE 9/Q.1152 (sheet 1 of 2)

Interworking of Signalling System No. 5 to INMARSAT aeronautical system

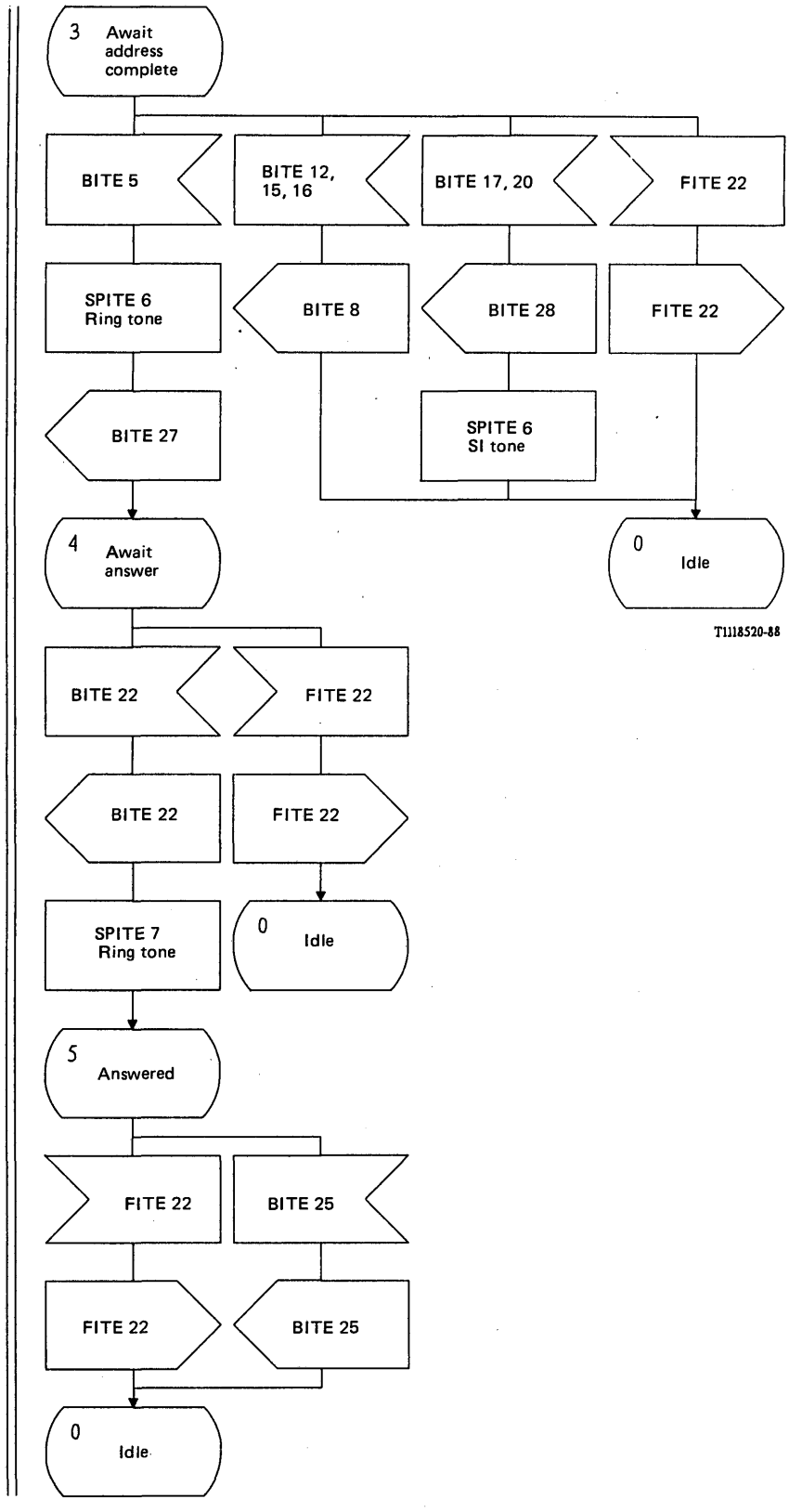


FIGURE 9/Q.1152 (sheet 2 of 2)

Interworking of Signalling System No. 5 to INMARSAT aeronautical system

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