INTERNATIONAL TELECOMMUNICATION UNION

CCITT

THE INTERNATIONAL
TELEGRAPH AND TELEPHONE
CONSULTATIVE COMMITTEE

YELLOW BOOK

VOLUME VI - FASCICLE VI.1

GENERAL RECOMMENDATIONS ON TELEPHONE SWITCHING AND SIGNALLING

INTERFACE WITH THE MARITIME SERVICE

RECOMMENDATIONS Q.1-Q.118bis

VIITH PLENARY ASSEMBLY
GENEVA, 10-21 NOVEMBER 1980

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1) "Telematic services" is used provisionally.

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REMARKS

1 The Recommendations in Volume VI of the *Yellow Book* are in agreement with Series E of the CCITT Recommendations (Fascicles II.2 and II.3 of the *Yellow Book* and with the provisions of the *Instructions for the International Telephone Service.*

2 The following expressions, which are in conformity with the CCITT *Terms and Definitions* have been used in Volume VI of the *Yellow Book.*

a) *Semi-automatic service* (or working), to designate a "service in which the calling subscriber's booking is given to an operator in the outgoing exchange, who completes the call through automatic switches".

b) *Automatic service* (or working), to designate a "system in which the switching operations are performed without the intervention of operators, the calling subscriber dialling (or keying) the called subscriber direct". This expression must be used to the exclusion of all others, such as "fully automatic service".

If a recommendation applies to both automatic and semi-automatic working, this should be explicitly specified in each sentence, since the CCITT has not defined a general expression to cover both of these services.

However, it has been agreed that the expressions

"automatic circuit" and "automatic equipment"

should, unless otherwise stated, be taken to indicate circuits or equipment which may be used either for semi-automatic or for automatic working.

3 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 explicitly stipulated to the contrary.

The values given in Fascicles VI.1 to VI.6 are imperative and must be met under normal service conditions.

4 The following Recommendation numbers which were listed in the table of contents of Volume VI.1 of the *Orange Book* have become available, since these Recommendations are now published only in the Recommendation series given in parentheses.

Q.51 to Q.64 and Q.80 to Q.96 (Series E)
Q.700 to Q.733 (Series M)

In the *Yellow Book*, some of these Recommendation numbers have been assigned to new Recommendations.

5 The Questions entrusted to each Study Group for the Study Period 1981-1984 can be found in Contribution No. 1 to that Study Group.

CCITT NOTE

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

PART I

Recommendations Q.1 and Q.2

SIGNALLING IN THE INTERNATIONAL MANUAL SERVICE

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SIGNAL RECEIVERS FOR MANUAL WORKING

In 1934 (CCIF *White Book*, Volume III, Xth Plenary Assembly, Budapest, 1934), a signalling current having a frequency of 500 Hz ± 2%, interrupted at a frequency of 20 Hz ± 2% was provisionally chosen for manually-operated international circuits.

500 Hz was chosen as the frequency to be transmitted, under normal conditions, by carrier terminal equipment and line repeaters. To avoid false operation due to speech currents, it was also considered desirable to interrupt the 500 Hz signalling current at low frequency. The use of a uniform interruption frequency of 20 Hz enables a high degree of selectivity to be obtained in signal receivers.

The effective power produced by the signalling current, when not interrupted, is fixed at 1 milliwatt at a zero relative level or an absolute power level of zero (with a tolerance of ± 1 decibel) which corresponds to an average power for the interrupted signalling current of 0.5 milliwatt, with a tolerance of ± 1 decibel.

The power levels specified above were chosen in 1954 (XVIIth CCIF Plenary Assembly, Geneva, 1954) on the basis of the limit imposed for the maximum energy which can be transmitted by signals during the busy hour; it must not exceed 2.5 microwatthours or 9000 microwattseconds at a zero relative level point. A reasonable value for the number of calls, or attempted calls, on a circuit during the busy hour was assumed and 2 seconds was assumed to be the sending duration of the signalling current to line by operation of the operator's ringing key.

On outgoing circuits from an international exchange, where the 500/20 Hz signals are liable to be sent over wideband carrier systems (coaxial carrier systems) it is desirable, to avoid overloading the repeaters, that the duration of the 500/20 Hz signals sent to line should not exceed 2 seconds and they should be limited to this value by automatic means.

Since, in general, the *Instructions for the International Telephone Service* (Article 32) [1] require the signalling current sent over an international circuit to have a duration of at least 2 seconds to avoid the risk of signals being undetected at the incoming end, the means for limiting the sending duration of the signalling current will generally consist of an arrangement which controls the sending duration independently of the time the ringing key is operated and which automatically fixes that duration at 2 seconds.

Note – In the case of short 2-wire circuits, it may be economical to use, by agreement between the Administrations concerned, a low-frequency signalling current (either between 16 and 25 Hz or 50 Hz).

ANNEX A

(to Recommendation Q.1)

Basic technical clauses of a model specification for the provision of 500/20-Hz voice-frequency signalling sets (signal transmitters and receivers) intended for manually-operated circuits

A.1 *Sending of signals*

Power – The signal transmitted shall supply a sinusoidal current at a frequency of 500 Hz ± 2% interrupted at a frequency of 20 Hz ± 2%.

The effective mean power of the 500/20-Hz current is fixed at 0.5 milliwatt or an absolute power level of −3 dBm (with a tolerance of ± 1 dB) at a zero relative level point.

Every precaution should be taken to avoid unbalance effects in the circuit during the transmission of a 500/20-Hz signalling current.

A.2 *Reception of signals*

Sensitivity – The signal receiver shall operate correctly when the 500/20-Hz current at the input to the signal receiver is within the following limits:

$$-8.5 + n \leqslant N \leqslant +2.5 + n \text{ dB}$$

where n is the relative power level at the point of the circuit at which the signal receiver is connected.

The limits take account of the tolerances indicated above for the transmitted power level and include a margin of ± 4.5 decibels on the nominal absolute power level of the 500/20 Hz current received at the input to the signal receiver. This margin allows for variations in transmission conditions on international circuits.

Tuning – Tuning should be such that the signal receiver operates only at a frequency of 500 Hz guaranteed to within ± 2% and at an interrupting frequency of 20 Hz guaranteed to within ± 2%.

Delay – The delay, i.e. the time which elapses between the application of the signalling voltage and the operation of the signal receiver, must be long enough for the signal receiver to remain insensitive to all speech currents which normally flow in the circuit to which it is connected. The duration of this delay must, however, be less than 1200 milliseconds. (In other words, 1200 milliseconds is the maximum signal recognition time within which a signal has to be recognized).

Selectivity (resulting from the tuning of the resonant circuit and the delay mentioned above) – The receipt of a speech (or noise) current circulating in the circuit must not give rise to a current liable to cause the operation of the signalling equipment and, in consequence, to cause a wrong indication to be given on the international positions even though the speech (or noise) voltage reaches the maximum value likely to be met in practice. In particular, the signal receiver must not operate when a speech power not exceeding 6 milliwatts is applied at a zero relative level point.

Insertion loss – The insertion loss introduced by the signal receiver in the circuit with which the signalling set is associated must be less than 0.3 dB for any frequency effectively transmitted by the circuit.

Reference

[1] *CCITT Instructions for the international telephone service (1 October 1981)*, ITU, Geneva, 1981.

Recommendation Q.2

SIGNAL RECEIVERS FOR AUTOMATIC AND SEMI-AUTOMATIC WORKING, USED FOR MANUAL WORKING

The directives relating to 500/20-Hz signalling sets are provisional. An Administration intending to purchase new signalling sets for use on international circuits which for the time being are to be operated on a manual basis, may find it advantageous, by agreement with the Administrations interested in the operation of the circuits concerned, to use signal receivers and transmitters conforming to the specifications for international automatic equipment. This will permit a greater technical uniformity of installations and will avoid having to replace the signal receivers when, ultimately, these circuits are operated on an automatic or semi-automatic basis.

The signal receivers must therefore conform with the specifications for the applicable recommended CCITT systems.

Sending of signals

The frequency and power level of the signalling current must be in accordance with the specifications for international automatic equipment. If two-frequency signal receivers are concerned, the two frequencies (compound signal) must be transmitted simultaneously.

The nominal duration of a signal sent to line is fixed at 2 seconds so as to be the same as that specified for 500/20 Hz signalling.

Reception of signals

At the receiving end, provision must be made for a splitting arrangement conforming to the specifications for international automatic equipment. This splitting arrangement can be:

- either an integral part of the signal receivers, or
- placed at the end of the circuit after the signal receiver.

The signalling equipment (at the output of the signal receiver) which causes the lighting of the calling and clearing lamps shall have a signal recognition time of between 100 and 1200 milliseconds:

- the minimum duration of 100 ms has been chosen so as to avoid the recognition of false signals due to imitation by speech currents;

- the maximum duration of 1200 ms has been chosen so as to permit the partial use of 500/20-Hz signal-receiver equipment.

Note 1 – The characteristics of signal receivers of the types used for automatic or semi-automatic working could possibly also be used to provide signals and supplementary facilities for operators if the Administrations concerned consider that the operational advantages to be obtained justify the equipment modifications involved at the international exchanges.

Note 2 – The time quoted in this Recommendation for the signal length and the signal recognition times would also be appropriate for out-band signalling systems using discontinuous signals for a manual service.

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PART II

Recommendations Q.5 to Q.49

GENERAL RECOMMENDATIONS RELATING TO SIGNALLING AND SWITCHING IN THE AUTOMATIC AND SEMI-AUTOMATIC SERVICES

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SECTION 1

CCITT BASIC RECOMMENDATIONS ON INTERNATIONAL AUTOMATIC AND SEMI-AUTOMATIC WORKING

Recommendation Q.5

ADVANTAGES OF SEMI-AUTOMATIC SERVICE IN THE INTERNATIONAL TELEPHONE SERVICE

(Geneva, 1954)

The CCITT,

considering

(a) the large economies in personnel that can result from the introduction of semi-automatic service at the incoming exchange;

(b) the very small number of faults due to the equipment used for the international semi-automatic service;

(c) the improvement in the "efficiency" (ratio of chargeable time to total holding time) of circuits using semi-automatic service compared with the efficiency of manual circuits operated on a demand basis;

(d) the improvement in the quality of the service given to users due to the reduction in the time of setting up a call;

(e) the fact that any type of call can be set up without difficulty over semi-automatic circuits, so that semi-automatic circuits can be used exclusively on an international relation;

draws the attention of Administrations

to the advantages of semi-automatic service from the point of view of economy and of the quality of service given to subscribers.

Recommendation Q.6

ADVANTAGES OF INTERNATIONAL AUTOMATIC WORKING

(New Delhi, 1960)

The CCITT,

considering

(a) that the advantages of semi-automatic working mentioned in Recommendation Q.5 apply as well to automatic working in respect of reliability, circuit efficiency and the satisfaction given to subscribers;

(b) that the advantages of automatic working are even greater as regards staff economy, since outgoing operators are dispensed with;

(c) that the changeover from semi-automatic to automatic working may be accomplished without any major modification to the international circuits or to the switching equipment at transit and incoming exchanges;

(d) that by 1960 the above advantages had been widely confirmed by experience on a number of international relations which had been using automatic service up to that time;

(e) that such experience has also shown that when a relation changes from demand working (manual or semi-automatic) to automatic working, there is a considerable increase in traffic;

(f) that the introduction of an international automatic service follows logically on the introduction of a national automatic service;

draws the attention of Administrations

to the additional advantages resulting from the introduction of an international automatic service.

Recommendation Q.7

SIGNALLING SYSTEMS TO BE USED FOR INTERNATIONAL AUTOMATIC AND SEMI-AUTOMATIC TELEPHONE WORKING

(Geneva, 1954 and 1964, Mar del Plata, 1968, Geneva, 1976 and 1980)

The CCITT,

considering

(a) that standardization of the signalling systems to be used for international automatic and semi-automatic telephone working is necessary to keep to a minimum the number of different types of equipment serving the various routes at any one exchange;

(b) that the following signalling systems have been standardized and are applicable for *general use* in international automatic and semi-automatic working:

- Signalling System No. 4, standardized by the CCIF in 1954;
- Signalling System No. 5, standardized by the CCITT in 1964;
- Signalling System No. 6, standardized by the CCITT in 1968;
- Signalling System No. 7, standardized by the CCITT in 1980;

(c) that the following signalling systems have been standardized and are applicable for *regional use* in international automatic and semi-automatic telephone working:

- Signalling System R1 (Regional Signalling System No. 1, formerly called the North American System), standardized by the CCITT in 1968;
- Signalling System R2 (Regional Signalling System No. 2, formerly called the MFC Bern System), standardized by the CCITT in 1968;

(d) that, under the conditions and subject to the reservations stated below, these signalling systems may be expected to give acceptable results for international automatic and semi-automatic telephone working;

desiring

that the CCITT Recommendation concerning the signalling systems for international automatic and semi-automatic telephone working be generally applied by all Administrations;

unanimously recommends

that, under the conditions and subject to the reservations stated below, Administrations should use, for international automatic and semi-automatic telephone working, one or more of the standard signalling systems mentioned in (b) and (c) above.

1 Criteria for selecting a signalling system

Many factors influence the selection of a given signalling system for a particular application. Factors that should be considered include:

1.1 *Satellite systems* because of long round trip propagation delays (540 ± 40 ms).

The inclusion of one satellite link in a telephone connection requires subscribers to keep more discipline than usual during a conversation. If use is made of two satellite links in tandem, requirements are even more stringent. In addition, there is the question of what transmission objectives are attainable on such a connection.

According to Recommendation Q.13 the inclusion of two satellite links in a connection should be avoided in all but exceptional cases. To facilitate the observance of this Recommendation, it is advisable to inform the subsequent transit centres by means of signalling that a satellite link is already included in the connection. During the following routing process the transit centre(s) should select a terrestrial link.

1.2 *Echo suppressors*

Both long terrestrial telephone links and satellite links call for the insertion of echo suppressors. Recommendations G.131 [1] and Q.115 include basic requirements for the insertion of echo suppressors.

Therefore, signalling systems should be arranged to act in cooperation with switching equipment to achieve the goals covered by Recommendations G.131 [1] and Q.115. This would be facilitated where the signalling system to be used provides the possibility of controlling the inclusion of echo suppressors.

In the future, the use of echo cancellers may need to be considered.

1.3 *Speech interpolation systems (e.g. TASI)*

In the case of a transmission system with speech interpolation, it must be ensured that the signalling system to be used is compatible with speech interpolation.

2 Further criteria for selecting a signalling system

Once Administrations decide to establish a route, they will have to specify the general requirements to be met by the signalling system.

In the following, some questions are drawn up which may serve as a guideline:

a) Does the transmission system provide for sufficient bandwidth (e.g. for outband line signalling)?

b) Is the signal capacity sufficient to allow the setting-up of an ordinary connection?

c) Is an additional exchange of information required, e.g.:
   - for echo suppressor control,
   - to increase routing facilities,
   - to obtain or to offer detailed information on congestion,
   - to obtain or to offer information on the condition of the called subscriber line,
   - to obtain or to offer information on the nature of the call:
     i) for identification or
     ii) for management purposes?

d) What requirements have to be set for the speed of the signalling system? What post-dialling and answering delays are to be tolerated?

e) Is there any interdependence between the minimum bundle size and signalling (e.g., as in the case of pilot interruption control of Signalling System R2)?

f) In the case of satellite systems, does the earth station require an extra interface between the terrestrial access circuits and the satellite links?

g) Is it necessary to introduce a new signalling system?

h) Is the signalling system suitable for application to the particular exchange type, e.g., electro-mechanical exchanges?

3 Characteristics of the standard CCITT Signalling Systems for general use

3.1 *Signalling System No. 4*

Described and specified in Fascicle VI.2.

Suitable for one-way operation.

Suitable for terminal and transit working; in the latter case two or three circuits equipped with Signalling System No. 4 may be switched in tandem.

Signalling System No. 4 is used in Europe and the Mediterranean Basin.

It makes use of a two-frequency code within the speech band.

A four-element binary code is employed for interregister signalling. Each of these elements consists of one of the two signal frequencies.

Each digit is acknowledged. In the case of long propagation times, these acknowledgements have an adverse effect because the propagation time is included twice in one signalling cycle. This disadvantage is more or less compensated for by the overlap mode of operation.

Signalling System No. 4 has a signal capacity of 16 codes for forward interregister signals and no register signals in the backward direction other than the acknowledgement signals.

One signal is provided for echo suppressor control on mutual agreement.

A signal is not provided to indicate whether the connection already includes a satellite link.

Not suitable for operation on transmission systems with speech interpolation.

3.2 *Signalling System No. 5*

Described and specified in Fascicle VI.2.

Suitable for both-way operation.

Suitable for terminal and transit working; in the latter case two or three circuits equipped with Signalling System No. 5 may be switched in tandem.

A multifrequency code (MFC: 2 out of 6) within the speech band is used for interregister signalling. The line signals consist of 1 or 2 frequencies within the speech band.

The entire address information is stored up to the last signal. It is then transmitted en bloc as a rapid sequence of pulsed multifrequency code signals.

The application of the en bloc mode of operation may result in an increased post-dialling delay, especially if the ST condition is determined by time out.

Signalling System No. 5 has a signal capacity of 15 codes for forward interregister signals and no backward interregister signals.

Signals are not provided either for echo suppressor control or for indicating whether the connection already includes a satellite link.

Suitable for operation on transmission systems with speech interpolation and on satellite links.

3.3 *Signalling System R1*

Described and specified in Fascicle VI.4.

Signalling System R1 is mainly used in North America.

Suitable for both-way operation.

Specified for terminal working.

A multifrequency code (MFC: 2 out of 6) within the speech band is used for interregister signalling.

In the analogue version of the Signalling System R1 line signalling, one frequency within the speech band is used. In the digital version of the Signalling System R1 line signalling, the two resultant signalling channels per speech circuit may be regarded as outband channels.

The following three modes of operation can be used to transmit the address information:

- en bloc,
- en bloc/overlap, or
- overlap.

The mode of operation selected influences:

– the seizing time of the next link, as well as

– the post-dialling delay.

The address information is transmitted as pulsed MFC signals.

Signalling System R1 has a signal capacity of 15 codes for forward interregister signals but no backward interregister signals.

Signals are not provided either for echo suppressor control or for indicating whether the connection already includes a satellite link.

Signalling System R1 can be used on satellite links. A variant of Signalling System R1 may be suitable for operation on transmission systems with digital speech interpolation, provided that the systems are designed and engineered to be transparent to pulsed interregister signals.

3.4 *Signalling System R2*

Described and specified in Fascicle VI.4.

Used for one-way operation on analogue transmission systems. Both-way operation is possible on digital transmission systems.

Suitable for terminal and transit working.

Signalling System R2 is used in both national and international telephone networks in several regions of the world.

A multifrequency code (MFC: 2 out of 6) within the speech band is used for interregister signalling. Since two different sets of six frequencies in separate bands are defined for forward and backward interregister signals, Signalling System R2 interregister signalling is suitable for use on 2-wire circuits as well as on 4-wire circuits.

For the analogue version of the Signalling System R2 line signalling, use is made of a low-level tone-on-idle method out of band. In addition, pilot interruption control is used.

There are two versions of the Signalling System R2 digital line signalling: the digital 1-bit and the digital 2-bit version. In international application the digital 2-bit version shall be used. The digital 1-bit version may be used in national networks. For both digital versions of Signalling System R2 line signalling, the signals for 30 speech channels are transmitted in the 16th time slot of the primary PCM system (Recommendation G.732 [2]).

Compelled signalling is used to transmit the address information in the overlap mode as multifrequency code signals, i.e., each forward interregister signal is acknowledged by a backward interregister signal. Considering that four times the propagation time is to be included in one signalling cycle, the exchange of signals is rather slow if the propagation time is long. This disadvantage is more or less compensated for by the overlap mode of operation.

Signalling System R2 has a higher signalling capacity than Signalling Systems No. 4, No. 5 and R1. The interregister signals allow, amongst others:

– improved routing,

– detailed information on congestion,

– information on:

  i) the nature of call,
  ii) the condition of the called subscriber line,

– no-charge calls, and

– address-complete information.

Signalling System R2 includes both forward and backward interregister signals for echo suppressor control.

In Signalling System R2, two signals are specified which indicate whether the connection already includes a satellite link.

Signalling System R2 may be suitable for use on satellite circuits, especially when it is already employed in the national or regional telephone networks concerned.

When Signalling System R2 is to be used on satellite links, the following must be borne in mind:

- In the case of analogue line signalling as well as in the digital 1-bit version of line signalling (the use of the latter is restricted to national networks only), intervals T1 and T2 have to be adapted.
- Pilot interruption control requires bundles comprising a multiple of 12 speech circuits.
- If use is made of the digital 1-bit version of the line signalling (permitted for national networks only), the bundles should comprise a multiple of 30 speech circuits.
- The register at the incoming end of a satellite link using Signalling System R2 shall be operated as an outgoing R2 register.
- The guard time for blocking and recognition of forward signals when pulsed signals are transmitted should be adapted to the propagation time on the satellite link.

Signalling System R2 may be suitable for operation on transmission systems with digital speech interpolation, provided the systems are designed and engineered to be transparent to pulsed interregister signals.

With 3 kHz spaced channels, the interregister signalling of Signalling System R2 may be used with the line signalling of Signalling System No. 4.

3.5 *Signalling System No. 6*

Fully described and specified in Fascicle VI.3.

Suitable for both-way operation.

Suitable for terminal and transit working.

During the period from 1970 to 1972 Signalling System No. 6 was tested internationally.

Some Administrations have introduced it for international telephone traffic. A variant of Signalling System No. 6 is employed in the national telephone network of the United States.

A common signalling link is used for signalling.

May be used in either an associated or quasi-associated mode of operation. Use in a quasi-associated mode may be more economic for small bundles of circuits.

Signalling is performed by means of signal units. Each unit is 28 bits in length, including 8 check bits. Transmission is at a speed of 2400 bit/s for the analogue version and 4 kbit/s (optionally 56 kbit/s) for the digital version.

Each signal unit within a block of 11 signal units is acknowledged and retransmitted in case of errors.

The address information can be transmitted en bloc and in the overlap mode. Because the transmission speed of Signalling System No. 6 is considerably higher than that of channel-associated signalling systems, the influence of the mode of operation on the post-dialling delay is reduced substantially.

The signal capacity (including the spare codes) of Signalling System No. 6 is much higher than that of Signalling Systems No. 4, No. 5, R1 and R2.

Signalling System No. 6 contains signals for echo suppressor control as well as signals indicating whether a satellite link is already included in the connection.

Signalling System No. 6 can be used for all types of telephone circuits including those with speech interpolation.

Signalling System No. 6 can be used on satellite links.

3.6 *Signalling System No. 7*

Fully described and specified in Fascicle VI.6.

Suitable for both-way operation.

Suitable for terminal and transit working.

A common signalling link is used for signalling.

Signalling System No. 7 can be used in national and international telecommunication networks.

Signalling System No. 7 can be used for dedicated networks (e.g. data transmission, telephone) and within an integrated services digital network. It is the preferred signalling system between Integrated Digital Network (IDN) exchanges and within the Integrated Services Digital Network (ISDN).

Signalling System No. 7 may be used in either an associated or quasi-associated mode of operation. Use in a quasi-associated mode may be more economical for small bundles of circuits.

Variable length signal units with an integer number of octets are used of which 6 perform message transfer part functions. Signalling System No. 7 is optimized for a digital bearer with transmission speed of 64 kbit/s, but operation at lower speeds (e.g. 4.8 kbit/s) on analogue bearers is possible.

Two error control methods (basic and preventive cyclic retransmission) are specified, each with its own field of application. In the basic method each signal unit is acknowledged and retransmitted in case of errors while in the preventive cyclic retransmission method no negative acknowledgements occur and error correction is performed by retransmission during idle periods of not yet acknowledged signal units.

The address information can be transmitted en bloc and in the overlap mode. Because the transmission speed of Signalling System No. 7 is considerably higher than that of channel-associated signalling systems, the influence of the mode of operation on the post-dialling delay is reduced substantially.

The signal capacity (including the spare codes) of Signalling System No. 7 is much higher than that of Signalling Systems No. 4, No. 5, R1 and R2.

Signalling System No. 7 contains signals for echo suppressor control as well as signals indicating whether a satellite link is already included in the connection.

Signalling System No. 7 can be used for all types of telephone circuits including those with speech interpolation.

Signalling System No. 7 can be used on satellite links.

References

[1] CCITT Recommendation *Stability and echo*, Vol. III, Fascicle III.1, Rec. G.131.

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

Recommendation Q.9

VOCABULARY OF SWITCHING AND SIGNALLING TERMS

(Geneva, 1980)

1 This Recommendation provides a vocabulary of terms and definitions which have been studied for application in documentation on switching and signalling in telephone networks. The possible evolution toward integrated digital networks and integrated services digital networks has been taken into account.

2 The terms are grouped in sections and within each section terms belonging to the same area of concepts are assembled. While such grouping in logical order may ease overview, it was not established according to firm principles and arbitrary placing of certain terms was accepted.

3 Part of the terms and definitions in this Recommendation also are contained in specialized glossaries which are attached to certain Recommendations of the G, Q and Z Series. Care has been taken then that identical texts appear in both the Recommendation and the glossary.

CONTENTS

According to the conventions applied in the lists, indications in round brackets are qualifiers or alternative terms in general use in addition to the principal term.

Examples: **call** (in software)
exchange (switching exchange, switching center)

Terms in square brackets are deprecated.

The indication *(USA)* after a term in English means that the terms is used in the United States, and is different from that current in the United Kingdom. The indication *(UK)* means the reverse.

Cross-references to the sources in §§ 1 to 9 are given, wherever possible, at the right-hand side of the line following the end of a definition.

Sources quoted are ISO, Recommendation G.702 [1], *List of Essential Telecommunication Terms* [2], the International Electrotechnical Vocabulary (IEV), and Supplement No. 7 to the Series E Recommendations [3]. The name of ISO and Recommendation G.702 are expressly mentioned each time along with a number; the terms derived from the "List of Essential Telecommunications Terms" and Supplement No. 7 give only a four digit number. The four digit number from Supplement No. 7 to the Series E Recommendations [3] is preceded by the designation "Study Group II". Numbers beginning with 714 ... refer to Chapter 714 (Switching) of IEV.

0 General terms

General terms and definitions as shown in § 0 have in many cases not been elaborated by Study Group XI. However, they need to be used in certain definitions for which the Study Group is responsible. A cross-reference to the source is given wherever possible. If no cross-reference is given, the term is quoted with the provisional meaning that Study Group XI adopted for it. Such definitions will be substituted by the definition of the competent body when available. It should be noted that the terms concerned will not necessarily be classified by the responsible body as "general" in the sense applied to § 0.

0001 **communication**

F: communication

S: comunicación

Comment – In the context of the present vocabulary, the ordinary dictionary meaning of this term is appropriate and sufficient.

0002 **telecommunication**

F: télécommunication

S: telecomunicación

Any process that enables a correspondent to pass to one or more given correspondents (telegraphy or telephony), or possible correspondents (broadcasting), information of any nature delivered in any usable form (written or printed matter, fixed or moving pictures, words, music, visible or audible signals, signals controlling the functioning of mechanisms, etc.) by means of any electromagnetic system (electrical transmission by wire, radio transmission, optical transmission, etc., or a combination of such systems).

01.01

0003 **call**

F: appel

S: llamada

In an automatic system, the action performed by a calling party in order to obtain the called party and by extension, the operations necessary in making a call.

16.01 b)

0004 **call**

F: communication

S: comunicación

The setting-up of a connection between two stations.

17.15

0006 **channel**

F: voie de transmission

S: canal de transmisión

A means of one-way transmission.

Several channels may share a common path as in carrier systems; in this case each channel is allotted a particular frequency band which is reserved to it.

Note – See also 32.01 for telegraph channel in Recommendation R.140 [9].

02.02

channel

F: voie

S: canal de transmisión

A means of unidirectional communication.

Note – Several channels may share a common carrier as in frequency division and time division systems; in these cases, each channel is allocated a particular frequency band or a particular time slot which is reserved for it.

714.00.05

0010 **connection** (in telecommunication)

F: connexion

S: conexión

An association of channels and other functional units providing means for the transfer of information between two or more terminal points.

Note 1 – A connection is the result of a switching operation.

Note 2 – A connection which allows an end-to-end communication, e.g. a conversation, may be called a "complete connection".

Note 3 – The connection makes a communication possible but is not a communication.

714.00.10

0012 **(telecommunication) circuit**

F: voie de communication; circuit (de télécommunication)

S: circuito (de telecomunicaciones)

A means of both-way communication between two points, comprising associated "go" and "return" *channels.*

Note – See also 32.02 for telegraph circuit in Recommendation R.140 [9].

02.03

telecommunication circuit

F: circuit de télécommunication

S: circuito de telecomunicaciones

A means of bidirectional communication between two points comprising associated "go" and "return" channels.

Note – The "go" and "return" channels:

a) may be permanently associated together,

b) may be selected from separate sets for association together throughout a call,

c) may be selected from time to time during a call and then released, the selecting and releasing processes being determined, separately in the two directions, by the varying characteristics of the information being transmitted over the circuit.

714.00.06

0014 **circuit**

F: circuit

S: circuito

A pair of complementary channels with associated equipments terminating in two exchanges. A "pair of complementary channels" is defined as: two channels, one in each direction, which provide bidirectional communication.

Study Group II 14.14 and 14.12

0015 **telephone circuit**

F: circuit téléphonique

S: circuito telefónico

A permanent electrical connection permitting the establishment of a telephone communication in both directions between two telephone exchanges.

02.06

0016 **hypothetical reference circuit (nominal maximum circuit)**

F: circuit fictif de référence

S: circuito ficticio de referencia

A hypothetical circuit having a defined length and a defined amount of terminal and intermediate equipment, these quantities being reasonably large but not extreme. Such a conception is of value in the study of certain characteristics (noise, for example) of long-distance circuits.

02.08

0019 **(electric) circuit**

F: circuit (électrique)

S: circuito (eléctrico)

A region of electrical action where such action takes place essentially along a path and can be uniquely specified in terms of time and a single dimension.

Note – In contradistinction, an "electric field" implies action which can only be specified uniquely in terms of time and two or three dimensions.

02.01 a)

0020 **... circuit** (specific function)

F: circuit de ...

S: circuito de ...

Part of an installation forming (or able to form part of) an electric circuit traversed by a current having a definite function, specified in each case, (example: calling, speaking, feeding, etc. ...).

02.01 b)

0022 **circuit group**

F: faisceau de circuits

S: haz de circuitos

A group of circuits which are traffic-engineered as a unit.

Study Group II 14.20

0023 **circuit sub-group**

F: sous-faisceau de circuits

S: subhaz de circuitos

A number of circuits with similar characteristics (e.g. type of signalling, type of transmission path, etc.).

It is not engineered as a unit, but as a part of a circuit group. Circuit sub-groups are provided for reasons of service, protection, equipment limitation, maintenance, etc.

Study Group II 14.18

0026 **path**

F: itinéraire

S: trayecto

The implementation of a means of transmission.

Note 1 – This may be a physical transmission means, a frequency band in a frequency multiplex, a time slot in a time division multiplex, etc.

Note 2 – The path includes the channels used for the transmission and the means used for connecting them together.

714.00.08

0031 **link**

F: liaison

S: enlace

A communication path of specified character between two points.

714.00.09

0050 **subscriber's line**

F: ligne d'abonné

S: línea de abonado

The telephone line connecting the exchange to the subscriber's station.

13.24

0060 **process (in a data processing system)**

F: processus (dans un traitement de l'information)

S: proceso (en un sistema de proceso de datos)

A course of events occurring according to an intended purpose or effect.

(10.01.03 in ISO/TC97/SC1/515, Nov. 75)

0063 **bidirectional**

F: bidirectionnel

S: bidireccional

A qualification which implies that the transmission of information occurs in both directions.

Study Group II 14.04

0064 **unidirectional**

F: unidirectionnel

S: unidireccional

A qualification which implies that the transmission of information always occurs in one direction.

Study Group II 14.02

0066 **space division**

F: répartition dans l'espace

S: división en el espacio

The separation in the space domain of a plurality of transmission channels between two points.

714.00.13

0067 **time division**

F: répartition dans le temps, répartition temporelle

S: división en el tiempo

The separation in the time domain of a plurality of transmission channels between two points.

714.00.14

0068 **frequency division**

F: répartition en fréquence

S: división de frecuencia

The separation in the frequency domain of a plurality of transmission channels between two points.

0069 **code division**

F: répartition en code

S: división en código

The separation of a plurality of transmission channels by using specific values of codes belonging to the same set.

0105 **functional unit**

F: unité fonctionnelle

S: unidad funcional

An entity of hardware or software, or both, capable of accomplishing a special purpose.

ISO 10.01.01

0108 **traffic-carrying device**

F: organe de trafic

S: dispositivo de transmisión de tráfico

Functional unit used directly or indirectly during the establishment and sustaining of a connection.

714.00.11

0112 **(network) resource(s)**

F: ressource(s) (du réseau)

S: recurso(s) (de la red) (órgano de la red)

Means of supplying a want or a stock that can be drawn on. In context with the telecommunication network, in particular devices for sending recorded announcements, traffic service positions, network integrated data banks, etc.

0115 **software**

F: logiciel

S: soporte lógico

Computer programs, procedures, rules and any associated documentation concerned with the operation of a system.

714.61.01 (ISO 01.04.05 mod.)

0120 **processor**

F: processeur

S: procesador (unidad de proceso)

A device capable of performing systematic execution of operations upon data.

0122 **administrative processor**

F: processeur de gestion

S: procesador de gestión

A centralized *processor* for administrative purposes, e.g. billing, which serves several switching centres.

0124 **operation and maintenance centre processor**

F: processeur de centre d'exploitation et de maintenance

S: procesador de centro de explotación y mantenimiento

A centralized *processor* for operation and maintenance purposes which serves one or more switching centres.

0205 **seizure**

F: prise

S: toma

A successful bid.

With "bid": a single attempt to obtain the service of a resource.

Study Group II 11.08 and 11.06

0208 **busy**

F: occupation

S: ocupado

Condition of a resource which is in use, following its seizure.

Study Group II 11.20

0209 **engaged test** (UK); **busy test** (USA)

F: test d'occupation

S: prueba de ocupación

An engaged test is a test made to find out whether or not certain facilities which may be desired, such as a subscriber's line or trunk, are available for use.

17.66

busy test

F: test d'occupation

S: prueba de ocupación

A procedure for determining whether a traffic carrying device is free and available for use.

714.13.16

0212 **release**

F: libération

S: liberación

The event which is the end of a busy state.

Study Group II 11.22

0215 **one-way**

F: à sens unique

S: en un solo sentido

A qualification applying to traffic which implies that the call set-ups always occur in one direction.

Study Group II 14.06

0216 **both-way**

F: à double sens

S: en ambos sentidos

A qualification applying to traffic which implies that the call set-ups occur in both directions.

Note – The amount of traffic flowing in the two directions is not necessarily equal either in the short term or in the long term.

Study Group II 14.08

1 Switching functions and techniques

1001 **exchange (switching exchange, switching centre)**

F: centre – central (centre ou central de commutation)

S: central (central de conmutación, centro de conmutación)

An aggregate of traffic carrying devices, switching stages, controlling and signalling means at a network node that enables subscriber lines and/or other telecommunication circuits to be interconnected as required by individual callers. (See Figure 1/Q.9.)

1002 **local exchange** [local central office]

F: central urbain

S: central local

An exchange in which subscribers' lines terminate. (See Figure 1/Q.9.)

15.02

1004 **transit exchange** [tandem exchange, tandem central office, tandem office]

F: centre de transit

S: central de tránsito

An exchange used primarily as a switching point for traffic between other exchanges. (See Figure 1/Q.9.)

15.04

1005 **combined local/transit exchange**

F: centre mixte urbain et de transit

S: central combinada local/de tránsito

An exchange in which subscribers' lines terminate that also is used as a switching point for traffic between other exchanges. (See Figure 1/Q.9.)

1007 **geographically distributed exchange** [geographically dispersed exchange]

F: centre géographiquement dispersé

S: central geográficamente distribuida

An exchange where not all sub-systems such as switching stages and control means are at the same location. (See Figure 1/Q.9.)

1008 **remotely controlled exchange**

F: centre télécommandé

S: central controlada a distancia (central telecontrolada)

An exchange whose switching functions are wholly or partially controlled by a control unit or a processor in another location. (See Figure 1/Q.9.)

1010 **digital exchange**

F: centre numérique

S: central digital

An exchange that switches information in digital form through its switching devices.

1011 **integrated services exchange**

F: central avec intégration des services

S: central de servicios integrados

An exchange arranged to handle multiple services such as telephone and data using all or part of the switching, signalling and control devices in common.

1013 **satellite exchange**

F: centre satellite

S: central satélite

A local exchange on a low level of the network hierarchy which is associated to another exchange and with no route switching functions except those towards the associated higher level local exchange. A satellite exchange has normally the capability to connect locally subscribers' lines terminating in it. (See Figure 1/Q.9.)

1015 **switching stage**

F: étage de commutation

S: etapa de conmutación

An aggregate of switching devices constituting a subset of the switching network in an exchange and designed to operate as a single unit from a traffic handling point of view. (See Figure 1/Q.9.)

1016 **remote switching stage**

F: étage de commutation distant

S: etapa de conmutación distante

A switching stage associated with and controlled by an exchange in a different location. (See Figure 1/Q.9.)

1018 **exchange concentrator**

F: concentrateur de central

S: concentrador de central

A switching stage wherein a number of subscriber lines or inter-exchange circuits carrying relatively low traffic volumes can be through-connected to a few number of circuits carrying higher traffic volumes. (See Figure 1/Q.9.)

1019 **co-located exchange concentrator**

F: concentrateur de central local

S: concentrador de central local

A concentrator in the same location as the exchange that controls it and to which its higher traffic volume circuits are connected. (See Figure 1/Q.9.)

1020 **remote exchange concentrator**

F: concentrateur de central distant

S: concentrador de central distante

A concentrator located remotely from the exchange that controls it and to which its higher traffic volume circuits are connected. The switching stages comprised normally have no capability to directly interconnect subscriber lines terminating in that concentrator. (See Figure 1/Q.9.)

1025 **line concentrator (stand alone concentrator)**

F: concentrateur de lignes (concentrateur autonome)

S: concentrador de líneas (concentrador independiente)

A switching device which concentrates traffic from a number of circuits or subscribers' lines onto a smaller number of circuits to a parent local exchange, where a similar switching device deconcentrates the traffic to the original number of lines. In the case of subscribers' lines, the correspondence of the lines before concentration and after deconcentration must be maintained. The system is both-way working, i.e., traffic from the exchange is concentrated onto the same circuits and deconcentrated to the subscribers as well. (See Figure 1/Q.9.)

1030 **semi-automatic system**

F: système semi-automatique

S: sistema semiautomático

A system in which the calling subscriber's order is given to an operator who completes the call through automatic switches.

16.19

1031 **automatic system**

F: système automatique

S: sistema automático

A system in which the *switching* operations are performed by electrically controlled devices without the intervention of operators.

16.20

1105 **inlet**

F: accès d'arrivée

S: entrada (en conmutación); acceso de entrada

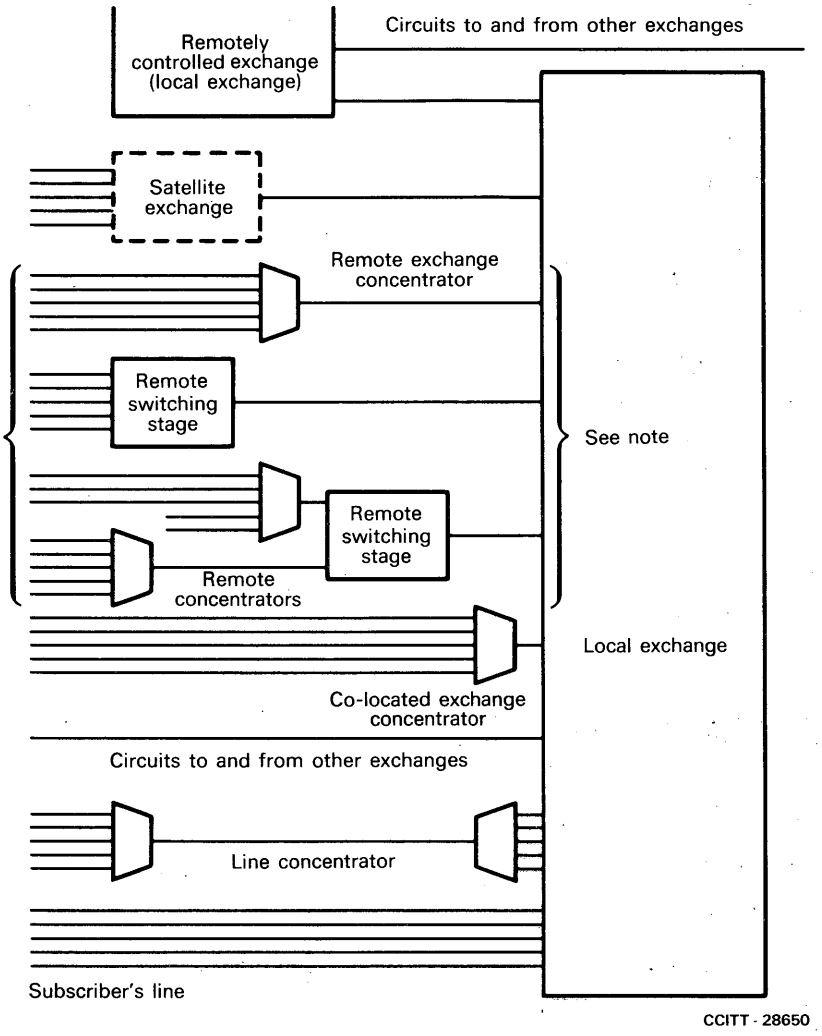
Point through which the incoming traffic flow enters a switching stage.

1106 **outlet**

F: accès de départ

S: salida (de conmutación); acceso de salida

Point through which the outgoing traffic flow leaves a switching stage.



Note – The brackets comprise the component parts of a geographically distributed exchange.

FIGURE 1/Q.9

Exchange and related terms

1110 **switching**

F: commutation

S: conmutación

(1) The establishing, on demand, of an individual connection from a desired inlet to a desired outlet within a set of inlets and outlets for as long as is required for the transfer of information.

(2) A qualification implying the action as defined above, e.g.:

switching centre
switching delay
switching device
switching equipment
switching exchange
switching matrix
switching network
switching node
switching point
switching system
switching unit

1111 **switching node**

F: nœud de commutation

S: nodo de conmutación

An interstitial point in a network where interconnection of required inlets and outlets may be undertaken.

1112 **switching network**

F: réseau de commutation

S: red de conexión

The switching stages of a telecommunication exchange taken collectively.

1113 **switching matrix**

F: matrice de commutation

S: matriz de conmutación

An array of crosspoints in a space division exchange which, from a traffic point of view, operates as a switch.

1115 **selection stage**

F: étage de sélection

S: etapa de selección

An aggregate of switches enabling an inlet to access one of a plurality of outlets and designed to operate as a single unit from a traffic handling point of view.

1117 **concentration** (in a switching stage)

F: concentration

S: concentración

A configuration wherein the number of inlets into the switching stage is larger than the number of outlets.

1118 **expansion** (in a switching stage)

F: expansion

S: expansión

A configuration wherein the number of inlets into the switching stage is smaller than the number of outlets.

1120 **digital switching**

F: commutation numérique

S: conmutación digital

A process in which connections are established by operations on digital signals without converting them to analogue signals.

G.702.9010

1122 **digital circuit**

F: circuit numérique

S: circuito digital

A circuit which transmits information signals in digital form between two exchanges. It includes termination equipment but not switching stages.

1125 **circuit switching**

F: commutation de circuits

S: conmutación de circuitos

The switching of circuits for the exclusive use of the connection for the duration of a call.

1126 **space division switching**

F: commutation par répartition dans l'espace (commutation spatiale)

S: conmutación por división en el espacio; conmutación espacial

The switching of inlets to outlets using space division techniques.

1127 **time division switching**

F: commutation par répartition dans le temps (commutation temporelle)

S: conmutación por división en el tiempo; conmutación temporal

The switching of inlets to outlets using time division (multiplexing) techniques.

1128 **frequency division switching**

F: commutation par répartition en fréquence

S: conmutación por división de frecuencia

The switching of inlets to outlets using frequency division (multiplexing) techniques.

1129 **channel switching**

F: commutation de voies

S: conmutación de canales

The switching of single channels for the exclusive use of the connection for the duration of a call.

1130 **message switching**

F: commutation de messages

S: conmutación de mensajes

The transfer of stored messages so as to minimize queue and idle times of traffic carrying devices.

1135 **digital connection**

F: connexion numérique

S: conexión digital

An association of digital circuits, digital switches and other functional units providing means for the transfer of digitally encoded information signals between two terminal points.

1136 **multislot connection**

F: connexion à intervalles de temps multiples

S: conexión multiintervalo

Time slots associated with two or more digital circuits switched in parallel through a digital exchange for use on the same call to provide a wideband service.

1137 **trombone (loop) connection**

F: connexion en boucle

S: conexión en bucle

The use for a single call of two circuits in tandem between a remote switching stage and its controlling entity.

1138 **semi-permanent connection**

F: connexion semi-permanente

S: conexión semipermanente

A connection established part-time for the use of one user. At other times the connection may be released and available for use in handling traffic of the switched network.

1140 **two-wire switching**

F: commutation à deux fils

S: conmutación a dos hilos

Switching using the same path, frequency band or time interval for both directions of transmission.

1141 **four-wire switching**

F: commutation à quatre fils

S: conmutación a cuatro hilos

Switching using a separate path, frequency band or time interval for each direction of transmission.

1146 **reentrant trunking**

F: jonction réentrante

S: enlace reentrante

The routing of a circuit from outlet to inlet in a switching stage in order to access equipment associated with special services such as operators, auxiliary equipment, etc.

Note – Not to be confused with the action of mutual help where the purpose of re-entering the call is to attempt to reduce the probability of switching congestion on a given call by allowing a new possibility of choice of path from the new inlet to a trunk in the desired route.

1149 **multiple**

F: multiplage

S: múltiple

Interconnection of several inlets or outlets in a switching stage to the same traffic carrying device (e.g. other switching stage or circuit).

1205 **crossbar system**

F: système automatique "crossbar"

S: sistema de barras cruzadas

An automatic switching system in which the selecting mechanisms are *crossbar switches.*

16.26

1206 **junctor** (in the crossbar system)

F: joncteur

S: conector

In crossbar systems, a junctor is a circuit extending between frames of a switching unit and terminating in a switching device on each frame.

15.68

1207 **link** (in the crossbar system)

F: maillon

S: enlace; conexión interna

A link is a circuit extending between the primary and secondary selectors of a selection stage.

15.69

1210 **register**

F: enregistreur

S: registrador

The apparatus, in an automatic system, which receives the dialled impulses and controls the subsequent switching operations.

15.56

1212 **translation**

F: traduction

S: traducción

In automatic telephony: the retransmission of received trains of impulses after changing the number of impulses in each train and/or changing the number of trains.

15.58

1213 **translator**

F: traducteur

S: traductor

In automatic telephony: a device used for the *translation* of trains of impulses.

15.57

1305 **(time division) highway (in switching); bus** (USA)

F: canal (à multiplexage dans le temps)

S: canal principal (por división en el tiempo) (en conmutación)

A common path within an apparatus or station over which signals from a plurality of channels pass, separated by time division.

G.702.3001

1310 **character signal**

F: signal de caractère

S: señal de carácter

A set of signal elements representing a character, or in PCM representing the quantized value of a sample.

Note – In PCM, the term "PCM word" may be used in this sense.

G.702.2010

1315 **cross-exchange check (cross-office)**

F: vérification du trajet dans le central

S: verificación a través de la central

A check made across the exchange to verify that a speech path exists.

1318 **in-call**

F: communication en cours

S: en comunicación

A call in progress, initial switching at a given exchange having been completed.

1319 **in-call rearrangement**

F: remaniement des liaisons pendant la communication

S: reestructuración en comunicación

Reassignment of the switched path of an in-call during the call.

1330 **channel gate**

F: porte de voie

S: puerta de canal

A device for connecting a channel to a highway, or a highway to a channel, at specified times.

G.702.3002

1331 **primary block; digroup** (USA)

F: bloc primaire

S: bloque primario

A basic group of PCM channels assembled by time division multiplexing.

Note – The following conventions could be useful:

Primary block μ – a basic group of PCM channels derived from 1544 kbit/s PCM multiplex equipment.

Primary block A – a basic group of PCM channels derived from 2048 kbit/s PCM multiplex equipment.

G.702.3003

1332 **frame**

F: trame

S: trama

A set of consecutive digit time slots in which the position of each digit time slot can be identified by reference to a frame alignment signal.

The frame alignment signal does not necessarily occur, in whole or in part, in each frame.

G.702.3004

1333 **multiframe**

F: multitrame

S: multitrama

A set of consecutive frames in which the position of each frame can be identified by reference to a multiframe alignment signal.

The multiframe alignment signal does not necessarily occur, in whole or in part, in each multiframe.

G.702.3005

1334 **subframe**

F: secteur de trame – sous-trame

S: subtrama

A sequence of noncontiguous sets of digits assembled within a frame, each set occurring at n times the frame repetition rate where n is an integer > 1.

G.702.3006

1335 **parallel to serial converter; serializer** (USA) **[dynamicizer]**

F: convertisseur parallèle/série

S: convertidor paralelo/serie

A device that converts a group of digits, all of which are presented simultaneously, into a corresponding sequence of signal elements.

G.702.3007

1336 **serial to parallel converter; deserializer** (USA) **[staticizer]**

F: convertisseur série/parallèle

S: convertidor serie/paralelo

A device which converts a sequence of signal elements into a corresponding group of digits, all of which are presented simultaneously.

G.702.3008

1405 **frame alignment**

F: verrouillage de trame

S: alineación de trama

The state in which the frame of the receiving equipment is correctly phased with respect to that of the received signal.

G.702.4001

1406 **frame alignment signal**

F: signal de verrouillage de trame

S: señal de alineación de trama

The distinctive signal used to secure frame alignment; this signal does not necessarily occur, in whole or in part, in each frame.

G.702.4002

1407 **bunched frame alignment signal**

F: signal de verrouillage de trame concentré

S: señal de alineación de trama concentrada

A frame alignment signal in which the signal elements occupy consecutive digit time slots.

G.702.4003

1408 **distributed frame alignment signal**

F: signal de verrouillage de trame réparti

S: señal de alineación de trama distribuida

A frame alignment signal in which the signal elements occupy non-consecutive digit time slots.

G.702.4004

1409 **frame alignment recovery time**

F: temps de reprise du verrouillage de trame

S: tiempo de recuperación de la alineación de trama

The time that elapses between a valid frame alignment signal being available at the receive terminal equipment and frame alignment being established.

Note – The frame alignment recovery time includes the time required for replicated verification of the validity of the frame alignment signal.

G.702.4005

1410 **out-of-frame alignment time**

F: durée de perte du verrouillage de trame

S: duración de la pérdida de alineación de trama

The time during which frame alignment is effectively lost. That time will include the time to detect loss of frame alignment and the alignment recovery time.

G.702.4006

1414 **time slot**

F: intervalle de temps

S: intervalo de tiempo

Any cyclic time interval that can be recognized and defined uniquely.

G.702.5004

1415 **channel time slot**

F: intervalle de temps de voie

S: intervalo de tiempo de canal

A time slot starting at a particular phase in a frame and allocated to a channel for transmitting a character signal and possibly in-slot signalling or other information.

Note – Where appropriate a description may be added, for example "telephone channel time slot".

G.702.5005

1416 **signalling time slot**

F: intervalle de temps de signalisation

S: intervalo de tiempo de señalización

A time slot starting at a particular phase in each frame and allocated to the transmission of signalling.

G.702.5006

1417 **frame alignment time slot**

F: intervalle de temps de verrouillage de trame

S: intervalo de tiempo de alineación de trama

A time slot starting at a particular phase in each frame and allocated to the transmission of a frame alignment signal.

G.702.5007

1418 **digit time slot**

F: intervalle de temps pour élément numérique

S: intervalo de tiempo de dígito

A time slot allocated to a single digit.

G.702.5008

1420 **time slot sequence integrity**

F: intégrité de la séquence des intervalles de temps

S: integridad de la secuencia de intervalos de tiempo

The assurance that the digital information contained in the *n* time slots of a multislot connection arrives at the output (or terminal) in the same sequence as it was introduced.

1422 **time slot interchange**

F: échange entre intervalles de temps

S: intercambio de intervalos de tiempo

The transfer of information from one time slot to another between incoming and outgoing time division highways.

1425 **retiming**

F: réajustement du rythme

S: reajuste de la temporización

Adjustment of the intervals between corresponding significant instants of a digital signal, by reference to a timing signal.

G.702.5009

1426 **timing recovery (timing extraction)**

F: récupération du rythme

S: recuperación de la temporización; (extracción de la temporización)

The derivation of a timing signal from a received signal.

G.702.5010

1428 **isochronous**

F: isochrone

S: isócrono

A signal [1] is isochronous if the time interval separating any two significant instants is theoretically equal to the unit interval or to a multiple of the unit interval.

Note – In practice, variations in the time intervals are constrained within specified limits.

G.702.5011

1429 **anisochronous**

F: anisochrone

S: anisócrono

A signal [1] is anisochronous if the time interval separating any two significant instants is not necessarily related to the time interval separating any other two significant instants.

G.702.5012

1430 **synchronous**

F: synchrone

S: síncrono

Signals [1] are synchronous if their corresponding significant instants have a desired phase relationship with each other.

G.702.5013

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[1] In the definitions, "signal" is taken with the general meaning of Definition 02.27. For information, Definition 02.27 is reproduced below:

02.27 **signal** (general sense)

Aggregate of waves propagated along a transmission channel and intended to act on a receiving unit.

1431 **synchronization**

F: synchronisation

S: sincronización

The process of adjusting the corresponding significant instants of signals [1] to make them synchronous.

G.702.5014

1432 **homochronous**

F: homochrone

S: homócrono

Signals [1] are homochronous if their corresponding significant instants have a constant, but uncontrolled, phase relationship with each other.

G.702.5015

1433 **mesochronous**

F: mésochrone

S: mesócrono

Signals [1] are mesochronous if their corresponding significant instants occur at the same average rate.

Note – The phase relationship between corresponding significant instants usually varies between specified limits.

G.702.5016

1434 **plesiochronous**

F: plésiochrone

S: plesiócrono

Signals [1] are plesiochronous if their corresponding significant instants occur at nominally the same rate, any variation in rate being constrained within specified limits.

Note 1 – Two signals having the same nominal digit rate, but not stemming from the same clock [2] or homochronous clocks, are usually plesiochronous.

Note 2 – There is no limit to the phase relationship between corresponding significant instants.

G.702.5017

1435 **heterochronous**

F: hétérochrone

S: heterócrono

Signals [1] are heterochronous if their corresponding significant instants do not necessarily occur at the same rate.

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[1] In the definitions, "signal" is taken with the general meaning of Definition 02.27. For information, Definition 02.27 is reproduced below:

02.27 **signal** (general sense)

Aggregate of waves propagated along a transmission channel and intended to act on a receiving unit.

[2] In these definitions "clock" is taken with the general meaning of Definition 51.10 and it is assumed that where replicated sources are used for security reasons, the assembly of these is regarded as being a single clock.

For information, Definition 51.10 is reproduced below:

51.10 **clock**

Equipment providing a time base used in a transmission system to control the timing of certain functions such as the control of the duration of signal elements, the sampling, etc.

Note 1 – Two signals having different nominal digit rates, and not stemming from the same clock or from homochronous clocks [2] are usually heterochronous.

Note 2 – Terms 1428 to 1435 are based on the following Greek roots:

iso = equal
syn = together
homo = same
meso = middle
plesio = near
hetero = different

1438 **unilateral control**

F: commande unilatérale

S: control unilateral

Control between two synchronization nodes such that the frequency of the clock [2] of only one of these nodes is influenced by timing information derived from the clock of the other node.

G.702.9013

1439 **bilateral control**

F: commande bilatérale

S: control bilateral

Control between two synchronization nodes such that the frequency of the clock [2] of each of these nodes is influenced by timing information derived from the clock of the other node.

G.702.9014

1440 **single-ended synchronization**

F: synchronisation unilatérale

S: sincronización uniterminal

A method of synchronizing a specified synchronization node with respect to another synchronization node in which synchronization information at the specified node is derived from the phase difference between the local clock [2] and the incoming digital signal from the other node.

G.702.9015

1441 **double-ended synchronization**

F: synchronisation bilatérale

S: sincronización bilateral

A method of synchronizing a specified synchronization node with respect to another synchronization node in which synchronization information at the specified node is derived by comparing the phase difference between the local clock [2] and the incoming digital signal from the other node, with the phase difference at the other node between its local clock and the digital signal incoming from the specified node.

G.702.9016

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[2] In these definitions "clock" is taken with the general meaning of Definition 51.10 and it is assumed that where replicated sources are used for security reasons, the assembly of these is regarded as being a single clock.

For information, Definition 51.10 is reproduced below:

51.10 **clock**

Equipment providing a time base used in a transmission system to control the timing of certain functions such as the control of the duration of signal elements, the sampling, etc.

1442 **analogue control**

F: mode analogique

S: control analógico

Synchronization control in which the relationship between the actual phase error between clocks [2] and the error signal device is a continuous function, at least over a limited range.

G.702.9017

1443 **amplitude quantized control**

F: mode à quantification d'amplitude

S: control por cuantificación de amplitud

Synchronization control in which the functional relationship between actual phase error and derived error signal includes discontinuities.

Note – In practice this implies that the working range of phase errors is divided into a finite number of subranges and that a unique signal is derived for each subrange whenever the error falls within a subrange.

G.702.9019

1444 **time quantized control**

F: mode à quantification temporelle

S: control por cuantificación temporal

Synchronization control in which the error signal is derived or utilized only at a number of discrete instants which may or may not be equally spaced in time.

G.702.9020

1446 **synchronized network [synchronous network]**

F: réseau synchronisé [réseau synchrone]

S: red sincronizada [red síncrona]

A network in which the corresponding significant instants of nominated signals are adjusted to make them synchronous.

Note – Ideally the signals are synchronous, but they may be mesochronous in practice. By common usage such mesochronous networks are frequently described as synchronized.

G.702.9021

1447 **nonsynchronized network**

F: réseau non synchronisé

S: red no sincronizada

A network in which the corresponding significant instants of signals need not be synchronized or mesochronous.

G.702.9022

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[2] In these definitions "clock" is taken with the general meaning of Definition 51.10 and it is assumed that where replicated sources are used for security reasons, the assembly of these is regarded as being a single clock.

For information, Definition 51.10 is reproduced below:

51.10 **clock**

Equipment providing a time base used in a transmission system to control the timing of certain functions such as the control of the duration of signal elements, the sampling, etc.

1448 **mutually synchronized network**

F: réseau à synchronisation mutuelle

S: red mutuamente sincronizada

A synchronized network in which each clock [2] exerts a degree of control on all others.

G.702.9023

1449 **democratic (mutually synchronized) network**

F: réseau démocratique (à synchronisation mutuelle)

S: red democrática (mutuamente sincronizada)

A mutually synchronized network in which all clocks [2] in the network are of equal status and exert equal amounts of control on the others, the network operating frequency (digit rate) being the mean of the natural (uncontrolled) frequencies of the population of clocks.

G.702.9024

1450 **hierarchic (mutually synchronized) network**

F: réseau hiérarchisé (à synchronisation mutuelle)

S: red jerárquica (mutuamente sincronizada)

A mutually synchronized system in which some clocks [2] exert more control than others, the network operating frequency being a weighted mean of the natural frequencies of the population of clocks.

G.702.9025

1451 **despotic (synchronized) network**

F: réseau (à synchronisation) despotique

S: red despótica (sincronizada)

A synchronized network in which a unique master clock [2] exists with full power of control of all other clocks.

G.702.9026

1452 **oligarchic (synchronized) network**

F: réseau (à synchronisation) oligarchique

S: red oligárquica (sincronizada)

A synchronized network in which control is exercised by a few selected clocks [2], the remainder being controlled by these.

G.702.9027

1505 **transmission delay (through a digital exchange)**

F: temps de transmission (dans un central numérique)

S: tiempo de transmisión (a través de una central digital)

The sum of the times necessary for an octet to pass in both directions on a connection through a digital exchange due to buffering, frame alignment and time-slot interchange functions for digital-to-digital connections and in addition, for analogue-to-analogue connections, to the A/D conversions.

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[2] In these definitions "clock" is taken with the general meaning of Definition 51.10 and it is assumed that where replicated sources are used for security reasons, the assembly of these is regarded as being a single clock.

For information, Definition 51.10 is reproduced below:

51.10 **clock**

Equipment providing a time base used in a transmission system to control the timing of certain functions such as the control of the duration of signal elements, the sampling, etc.

1506 **switching delay (processing (handling) time)**

F: temps de commutation (temps de traitement)

S: tiempo de conmutación (tiempo de proceso (tratamiento))

The interval of time attributable to the functions performed in a switching exchange in the process of setting up a call.

1507 **incoming response delay**

F: temps de réponse à la prise d'un circuit d'arrivée

S: duración de la preselección

A characteristic that is applicable where channel associated signalling is used. It is defined as the interval from the instant an incoming circuit seizure signal is recognized until a proceed-to-send signal is sent backwards by the exchange.

1508 **exchange call set-up delay**

F: temps d'établissement de la communication dans le central

S: tiempo de establecimiento de la comunicación por una central

The interval from the instant when the digits required for setting up a call are available in the exchange or the address information is received at the incoming signalling data transmission control of the exchange to the instant when the seizing signal is sent to the subsequent exchange or the corresponding address information is sent from the outgoing signalling data transmission control.

1510 **through-connection delay**

F: temps de transfert

S: tiempo de transferencia de la central

The interval from the instant at which the information required for setting up a through-connection in an exchange is available for processing in the exchange to the instant that the switching network through-connection is established and available for carrying traffic between the incoming and outgoing 64-kbit/s circuits.

1512 **exchange call-release delay**

F: temps de libération de la communication par le central

S: tiempo de liberación de la comunicación por una central

Exchange call release delay is the interval from the instant at which the last information required for releasing a call in an exchange is available for processing in the exchange to the instant that the switching network through-connection is no longer available between the incoming and outgoing 64-kbit/s circuits and the disconnection signal is sent to the subsequent exchange. This interval does not include the time taken to detect the release signal, which might become significant during certain failure conditions, e.g. transmission system failures.

1514 **post dialling delay**

F: délai d'attente après numérotation

S: periodo de espera después de marcar

Time interval between the end of dialling by the subscriber and the reception by him of the appropriate tone or recorded announcement, or the abandon of the call without tone.

1801 **digital section**

F: section numérique

S: sección digital

The whole of the means of transmitting and receiving between two consecutive digital distribution frames (or equivalent) a digital signal of specified rate (see Figure 2/Q.9).

Note 1 – A digital section forms either a part or the whole of a digital path.

Note 2 – Where appropriate, the bit rate should qualify the title.

Note 3 – The description always applies to the combination of "go" and "return" directions of transmission, unless stated otherwise.

G.702.9006

1802 **digital path**

F: conduit numérique

S: trayecto digital

The whole of the means of transmitting and receiving a digital signal of specified rate between those two digital distribution frames (or equivalent) at which terminal equipments or switches will be connected. Terminal equipments are those at which signals at the specified bit rate originate or terminate (see Figure 2/Q.9).

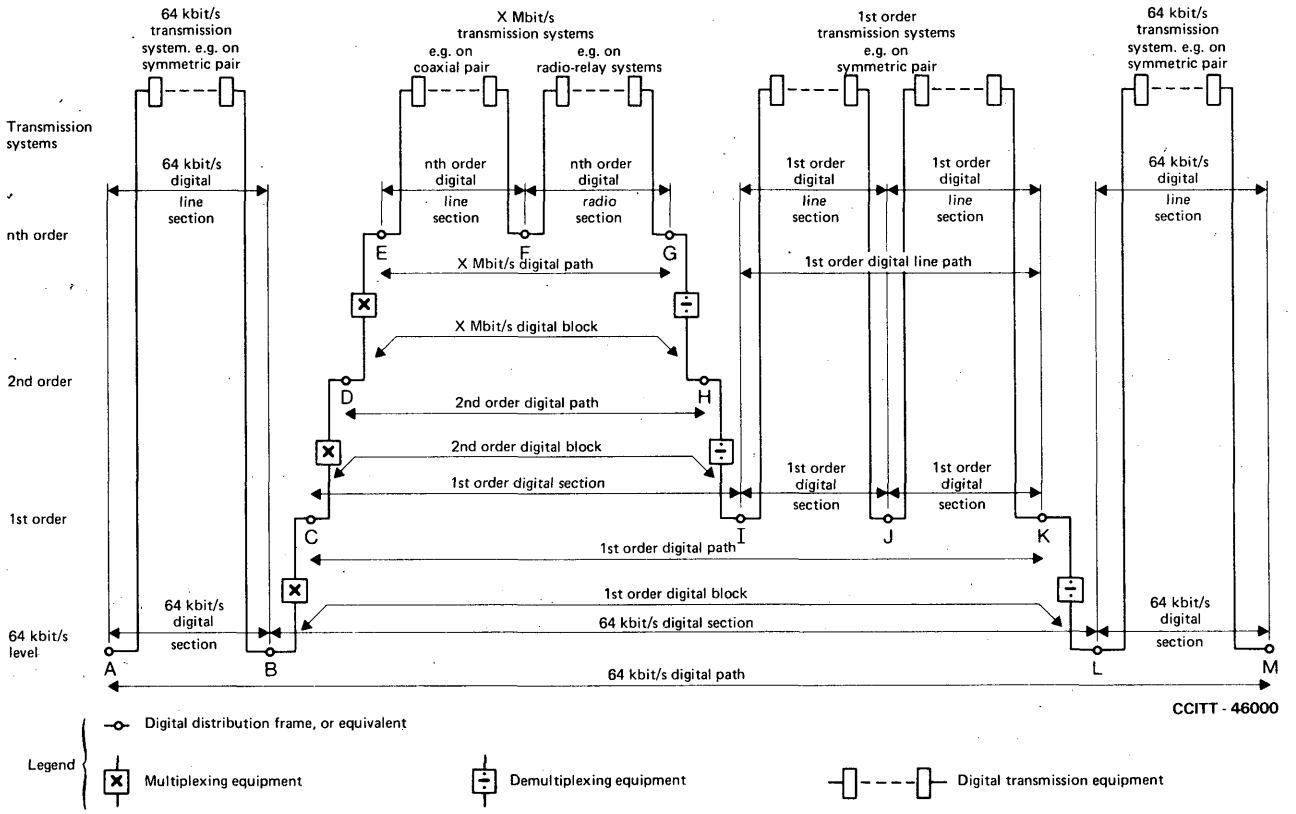
Note 1 – A digital path comprises one or more digital sections.

Note 2 – Where appropriate, the bit rate should qualify the title.

Note 3 – The description always applies to the combination of "go" and "return" directions of transmission, unless stated otherwise.

Note 4 – Digital paths interconnected by digital switches form a digital connection.

G.702.9007



Note 1 – Digital line and radio sections may be at digit rates which are either hierarchical or non-hierarchical.
Note 2 – A-B is a 64 kbit/s digital line section, which is a particular case of a 64 kbit/s digital section.
Note 3 – A-M is a 64 kbit/s digital path which comprises three 64 kbit/s digital sections, A-B, B-L and L-M.
Note 4 – F-G is an X Mbit/s digital radio section which forms part of an X Mbit/s digital path E-G.
Note 5 – C-I is a 1st order digital section which contains a 2nd order digital path D-H.
Note 6 – I-K is an example of a digital line path.

FIGURE 2/Q.9

Examples of digital path, digital section, digital line section, etc.

1803 **digital line section**

F: section de ligne numérique

S: sección de línea digital

Two consecutive line terminal equipments, their interconnecting transmission medium and the in-station cabling between them and their adjacent digital distribution frames (or equivalents), which together provide the whole of the means of transmitting and receiving between two consecutive digital distribution frames (or equivalents) a digital signal of specified rate (see Figure 2/Q.9).

Note 1 – Line terminal equipments may include the following:

- regenerators
- code converters
- scramblers
- remote power feeding
- fault location
- supervision.

Note 2 – A digital line section is a particular case of a digital section.

G.702.9028

1804 **digital block**

F: bloc numérique

S: bloque digital

The combination of a digital path and associated digital multiplex equipments (see Figure 2/Q.9).

Note – The bit rate of the digital path should form part of the title.

G.702.9030

2 Signalling functions and techniques

2001 **signalling**

F: signalisation

S: señalización

The exchange of electrical information (other than by speech) specifically concerned with the establishment and control of connections, and management, in a communication network.

G.702.6001

2004 **speech digit signalling**

F: signalisation par éléments numériques vocaux

S: señalización por dígitos de conversación

A type of channel-associated signalling in which digit time slots primarily used for the transmission of encoded speech are periodically used for signalling.

G.702.6002

2005 **in-slot signalling**

F: signalisation dans l'intervalle de temps

S: señalización dentro del intervalo

Signalling associated with a channel and transmitted in a digit time slot permanently (or periodically) allocated in the channel time slot.

G.702.6003

2006 **out-slot signalling**

F: signalisation hors intervalle de temps

S: señalización fuera del intervalo

Signalling associated with a channel but transmitted in one or more separate digit time slots not within the channel time slot.

G.702.6004

2008 **common channel signalling**

F: signalisation sur voie commune (signalisation par canal sémaphore)

S: señalización por canal común

A signalling technique in which signalling information relating to a multiplicity of circuits, and other information such as that used for network management, is conveyed over a single channel by addressed messages.

G.702.6005

2009 **channel associated signalling**

F: signalisation voie par voie

S: señalización asociada al canal

A signalling method in which the signals necessary for the traffic carried by a single channel are transmitted in the channel itself or in a signalling channel permanently dedicated to it.

2011 **in-band signalling**

F: signalisation dans la bande

S: señalización dentro de banda

A signalling method in which signals are sent over the same transmission channel or circuit as the user's communication and in the same frequency band as that provided for the users.

2012 **out-band signalling**

F: signalisation hors bande

S: señalización fuera de banda

A signalling method in which signals are sent over the same transmission channel or circuit as the user's communication but in a different frequency band from that provided for the users.

2014 **line signalling**

F: signalisation de ligne

S: señalización de línea

A signalling method in which signals are transmitted between equipments which terminate and continuously monitor part or all of the traffic circuit.

2015 **compelled signalling**

F: signalisation asservie

S: señalización de secuencia obligada

A signalling method in which, after one signal, or group of signals, has been sent, the sending of any further signals in the same direction is inhibited until the sent signal has been acknowledged in the opposite direction by the receiving terminal and the acknowledgement has been received.

2016 **register signalling** (signalling system R1)

F: signalisation entre enregistreurs

S: señalización entre registradores

Link-by-link multifrequency (MF) in-band pulse signalling is used for the transmission of address information. The signalling frequencies are 700 Hz to 1700 Hz, in 200 Hz steps, and combinations of two, and two only, determine the signal. The address information is preceded by a KP signal (start-of-pulsing) and terminated by an ST signal (end-of-pulsing). Either en bloc, or en bloc overlap, or overlap sending may apply. This register signalling arrangement is used extensively with other in-band and out-band line signalling systems.

2020 **signalling system**

F: système de signalisation

S: sistema de señalización

The procedures for the interpretation and use of a repertoire of signals together with the hardware and/or software needed for the generation, transmission, and reception of these signals.

2101 **message transfer part**

F: Sous-système Transport de Messages

S: parte de transferencia de mensajes

The functional part of a common channel signalling system which transfers signal messages as required by all the users, and which performs the necessary subsidiary functions, for example error control and signalling security.

2102 **user part**

F: Sous-système Utilisateur

S: parte de usuario

A functional part of the common channel signalling system which transfers signalling messages via the message transfer part. Different types of user parts exist (e.g. for telephone and data services), each of which is specific to a particular use of the signalling system.

2104 **signalling network**

F: réseau sémaphore

S: red de señalización

A network used for signalling and consisting of signalling points and connecting common channel signalling links.

2105 **signalling network management functions**

F: fonctions de gestion du réseau sémaphore

S: funciones de gestión de la red de señalización

Functions that, on the basis of predetermined data and information about the status of the signalling network, control the current message routing and configuration of signalling network facilities.

2106 **signalling point**

F: point sémaphore

S: punto de señalización

A node in a signalling network which either originates and receives signal messages, or transfers signal messages from one signalling link to another, or both.

2107 **(signalling) originating point**

F: point sémaphore d'origine

S: punto de origen (de la señalización)

A signalling point in which a message is generated.

2108 **signal transfer point**

F: point de transfert sémaphore

S: punto de transferencia de la señalización

A signalling point with the function of transferring signalling messages from one signalling link to another.

2109 **(signalling) destination point**

F: point sémaphore de destination

S: punto de destino (de la señalización)

A signalling point to which a message is destined.

2110 **adjacent signalling points**

F: points sémaphores adjacents

S: puntos de señalización adyacentes

Two signalling points that are directly interconnected by a signalling link(s).

2111 **signalling relation**

F: relation sémaphore

S: relación de señalización

A relation formed by two signalling points involving the possibility of information interchange between corresponding user part functions.

2112 **signalling route**

F: route sémaphore

S: ruta de señalización

A predetermined path described by a succession of signalling points that may be transversed by signalling messages directed by a signalling point towards a specific destination point.

2113 **signalling route set**

F: faisceau de routes sémaphores

S: conjunto de rutas de señalización

The combination of all the permitted signalling routes that may be used to pass signalling messages from a signalling point to a specific destination.

2114 **signalling routing**

F: acheminement de la signalisation

S: encaminamiento de señalización

Procedures for directing the choice and allocation of signalling paths.

2116 **data channel**

F: voie de données

S: canal de datos

A unidirectional transmission path for data, with transmission terminal equipment at both ends.

2117 **data link**

F: liaison de données

S: enlace de datos

This is an ensemble of terminal installations and the interconnecting network operating in a particular mode that permits information to be exchanged between terminal installations.

A bidirectional transmission path for data, comprising two data channels in opposite directions which operate together at the same data rate.

2118 **signalling link**

F: canal sémaphore (liaison de signalisation)

S: enlace de señalización

A transmission means which consists of a signalling data link and its transfer control functions, used for reliable transfer of signalling messages.

2119 **signalling link set**

F: faisceau de canaux sémaphores (faisceau de liaisons de signalisation)

S: conjunto de enlaces de señalización

A set of signalling link(s) directly connecting two signalling points.

2120 **regular signalling link**

F: canal sémaphore normal (liaison de signalisation régulière)

S: enlace de señalización regular

The signalling link which normally carries some particular parcel of signalling traffic.

2121 **reserve signalling link**

F: canal sémaphore de secours (liaison de signalisation de réserve)

S: enlace de señalización de reserva

The signalling link which can be used to carry all, or part of, the signalling traffic of a regular signalling link when the latter has failed or has been withdrawn from service.

2122 **signalling channel** (Signalling System No. 6)

F: voie de signalisation

S: canal de señalización

A data channel in combination with the associated signalling terminal equipment at each end.

2123 **signalling data link**

F: liaison sémaphore de données (liaison de données de signalisation)

S: enlace de datos de señalización

A combination of two data channels operating together in a single signalling system. The data channels operate in opposite directions and at the same data rate.

2125 **changeover**

F: passage sur canal sémaphore de secours (passage sur liaison de réserve)

S: paso a enlace de reserva

The procedure of transferring signalling traffic from one signalling link to one or more different signalling links, when the link in use fails or is required to be cleared of traffic.

2126 **changeback**

F: retour sur canal sémaphore normal (retour sur la liaison normale)

S: retorno al enlace de servicio

The procedure of transferring signalling traffic from one or more alternative signalling links to a signalling link which has become available.

2128 **load-sharing** (general)

F: partage de la charge

S: compartición de carga

A process by which signalling traffic is distributed over two or more signalling or message routes, in view of traffic equalization or security.

2130 **associated mode (of signalling)**

F: mode (de signalisation) associé

S: modo (de señalización) asociado

The mode where messages for a signalling relation involving two adjacent signalling points are conveyed over a directly interconnecting signalling link.

2131 **non-associated mode (of signalling)**

F: mode (de signalisation) non associé

S: modo (de señalización) no asociado

The mode where messages for a signalling relation involving two (non-adjacent) signalling points are conveyed, between those signalling points, over two or more signalling links in tandem passing through one or more signalling transfer points.

2133 **quasi-associated mode (of signalling)**

F: mode (de signalisation) quasi associé

S: modo (de señalización) cuasiasociado

A non-associated mode (of signalling) in which the (signalling) message route is determined basically, for each signalling message, by information contained in this message (namely in its routing label) and is fixed in normal operation.

2135 **block (data)**

F: bloc (de données)

S: bloque (de datos)

A group of bits, or *n*-ary digits, transmitted as a unit over which an encoding procedure is generally applied for error-control purposes.

2136 **block** (Signalling System No. 6)

F: bloc

S: bloque

A group of 12 signal units on the signalling channel.

2137 **signal units**

F: trame sémaphore

S: unidad de señalización

A group of bits forming a separately transferable entity used to convey information on a signalling link.

2138 **signalling message**

F: message (de signalisation)

S: mensaje de señalización

An assembly of signalling information pertaining to a call, management transaction, etc. that is transferred as an entity.

2139 **(signalling) message route**

F: route de message (de signalisation)

S: ruta de mensajes (de señalización)

The signalling link or consecutive links connected in tandem that are used to convey a signalling message from an originating point to its destination point.

2140 **continuity check**

F: contrôle de continuité

S: prueba de continuidad

A check made to a circuit or circuits in a connection to verify that an acceptable path (for transmission of data, speech, etc.) exists.

2202 **service indicator**

F: indicateur de service

S: indicador de servicio

Information within a signalling message identifying the user to which the message belongs.

2203 **country-code indicator**

F: indicateur d'indicatif de pays

S: indicador de indicativo de país

Information sent in the forward direction indicating whether or not the country code is included in the address information.

2204 **calling party's category indicator**

F: indicateur de catégorie du demandeur

S: indicador de la categoría del abonado que llama

Information sent in the forward direction denoting the category of the calling party which is used together with other call set-up information to select the appropriate call treatment.

2205 **address separator**

F: séparateur d'adresse

S: separador de dirección

The character which separates the different addresses in the selection signals.

2206 **label**

F: étiquette

S: etiqueta

Information within a signalling message used to identify typically the particular circuit, call or management transaction to which the message is related.

2207 **band number**

F: numéro de bande

S: número de banda

A subdivision of the address label, containing the most significant bits, used for routing the signal message and possibly for identifying the circuit group containing the traffic circuit concerned.

2301 **address signal**

F: signal d'adresse

S: señal de dirección

A signal containing one element of the part of the selection signals which indicate the destination of a call initiated by a customer, network facility, etc.

2302 **address signal complete**

F: signal d'adresse complet

S: señal de dirección completa

A signal sent in the backward direction indicating that signals required for routing the call to the called party have been received and that no called party's line condition signals will be sent.

2303 **address-incomplete signal**

F: signal d'adresse incomplet

S: señal de dirección incompleta

A signal sent in the backward direction indicating that the number of address signals received is not sufficient for setting up the call.

2304 **end-of-pulsing (ST) signal**

F: signal de fin de numérotation

S: señal de fin de numeración (SFN)

An address signal sent in the forward direction indicating that there are no more address signals to follow.

2306 **call-failure signal**

F: signal d'échec de l'appel

S: señal de llamada infructuosa

A signal sent in the backward direction indicating the failure of a call set-up attempt due to the lapse of a time-out or a fault not covered by specific signals.

2309 **ringing tone; ringback tone** (USA)

F: tonalité de retour d'appel

S: tono de llamada

A tone which indicates that the ringing function is being applied at the called end.

2310 **release-guard signal**

F: signal de libération de garde

S: señal de liberación de guarda

A signal sent in the backward direction in response to the clear-forward signal when the circuit concerned is brought into the idle condition.

2311 **clear-forward signal**

F: signal de fin

S: señal de fin (desconexión)

A signal sent in the forward direction to terminate the call or call attempt and release the circuit concerned. This signal is normally sent when the calling party clears.

2312 **clear-back signal**

F: signal de raccrochage

S: señal de colgar

A signal sent in the backward direction indicating that the called party has cleared.

2313 **confusion signal**

F: signal de confusion

S: señal de confusión

A signal sent in the backward direction indicating that an exchange is unable to act upon a message received from the preceding exchange because the message is considered unreasonable.

3 Control functions

3001 **exchange control system**

F: système de commande du central

S: sistema de control de la central

The central control *system* of a stored program controlled switching *system.* It may consist of one or more *processors.*

3008 **register function**

F: fonction d'enregistreur

S: función de registrador

The functions of receiving, storing, analyzing and possibly translating and transmitting address and other information for the purpose of controlling the setting up of a call.

3012 **I/O devices**

F: dispositif d'entrée/sortie

S: dispositivos de entrada/salida

Memory and keyboard devices for entering or receiving data to or from the *system.* Can be controlled manually for entering or receiving data.

3101 **CCITT MML**

F: langage homme-machine du CCITT

S: LHM del CCITT

The man-machine language (MML) for stored program controlled switching systems developed by the International Telegraph and Telephone Consultative Committee (CCITT).

3103 **system** (in MML)

F: système

S: sistema

Refers to a stored program controlled switching *system* and also to its man-machine communication facility.

3105 **command** (in MML)

F: commande

S: instrucción; orden

A specification of an expected action or function by the system.

3110 **control character** (in MML)

F: caractère de commande

S: carácter de control

A character whose occurrence in a particular context initiates, modifies, or stops an action that affects the recording, processing or interpretation of data.

3115 **function** (in MML)

F: fonction

S: función

A function is an action which various groups of staff wish to carry out, e.g. add subscriber's line, initiate a testing routine, read a subscriber's class of service. To carry out one function, one or more *commands* may be necessary. The function is characterized by the *command code(s).*

4 Interface functions (machine-machine)

Note – Figure 1/Q.503 shows a number of typical interfaces.

4001 **interface**

F: jonction, interface

S: interfaz

A shared boundary, for example, the boundary between two subsystems or two devices.

Note – An interface is used to specify the interconnection between two different machines. The specification includes the type, quantity and function of the interconnecting means and the type, form and sequencing order of the signals to be interchanged via those means.

5 Equipment and hardware

5001 **automatic switching equipment**

F: commutateur automatique

S: equipo de conmutación automática

Equipment in which *switching* operations are performed by electrically controlled apparatus without the intervention of operators.

15.12

5004 **distribution frame**

F: répartiteur

S: repartidor

A structure for terminating wires and connecting them together in any desired order.

15.20

5005 **main distribution frame**

F: répartiteur d'entrée

S: repartidor principal

A *distribution frame* to which are connected on one side the lines exterior to the exchange, and on the other side the internal cabling of the exchange.

15.21

5006 **intermediate distribution frame**

F: répartiteur intermédiaire

S: repartidor intermedio

A *distribution frame* intermediate between the main distribution frame and the switchboard, or the switching apparatus or intermediate between two ranks of switches in an automatic exchange.

15.22

5012 **crossbar switch**

F: commutateur crossbar

S: conmutador de barras cruzadas

A *switch* having a plurality of vertical paths, a plurality of horizontal paths, and electromagnetically-operated mechanical means for interconnecting any one of the vertical paths with any of the horizontal paths.

15.45

6 Executive software

6.1 *Basic software concepts*

6102 **algorithm**

F: algorithme

S: algoritmo

A prescribed finite set of well-defined rules or processes for the solution of a problem in a finite number of steps.

ISO 01.04.10

6103 **real time** (adjective)

F: en temps réel

S: en tiempo real

Pertaining to the processing of data by a computer in connection with another process outside the computer according to time requirements imposed by the outside process.

ISO 10.03.04

6104 **file**

F: fichier

S: fichero

A set of related records treated as a unit.

ISO 04.11.05

6105 **record**

F: enregistrement

S: registro

A set of related data or words treated as a unit.

ISO 04.11.03

6106 **field**

F: zone

S: campo

In a record, a specified area used for a particular category of data.

ISO 04.11.11

6107 **key (tag) (label)**

F: clé (étiquette) (label)

S: clave (etiqueta)

One or more characters within or attached to a set of data, that contains information about the set, including its identification.

ISO 04.12.04

6108 **identifier**

F: identificateur

S: identificador

A character, or group of characters, used to identify or name an item of data and possibly to indicate certain properties of that data.

ISO 07.04.01

6109 **parameter**

F: paramètre

S: parámetro

A variable that is given a constant value for a specified application and that may denote the application.

ISO 02.02.04

6110 **call** (in software) procedure call

F: appel

S: llamada

The use of a procedure name in an expression or statement which causes the execution of the procedure when encountered.

6111 **address**

F: adresse

S: dirección

A character or group of characters that identifies a storage or a device without the use of any intermediate reference.

ISO 07.01.11

6112 **absolute address**

F: adresse absolue

S: dirección absoluta

An address in a computer language that identifies a storage or a device without the use of any intermediate reference.

ISO 07.19.03

6113 **indirect address**

F: adresse indirecte

S: dirección indirecta

An address that designates the storage location of an item of data to be treated as the address of an operand but not necessarily as its direct address.

ISO 07.19.11

6114 **direct address**

F: adresse directe

S: dirección directa

An address that designates a storage location of an item of data to be treated as an operand.

ISO 07.19.10

6115 **base address**

F: adresse de base; adresse base

S: dirección de base

A numeric value that is used as a reference in the calculation of addresses in the execution of a computer program.

ISO 07.19.05

6116 **relocatable address**

F: adresse translatable

S: dirección reubicable

An address that is adjusted when the computer program containing it is relocated.

ISO 07.19.08

6117 **monitor**

F: moniteur

S: monitor

A functional unit that observes and records selected activities within a system for analysis.

ISO 11.03.02 mod

6118 **direct access** [random access]

F: accès sélectif

S: acceso directo

The facility to obtain data from a storage device or to enter data into a storage device in such a way that the process depends only on a reference to data previously accessed.

ISO 12.05.03

6.2 *Software organization*

6201 **operating system**

F: système d'exploitation

S: sistema operativo

Software that controls the management and the execution of programs.

ISO 01.04.07 mod

6202 **conversational mode**

F: mode dialogué

S: modo conversacional

A mode of operation of a data processing system in which a sequence of alternating entries and responses between a user and the system takes place in a manner similar to a dialogue between two persons.

ISO 10.03.03 mod

6203 **time sharing** [time slicing]

F: partage de temps

S: tiempo compartido

A mode of operation of a data processing system that provides for the interleaving in time of two or more processes in one processor.

ISO 10.04.05 mod

6204 **time slicing** [time sharing]

F: découpage de temps

S: segmentación de tiempo

A mode of operation in which two or more processes are assigned quanta of time on the same processor.

ISO 10.04.04

6205 **to pack**

F: condenser

S: compactar

To store data in a compact form in a storage medium by taking advantage of known characteristics of the data and of the storage medium, in such a way that the original form of the data can be recovered.

Example: To make use of bit or byte locations that would otherwise go unused.

ISO 06.03.12

6206 **to map (over)**

F: appliquer

S: aplicar (correlacionar)

To establish a set of values having a defined correspondence with the quantities or values of another set.

ISO 02.04.04

6207 **to relocate**

F: translater

S: reubicar

To move a computer program or part of a computer program, and to adjust the necessary address references so that the computer program can be executed after being moved.

ISO 07.12.03

6208 **chaining search**

F: recherche en chaîne

S: búsqueda en cadena

A search in which each item contains means for locating the next item to be considered in the search.

ISO 06.04.08

6209 **dichotomizing search**

F: recherche dichotomique

S: búsqueda dicotómica

A search in which an ordered set of items is partitioned into two parts, one of which is rejected, the process being repeated on the accepted part until the search is completed.

ISO 06.04.04

6210 **interrupt; interruption**

F: interruption

S: interrupción

A suspension of a process, such as the execution of a computer program, caused by an event external to that process and performed in such a way that the process can be resumed.

ISO 10.01.09

6211 **to dump**

F: vider

S: vaciar

To write the contents of a storage, or part of a storage, usually from an internal storage, on to an external medium for a specific purpose such as to allow other use of the storage, as a safeguard against faults or errors, or in connection with debugging.

ISO 07.14.01

6212 **to patch**

F: rapiécer

S: parchear

To make an improvized modification.

ISO 07.15.06

6.3 *Programming*

6301 **to assemble**

F: assembler

S: ensamblar

To translate a program expressed in an assembly language and perhaps to link subroutines.

ISO 07.03.04

6302 **assembler; assembly program**

F: assembleur; programme d'assemblage

S: ensamblador; programa de ensamblaje

A program used to assemble.

ISO 07.03.05 mod

6303 **to compile**

F: compiler

S: compilar

To translate a program expressed in a high level language into a program expressed in a computer language.

ISO 07.03.06 mod

6304 **compiler; compiling program**

F: compilateur

S: compilador; programa compilador

A program used to compile.

ISO 07.03.07 mod

6305 **link** (in programming)

F: lien

S: enlace

A part of a program that passes control and parameters between separate portions of the program.

ISO 07.09.09 mod

6306 **to link** (in programming)

F: relier

S: enlazar

To provide a link.

ISO 07.09.10

6307 **programming system**

F: système de programmation

S: sistema de programación

One or more programming languages and the necessary software for using these languages with particular automatic data processing equipment.

ISO 07.01.01

6308 , **routine**

F: routine

S: rutina

An ordered set of instructions that may have some general or frequent use.

ISO 01.04.08 mod

6309 **subroutine**

F: sous-programme

S: subrutina

A sequence set of statements which taken as an entity may be used in one or more programs and at one or more points in a program, as required for repetitive occurrence of the same task.

ISO 07.08.01 mod

6310 **executive program ; supervisory program ; supervisor**

F: (programme) superviseur

S: programa ejecutivo ; programa supervisor ; supervisor

A program, usually part of an operating system, that controls the execution of other programs and regulates the flow of work in a data processing system.

ISO 07.06.01 mod

6311 **reusable program (routine)**

F: programme (routine) réutilisable

S: programa (rutina) reutilizable

A program (A routine) that may be loaded once and executed repeatedly subject to the requirements that any instructions that are modified during its execution are returned to their states and that its external program parameters are preserved unchanged.

ISO 07.08.05 mod

6312 **reentrant program (routine) (subroutine) ; reenterable program (routine) (subroutine)**

F: programme (routine) ; (sous-programme) rentrant

S: programa (rutina) (subrutina) reentrante ; programa (rutina) (subrutina) reintroducible

A program (A routine) (A subroutine) that may be entered repeatedly and may be entered before prior executions of the same program (routine) (subroutine) have been completed, subject to the requirement that neither its external program parameters nor any instructions are modified during its execution.

Note – A reentrant program, routine or subroutine may be used by more than one computer program simultaneously.

ISO 07.08.06

6313 **target program ; object program**

F: programme résultant ; programme-objet

S: programa resultante ; programa objeto

A program in a target language that has been translated from a source language.

ISO 07.03.02 mod

6314 **microinstruction**

F: micro-instruction

S: microinstrucción

An instruction of a microprogram.

ISO 07.16.13

6315 **microprogram**

F: microprogramme

S: microprograma

A sequence of elementary instruction that corresponds to a specific computer operation, maintained in special storage, whose execution is initiated by the instruction register of a computer.

ISO 07.01.13

6316 **to debug** (in programming)

F: mettre au point

S: depurar

To detect, to trace, to eliminate mistakes in programs or in other software.

ISO 07.15.01

6.4 *Languages*

6401 **computer language; machine language**

F: langage-machine

S: lenguaje de computador; lenguaje de máquina

A low level language whose instructions consist only of computer instructions.

ISO 07.02.15 mod

6402 **macroinstruction; macro (instruction)**

F: macro-instruction

S: macroinstrucción

An instruction in a source language that is to be replaced by a defined sequence of instructions in the same source language.

Note – The macroinstruction may also specify values for parameters in the instructions that are to replace it.

ISO 07.16.05

6403 **command language**

F: langage de commande

S: lenguaje de instrucciones; lenguaje de órdenes

A source language consisting primarily of procedural operators that indicate the functions to be performed by an operating system.

ISO 10.02.09 mod

6404 **assembly language**

F: langage d'assemblage

S: lenguaje de ensamblaje

A low level language whose instructions are usually in one-to-one correspondence with computer instructions and that may provide facilities such as the use of macroinstructions.

ISO 07.02.16 mod

6405 **syntax**

F: syntaxe

S: sintaxis

The relationships among characters or groups of characters, independent of their meanings or the manner of their interpretation and use.

ISO 07.02.04

6406 **object language; target language**

F: langage résultant; langage-objet

S: lenguaje objeto; lenguaje resultante

A language into which statements are translated.

ISO 07.02.11

6407 **source language**

F: langage d'origine; langage-source

S: lenguaje fuente

A language from which statements are translated.

ISO 07.02.10

6408 **high level language (HLL)**

F: langage évolué

S: lenguaje de alto nivel

A programming language that does not reflect the structure of any given computer or any given class of computers.

ISO 07.02.17

6409 **low level language**

F: langage lié au calculateur

S: lenguaje de bajo nivel

A programming language that reflects the structure of a computer or that of a given class of computers.

ISO 07.02.14

6410 **man-machine language (MML)**

F: langage homme-machine (LHM)

S: lenguaje hombre-máguina (LHM)

A language designed to facilitate direct user control of a computer.

6411 **mnemonic (abbreviation)**

F: (abréviation) mnémonique

S: nemotécnica (abreviatura)

A representation of an entity by one or more characters, so chosen that the character representation has a relationship to normal language usage such that the name of the entity serves as an aid to the memory of a human operator in remembering the appropriate coded representation used.

6501 **CHILL**

F: CHILL

S: CHILL

A high level programming language for programming SPC telephone exchanges, developed by CCITT and fully described in Recommendation Z.200 [4].

Note – For details of the individual terms and definitions used in CHILL see Appendix 6 to Recommendation Z.200 [4].

6901 **comment** (in MML)

F: commentaire

S: comentario

A character string enclosed between the separator strings/* (solidus asterisk) and */ (asterisk solidus). Has no MML syntactical or semantical meaning.

6902 **format**

F: format

S: formato

The arrangement or layout of data on a data medium.

6903 **header**

F: en-tête

S: encabezamiento

The header provides general information which could comprise identification information, date and time, etc.

6904 **identifier** (in MML)

F: identificateur

S: identificador

An identifier is a representation of an entity, typically consisting of one or more *characters*. It is used to identify or name a unique item of data. In the *man-machine language*, the first character is a letter.

6905 **mnemonic abbreviation**

F: abréviation mnémonique

S: abreviatura nemotécnica

A representation of an entity typically consisting of one or more *characters* chosen to assist the human memory.

6906 **arithmetic expression** (in MML)

F: expression arithmétique

S: expresión aritmética

A combination of *arithmetic delimiters*, *numerals* (*decimal*, *hexadecimal*, *octal* or *binary*) and *identifiers* enclosed by parentheses.

6907 **binary numeral**

F: nombre binaire

S: numeral binario

A *numeral* in the binary (base 2) *numbering system*, represented by the characters 0 (zero), 1 (one) and optionally preceded by B' (B apostrophe).

6908 **character**

F: caractère

S: carácter

A member of the *character set* which is used for the organization, control or representation of data.

6910 **character set** (in MML)

F: ensemble de caractères

S: juego de caracteres; conjunto de caracteres

The finite set of different characters used in *CCITT MML*.

6911 **decimal numeral**

F: nombre décimal

S: numeral decimal

A *numeral* in the decimal (base 10) *numbering system*, represented by the *characters* 0 (zero), 1, 2, 3, 4, 5, 6, 7, 8, 9 optionally preceded by D' (D apostrophe).

6912 **digit**

F: chiffre

S: cifra; dígito

A *charater* of the *character set* representing an integer, listed in Table 1/Z.314 [5], column 3, positions 0 (zero) to 9.

6913 **flow line** (in MML)

F: ligne de liaison

S: línea de flujo

A line representing a connection path between *symbols* in a *syntax diagram.*

6914 **graphic characters**

F: caractères graphiques

S: caracteres gráficos

Graphic characters are a collection of *characters* within the *character set* used to improve readability of *output.*

6915 **hexadecimal numeral**

F: nombre hexadécimal

S: numeral hexadecimal

A *numeral* in the hexadecimal (base 16) *numbering system*, represented by the *characters* 0 (zero), 1, 2, 3, 4, 5, 6, 7, 8, 9, A, B, C, D, E, F, optionally preceded by H' (H apostrophe).

6916 **input** (in MML)

F: entrée

S: entrada

The process that constitutes the introduction of data into a data processing system or any part of it.

6917 **letter**

F: lettre

S: letra

A *character* of the *character set* representing the alphabet, listed in Table 1/Z.314 [5], columns 4, 5, 6 and 7 excluding table positions 5/15 and 7/15.

6918 **meta-language** (in MML)

F: métalangage

S: metalenguaje

A symbolic method for defining *MML input* and *output syntax.*

6919 **octal numeral**

F: nombre octal

S: número octal

A *numeral* in the octal (base 8) *numbering system*, represented by the *characters* 0, 1, 2, 3, 4, 5, 6, 7, optionally preceded by O' (letter O apostrophe).

6920 **output** (in MML)

F: sortie

S: salida

The process that consists of the delivery of data from a data processing system or from any part of it.

6921 **parameter** (in MML)

F: paramètre

S: parámetro

A parameter identifies and contains a piece of necessary information to execute a *command.*

6922 **separator** (in MML)

F: séparateur

S: separador

A *character* used to delimit *syntax* elements.

6923 **symbol**

F: symbole

S: símbolo

A conventional representation of a concept or a representation of a concept upon which agreement has been reached.

6924 **syntax diagram**

F: diagramme syntaxique

S: diagrama sintáctico

The syntax diagrams are a method of defining the *syntax* of the *input* and *output* language by pictorial representation.

6925 **comment** (in SDL)

F: commentaire

S: comentario

Information which is in addition to or clarifies an SDL diagram. Comments may be attached by a single square bracket connected by a dashed line to a *symbol* or *flow line.* (Recommendation Z.102, §§ 2.6, 2.7.2 [6].)

6926 **connector** (in SDL)

F: connecteur

S: conector

A connector (○) is either an *in-connector* or an *out-connector.* A *flow line* may be broken by a pair of *associated connectors,* with the flow assumed to be from the *out-connector* to its associated *in-connector.* (Recommendation Z.102, §§ 2.4, 2.5.2 [6].)

6927 **decision** (in SDL)

F: décision

S: decisión

A decision is an *action* within a *transition* which asks a question to which the answer can be obtained at that instant and chooses one of several paths to continue the *transition.* (Recommendation Z.101, § 1.3.7 [7].)

6928 **description** (in SDL)

F: description

S: descripción

The implementation of the requirements of a system is described in a description of the system. Descriptions consist of *general parameters* of the system as implemented and the *functional description (FD)* of its actual behaviour. (Recommendation Z.101, §§ 1.2.2 a), 1.2.2 b) [7].)

6929 **flow line** (in SDL)

F: ligne de liaison

S: línea de flujo

A flow line (——— or ———→) connects every *symbol* to the symbol(s) it follows. (Recommendation Z.102, § 2.5.1 [6].)

6930 **functional block** (in SDL)

F: bloc fonctionnel

S: bloque funcional

A functional block is an object of manageable size and relevant internal relationship, containing one or more *processes.* (Recommendation Z.101, § 1.2.4 [7].)

6931 **functional description (FD)** (in SDL)

F: description fonctionnelle (DF)

S: descripción funcional (DF)

The functional description (FD) of a system describes the actual behaviour of the implementation of the functional requirements of the system in terms of the internal structure and logic processes within the system. (Recommendation Z.101, § 1.2.3 [7].)

6932 **functional specification (FS)** (in SDL)

S: spécification fonctionnelle (SF)

F: especificación funcional (EF)

The functional specification (FS) of a system is a specification of the total functional requirements of that system from all significant points of view. (Recommendation Z.101, § 1.2.3 [7].)

6933 **general parameters** (in SDL)

F: caractéristiques générales

S: parámetros generales

The general parameters in both a *specification* and a *description* of a system relate to such matters as temperature limits, construction, exchange capacity, grade of service, etc. (Recommendation Z.101, § 1.2.2. c) [7].)

6934 **input** (in SDL)

F: entrée

S: entrada

An input is an incoming *signal* which is *recognized* by a *process.* (Recommendation Z.101, § 1.3.2 [7].)

6935 **output** (in SDL)

F: sortie

S: salida

An output in an *action* within a *transition* which generates a *signal* which in turn acts as an *input* elsewhere. (Recommendation Z.101, § 1.3.6 [7].)

6936 **pictorial element (PE)**

F: élément graphique (EG)

S: elemento pictográfico (EP)

One of a number of standardized graphical entities used within *state pictures* to represent switching system concepts. (Annexes to Recommendation Z.103 [8].)

6937 **process** (in SDL)

F: processus

S: proceso

A process performs a logic function that requires a series of information items to proceed, where these items become available at different points in time. In the context of SDL, a process is an object that either is in a *state* awaiting an *input* or in a *transition.* (Recommendation Z.101, §§ 1.2.5, 1.3.9 [7].)

6938 **save** (in SDL)

F: mise en réserve

S: conservación

A save is the postponement of *recognition of a signal* when a *process* is in a *state* in which *recognition of that signal* does not occur. (Recommendation Z.101, § 1.3.4 [7].)

6939 **signal** (in SDL)

F: signal

S: señal

A signal is a flow of data conveying information to a *process.* (Recommendation Z.101, § 1.3.1 [7].)

6940 **specification** (in SDL)

F: spécification

S: especificación

The requirements of a system are defined in a specification of that system. A specification consists of *general parameters* required of the system and the *functional specification (FS)* of its required behaviour. (Recommendation Z.101, §§ 1.2.2. a), 1.2.2 b) [7].)

6941 **specification and description language (SDL)**

F: langage de spécification et de description (LDS)

S: lenguaje de especificación y descripción (LED)

The CCITT language used in the presentation of the *functional specification* and *functional description* of the internal logic processes in stored programmed control (SPC) switching systems.

6942 **state** (in SDL)

F: état

S: estado

A state is a condition in which the action of a *process* is *suspended* awaiting an *input.* (Recommendation Z.101, § 1.3.3 [7].)

6943 **symbol** (in SDL)

F: symbole

S: símbolo

In the context of SDL, a symbol is a representation of the concept of either a *state, input, task, output, decision* or *save.* (Recommendation Z.102, § 2.2 [6].)

6944 **task** (in SDL)

F: tâche

S: tarea

A task is any action within a *transition* which is neither a *decision* nor an *output.* (Recommendation Z.101, § 1.3.8 [7].)

6945 **transition** (in SDL)

F: transition

S: transición

A transition is a sequence of *actions* which occurs when a *process* changes from one *state* to another in reponse to an *input.* (Recommendation Z.101, § 1.3.5 [7].)

7 (Spare)

8 (Spare)

9 Telephone subscriber's equipment and local lines

(Still to be prepared)

ANNEX A

(to Recommendation Q.9)

Alphabetical list of terms defined in this Recommendation

6112 absolute address
6111 address
2302 address signal complete
2303 address incomplete signal
2205 address separator
2301 address signal
2110 adjacent signalling points
0122 administrative processor
6102 algorithm
1443 amplitude quantized control
1442 analogue control
1429 anisochronous
6906 arithmetic expression (in MML)
6302 assembler
6404 assembly language
6302 assembly program
2130 associated mode (of signalling)
5001 automatic switching equipment
1031 automatic system
2207 band number
6115 base address
0063 bidirectional
1439 bilateral control
6907 binary numeral
2135 block (data)
2136 block (Signalling System No. 6)
0216 both-way
1407 bunched frame alignment signal
0208 busy
0209 busy test (USA)
0003 call
0004 call
6110 call (in software)
2306 call-failure signal
2204 calling party's category indicator
3101 CCITT MML
6208 chaining search
2126 changeback
2125 changeover
0006 channel
2009 channel associated signalling
1330 channel gate
1129 channel switching
1415 channel time slot
6908 character
6910 character set (in MML)
1310 character signal
6501 CHILL
0014 circuit
0022 circuit group
0020 circuit (specification)
0023 circuit sub-group
1125 circuit switching
2312 clear-back signal
2311 clear-forward signal
0069 code division
1019 co-located exchange concentrator
1005 combined local/transit exchange
3105 command (in MML)
6403 command language
6901 comment (in MML)
6925 comment (in SDL)
2008 common channel signalling
0001 communication
2015 compelled signalling
6304 compiler
6304 compiling programme
6401 computer language
1117 concentration (in a switching stage)
2313 confusion signal
0010 connection
6926 connector (in SDL)
3110 control character (in MML)
6202 conversational mode
2140 continuity check
5012 crossbar switch
1205 crossbar system
1315 cross-exchange check (cross-office)
2203 country-code indicator
2116 data channel
2117 data link
6911 decimal numeral
6927 decision (in SDL)
1449 democratic (mutually synchronized) network
6928 description (in SDL)
1451 despotic (synchronized) network
6209 dichotomizing search
6912 digit
1418 digit time slot
1804 digital block

1122 digital circuit
1135 digital connector
1010 digital exchange
1803 digital line section
1802 digital path
1801 digital section
1120 digital switching
6118 direct access
6114 direct address
1408 distributed frame alignment signal
5004 distribution frame
1441 double-ended synchronization
0019 electric circuit
2304 end-of-pulsing (ST) signal
0209 engaged test (UK)
1001 exchange (switching exchange, switching centre)
1512 exchange call release delay
1508 exchange call set up delay
1018 exchange concentrator
3001 exchange control system
6310 executive program
1118 expansion (in a switching stage)
6106 field
6104 file
6913 flow line (in MML)
6929 flow line (in SDL)
6902 format
1141 four-wire switching
1332 frame
1405 frame alignment
1409 frame alignment recovery time
1406 frame alignment signal
1417 frame alignment time slot
0068 frequency division
1128 frequency division switching
3115 function (in MML)
6930 functional block (in SDL)
6931 functional description (FD) (in SDL)
6932 functional specification (FS) (in SDL)
0105 functional unit
6933 general parameters (in SDL)
1007 geographically distributed exchange
6914 graphic characters
6903 header
1435 heterochronous
6915 hexa-decimal numeral
1450 hierarchic (mutually synchronized) network
6408 high level language (HLL)
1432 homochronous
0016 hypothetical reference circuit
6108 identifier
6904 identifier (in MML)
2011 in-band signalling
1318 in-call
1319 in-call rearrangement
1507 incoming response delay
6113 indirect address
1105 inlet
6916 input (in MML)
6934 input (in SDL)
2005 in-slot signalling
1011 integrated services exchange
4001 interface
5006 intermediate distribution frame
6210 interrupt interruption
3012 I/O devices
1428 isochronous
1206 junctor (in the crossbar system)
6107 key (tag) (label)
2206 label
1025 line concentrator (stand above concentrator)
2014 line signalling
0031 link
6305 link (in programming)
1207 link (in the crossbar system)
2128 load-sharing (general)
1002 local exchange [deprecated: local central office]
6409 low level language
6401 machine language
6402 macro (instruction)
6402 macroinstruction
5005 main distribution frame
6410 man-machine language (MML)
1433 mesochronous
1130 message switching
2101 message transfer part
6918 meta-language (in MML)
6314 microinstruction
6315 microprogram
6411 mnemonic (abbreviation)
6905 mnemonic abbreviation
6117 monitor
1333 multiframe
1149 multiple
1136 multi-slot connection
1448 mutually synchronized network
0112 (network) resources
2131 non-associated mode (of signalling)
1447 non-synchronized network
6406 object language
6313 object programme
6919 octal numeral
1452 oligarchic (synchronized) network
0215 one way

6201 operating system
0124 operation and maintenance centre processor
2012 out-band signalling
1410 out-of-frame alignment time
1106 outlet
6920 output (in MML)
6935 output (in SDL)
2006 out-slot signalling
1335 parallel to serial converter
6109 parameter
6921 parameter (in MML)
0026 path
6936 pictorial element (PE)
1434 plesiochronous
1514 post dialling delay
1331 primary block
6110 procedure call
0060 process
6937 process (in SDL)
0120 processor
6307 programming system
2133 quasi-associated mode (of signalling)
6118 random access (deprecated in the sense)
6103 real time (adjective)
6105 record
6312 reenterable programe (routine) (subroutine)
reentrant programme (routine) (subroutine)
1146 reentrant trunking
1210 register
3008 register function
2016 register signalling (Signalling System R1)
2120 regular signalling link
0212 release
2310 release-guard signal
6116 relocatable address
1020 remote exchange concentrator
1016 remote switching stage
1008 remotely controlled exchange
2121 reserve signalling link
1425 retiming
6311 reusable programme (routine) (subroutine)
2309 ringing tone ringback tone (USA)
6308 routine
6938 save (in SDL)
1013 satellite exchange
0205 seizure
1115 selection stage
1030 semi-automatic system
1138 semi-permanent connection
6922 separator (MML)
1336 serial to parallel converter
2202 service indicator
6939 signal (in SDL)
2108 signal transfer point
2137 signal units
2001 signalling
2122 signalling channel
2123 signalling data link
2109 (signalling) destination point
2118 signalling link
2119 signalling link set
2138 signalling message
2139 (signalling) message route
2104 signalling network
2105 signalling network management functions
2107 (signalling) originating point
2106 signalling point
2111 signalling relation
2112 signalling route
2113 signalling route set
2114 signalling routing
2020 signalling system
1416 signalling time slot
1440 single-ended synchronization
0115 software
6407 source language
0066 space division
1126 space division switching
6940 specification (in SDL)
6941 specification & description language (SDL)
2004 speech digit signalling
6942 state (in SDL)
1334 subframe
6309 subroutine
0050 subscriber's line
6310 supervisor
6310 supervisory program
1110 switching
1506 switching delay
1113 switching matrix
1112 switching network
1111 switching node
1015 switching stage
6923 symbol
6943 symbol (in SDL)
1431 synchronization
1446 synchronized network [synchronous network]
1430 synchronous
6405 syntax
6924 syntax diagram
3103 system (in MML)
6406 target language
6313 target program
6944 task (in SDL)
0002 telecommunication
0012 telecommunication circuit
0015 telephone circuit
1510 through connection delay

0067 time division
1127 time division switching
1305 (time division) highway (in switching)
1444 time quantized control
6203 time sharing time slicing (deprecated in this sense)
6204 time slicing time sharing (deprecated in this sense)
1414 time slot
1422 time slot interchange
1420 time slot sequence integrity
1426 timing recovery (timing extraction)
6301 to assemble
6303 to compile
6316 to debug (in programming)
6211 to dump
6306 to link (in programming)
6206 to map (over)
6205 to pack
6212 to patch
6207 to relocate
0108 traffic-carrying device
1004 transit exchange
6945 transition (in SDL)
1212 translation
1213 translator
1505 transmission delay
1137 trombone (loop) connection
1140 two-wire switching
0064 unidirectional
1438 unilateral control
2102 user part

References

[1] CCITT Recommendation *Vocabulary of pulse code modulation (PCM) and digital transmission terms*, Vol. III, Fascicle III.3, Rec. G.702.

[2] *List of definitions of essential telecommunication terms*, ITU, Geneva, 1961.

[3] *List of terms and definitions of teletraffic*, Vol. II, Fascicle II.3, Supplement No. 7.

[4] CCITT Recommendation *CCITT high level language (CHILL)*, Vol. VI, Fascicle VI.8, Rec. Z.200.

[5] CCITT Recommendation *The character set and basic elements*, Vol. VI, Fascicle VI.7, Rec. Z.314.

[6] CCITT Recommendation *Symbols and rules*, Vol. VI, Fascicle VI.7, Rec. Z.102.

[7] CCITT Recommendation *General explanation of the specification and description language (SDL)*, Vol. VI, Fascicle VI.7, Rec. Z.101.

[8] CCITT Recommendation *Use of pictorial elements within state symbols*, Vol. VI, Fascicle VI.7, Rec. Z.103.

[9] CCITT Recommendation *Definitions of essential technical terms in the field of telegraph transmission*, Vol. VII, Fascicle VII.1, Rec. R.140.

SECTION 2

NUMBERING PLAN AND DIALLING PROCEDURES IN THE INTERNATIONAL SERVICE

Recommendation Q.10

DEFINITIONS RELATING TO NATIONAL AND INTERNATIONAL NUMBERING PLANS [1]

1 international prefix

F: préfixe international

S: prefijo internacional

The combination of digits to be dialled by a calling subscriber making a call to a subscriber in another country, to obtain access to the automatic outgoing international equipment.

2 country code

F: indicatif du pays

S: indicativo de país

The combination of one, two or three digits characterizing the called country.

3 trunk prefix

F: préfixe interurbain

S: prefijo interurbano

A digit or combination of digits to be dialled by a calling subscriber, making a call to a subscriber in his own country but outside his own numbering area. It provides access to the automatic outgoing trunk equipment.

[1] . This Recommendation is an extract of Recommendation E.160 [1]. For the examples relating to §§ 1 to 7, see Fascicle II.2.

4 trunk code

F: indicatif interurbain

S: indicativo interurbano

A digit or combination of digits (not including the trunk prefix) characterizing the called numbering area within a country (or group of countries, included in one integrated numbering plan).

The trunk code has to be dialled before the called subscriber's number where the calling and called subscribers are in different numbering areas.

5 subscriber number [2]

F: numéro d'abonné

S: número de abonado

The number to be dialled or called to reach a subscriber in the same local network or numbering area.

This number is the one usually listed in the directory against the name of the subscriber.

6 national (significant) number

F: numéro national (significatif)

S: número nacional (significativo)

The number to be dialled following the trunk prefix to obtain a subscriber in the same country (or group of countries, included in one integrated numbering plan) but outside the same local network or numbering area.

The national (significant) number consists of the trunk code followed by the subscriber number.

It should be noted that, in some countries, it is customary to consider *for national purposes* that the trunk prefix is included in the national number [which is then not the national (significant) number]. A careful distinction must therefore be made between such national definition or practice and the CCITT definition, which is internationally valid. In order to avoid misunderstanding, the CCITT definition includes the word "significant" between brackets, reading as follows: "national (significant) number".

7 international number

F: numéro international

S: número internacional

The number to be dialled following the international prefix to obtain a subscriber in another country.

The international number consists of the country code of the required country followed by the national (significant) number of the called subscriber.

Reference

[1] CCITT Recommendation *Definitions relating to national and international numbering plans*, Vol. II, Fascicle II.2, Rec. E.160.

[2] Care should be taken not to use the term "local number" instead of "subscriber number".

Recommendation Q.11 [1]

ARRANGEMENT OF FIGURES, LETTERS AND SYMBOLS ON ROTARY DIALS AND PUSHBUTTON TELEPHONE SETS

1 Use of figures and letters in telephone numbers

1.1 For the automatic international service, it is preferable that the national numbering plan should not involve the use of letters (associated with figures). The use of letters in national numbering plans may, however, be necessary for national reasons. For example, countries using letters in their subscriber numbers will naturally use them in their national numbering.

1.2 For the automatic international service to countries using letters in telephone numbers, it would be helpful, in a country where letters are not used:

a) to include in the directory a table for converting into figures the letter codes of exchanges in countries with which an automatic service is available;

b) to supply, at the time of opening this automatic service, a booklet of instructions containing the conversion table to the main subscribers to the international service.

1.3 It would also be desirable, in countries with letters in the telephone numbers, that subscribers with considerable international traffic should be asked to show on their letterheads, below their national telephone number, the international number with figures only. (See Recommendation E.123 [1].)

2 Rotary dials (see Figure 1/Q.11)

2.1 For countries which have not yet adopted any specific type of dial, the figures on the dial should be arranged in the following order: 1, 2, 3, . . ., 0.

2.2 The dial shown in Figure 1/Q.11 uses the arrangement of letters and figures employed by some European Administrations. It may be convenient that the dials or pushbutton sets used by international operators for semiautomatic operating in Europe have this arrangement of letters and figures.

Note – On the North American dials and keysets, the digit 0 is not associated with letters O and Q but with the word *operator*, the letter O being associated with digit 6.

[1] This Recommendation is also included in the Series E Recommendations under the number E.161 (Fascicle II.2).

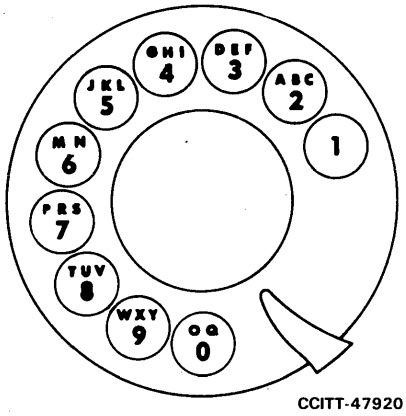


FIGURE 1/Q.11

Rotary dial

3 Pushbutton telephone sets

3.1 *10-pushbutton sets*

3.1.1 *Arrangement and numbering*

The standard arrangement and numbering for pushbuttons corresponding to the digits 1 to 0 is as shown below:

1 2 3
4 5 6
7 8 9
0

This arrangement, which corresponds to that already adopted in many countries – and on which some Administrations have based their standardization – is one found suitable for telephone users. This recommendation results from thorough studies made by several Administrations on subscriber reactions to various conceivable pushbutton patterns.

Where a need exists within an Administration for a 5 × 2 array for use on special telephone apparatus, the array should be as shown below:

1 2
3 4
5 6
7 8
9 0

Note – User dialling performance on this special array is slightly inferior to that on the standard array given above.

In view of the fact that purely numerical numbering plans are now recommended and that the association of letters to digits is not the same in different countries [2], it is undesirable to standardize letter symbols for the pushbuttons corresponding to each of the digits. In cases where a mixed letter-and-digit dialling system is still in use in a country, the letters associated with the figures in the dialling system of the country concerned may, of course, be included on the corresponding pushbuttons of their country's telephone sets (see Figure 2/Q.11).

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[2] Thus, for example, on the North American dials and keysets, the digit 0 is not associated with letters O and Q but with the word *operator*, the letter O being associated with the digit 6.

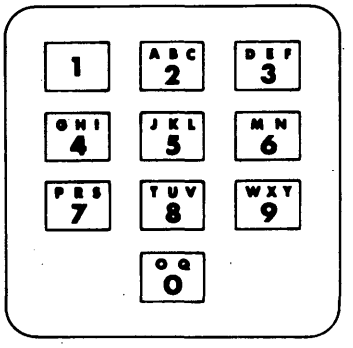

FIGURE 2/Q.11

10-pushbutton set

3.1.2 *Symbols*

The symbols for these buttons are the digits 1 to 0 as indicated in the figures of § 3.1.1 above. These buttons are to be known as button 1, button 2, etc.

3.2 *12-pushbutton sets*

3.2.1 *Arrangement*

In the 12-pushbutton set the standard arrangement shown in § 3.1.1 above is extended by two additional buttons, one to the left and the other to the right of the button 0, thus making a pattern of four horizontal rows of three buttons each forming a 4 × 3 array.

Two buttons may also be added to the 5 × 2 array shown in § 3.1.1 above. These should be located below and in line with buttons 9 and 0, thus making a 6 × 2 array.

3.2.2 *Symbols*

On the 4 × 3 array, the symbol on the button which is immediately to the left of the button 0 (on the 6 × 2 array, the corresponding button is located below button 9) and which, according to Recommendation Q.23, is used to transmit the frequency pair 941 Hz and 1209 Hz, should have a shape easily identified as the general shape shown in Figure 3/Q.11.

FIGURE 3/Q.11

The symbol will be known as the *star* as translated in the various languages.

On the 4 × 3 array, the symbol on the button which is immediately to the right of the button 0 (in the 6 × 2 array, the corresponding button is located below the button 0) and which, according to Recommendation Q.23, is used to transmit the frequency pair 941 Hz and 1477 Hz, should conform in shape to the specifications given in Figures 4/Q.11 or 5/Q.11. This symbol shall consist of four lines of equal length (*b*), forming two pairs of parallel lines. One pair is horizontal while the other is vertical or inclined to the right at an angle α of 80° as shown in Figure 5/Q.11. It will be seen that the two pairs of parallel lines overlap. The ratio a/b, where a is the overlap, shall be between 0.08 and 0.18.

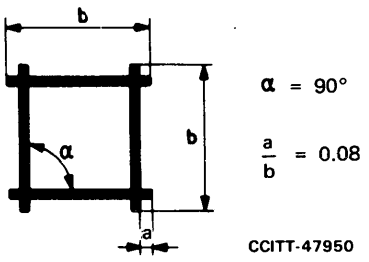

FIGURE 4/Q.11

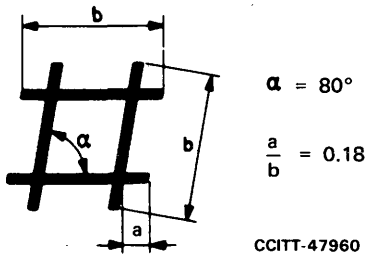

FIGURE 5/Q.11

The preferred values are:

– in Europe [3]:

  $\alpha = 90°$ with $a/b = 0.08$

– in North America [3]:

  $\alpha = 80°$ with a/b close to the upper limit of 0.18.

The symbol will be known as the *square* or the most commonly used equivalent term in other languages [4].

The additional buttons with these symbols will be placed as shown below:

Standard 4 × 3 array	6 × 2 array
1 2 3	1 2
4 5 6	3 4
7 8 9	5 6
* 0 #	7 8
	9 0
	* #

3.3 *16-pushbutton sets*

3.3.1 *Arrangement*

In the 16-pushbutton set, the 4 × 3 array shown in § 3.2.2 above is extended by four additional pushbuttons placed to the right in such a way as to form a 4 × 4 array.

3.3.2 *Symbols*

On the 4 × 4 array, the symbols on the additional buttons are A, B, C and D [5]. (The reasons for the choice of these four symbols are explained in Annex A.)

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[3] No information is available at the present time as to which of these values would be preferred in other continents.

[4] In some countries an alternative term (e.g. "number sign"), may be necessary for this purpose, unless further investigation indicates that "square" is suitable for the customer.

[5] If letters still appear on buttons 1 to 0 of the pushbutton set when 16-pushbutton sets are introduced, Administrations may choose to use the lower case letters a, b, c, d rather than the upper case letters until such a time as it is possible to remove the alphabetic characters from buttons 1 to 0.

A is the symbol for the button to the right of pushbutton 3 and is used to transmit the frequency pair 697 Hz and 1633 Hz [6].

B is the symbol for the button to the right of pushbutton 6 and is used to transmit the frequency pair 770 Hz and 1633 Hz [6].

C is the symbol for the button to the right of pushbutton 9 and is used to transmit the frequency pair 852 Hz and 1633 Hz [6].

D is the symbol for the button to the right of pushbutton # and is used to transmit the frequency pair 941 Hz and 1633 Hz [6].

In order to avoid any possibility of auditory confusion in transmitting these letters over international telephone lines the phonetic equivalents:

Amsterdam	or	Alfred
Baltimore		Benjamin
Casablanca		Charles
Denmark		David

as already used in international telephone working, are recommended for identifying the letters A, B, C, D.

The additional buttons with these symbols will be placed as shown below [7]:

1 2 3 A

4 5 6 B

7 8 9 C

*** 0 # D**

3.4 *Design of symbols*

Symbol size and the line thickness should be appropriate to provide optimal recognition [8].

3.5 *Use of colours*

The question of standardization of pushbutton and symbol colour for international purposes is still not settled. In the meantime, colours different from the digit buttons and symbols should not be used [8], [9].

4 Additional pushbuttons for use on telephones

4.1 *General*

For purposes other than dialling, additional pushbuttons may be required on a telephone. For example, a telephone may have a pushbutton to recall during an active call, control logic (e.g. a register) or an operator, or to effect the transfer of an active call to another station. To prevent subscriber confusion it may be desirable that the symbols used on those pushbuttons which have identical functions be standardized.

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6) These are the frequency pairs specified for the right-hand column as indicated in Recommendation Q.23.

7) Some Administrations may wish to provide spatial separation for special reasons between buttons A, B, C, D and the other twelve buttons.

8) Where exceptionally, for national purposes, Administrations use colours for the * and # symbols which are different from those used for the digit symbols, they should be red and blue respectively.

9) Further study may show whether some form of perceptual separation, such as colour or size, is required between the pushbuttons A, B, C, D and the other twelve pushbuttons.

4.2 *Specific recommendations*

4.2.1 *Register recall pushbutton*

For the recall of a register during an active call the following methods are possible:

– a switchhook flash,

– a depression of one of the pushbuttons of the normal 10, 12 or 16 button array,

– a depression of another pushbutton specially provided for this purpose, the register recall pushbutton.

From the human factors viewpoint the depression of a pushbutton for register recall seems to be preferable to the use of a switchhook flash.

If a special register recall pushbutton is used, this pushbutton should be designated with the symbol R (capital) on or next to the pushbutton. The pushbutton should be clearly distinguishable and spatially separated from the standard 12 or 16-pushbutton array.

This symbol is recommended because:

a) it symbolizes the term "Recall" in a number of languages;

b) studies have shown that it is subject to minimal auditory and visual confusion;

c) it avoids the difficulties inherent in specific technical terms for any lay subscribers.

The exact position, shape and colour of the button should not be standardized at the present time. Such standardization would inhibit design innovation and be unnecessarily restrictive.

ANNEX A

(to Recommendation Q.11)

Method used in selecting the symbols for pushbuttons 13 to 16 of 16-pushbutton telephone sets

During its Montreal meeting in June-July 1970, Study Group II agreed that a study had to be undertaken forthwith in order to choose suitable symbols for pushbuttons 13 to 16 of the 16-pushbutton set. The matter was considered urgent because at that time 16-pushbutton telephone sets were commercially available and various manufacturers had expressed an interest in their production. Standardization of the symbols was immediately needed to guide manufacturers before a large number of unstandardized sets was produced, that is, using different symbols or symbols that do not satisfy elementary human factor rules.

Pushbutton sets, it was noted, could be used not only for communications between subscribers but also for other purposes, e.g. for end-to-end data transmission. A large number of possible applications is envisaged. Many telephone and data applications, or functions, are not yet known but are likely to appear in the future when 16-pushbutton sets are introduced. These considerations led the CCITT to decide that the symbols for the pushbuttons 13 to 16 should not have any special meaning related to the functions of the pushbuttons.

A variety of symbols was considered during the studies made from 1970 to 1972. However, it appeared that only a set of four letters of the Latin alphabet satisfies most of the requirements mentioned in the Annex A to Recommendation E.123 [1], "Desirable properties of diallable symbols". In short, these desirable properties are:

1) distinct from other diallable symbols,

2) widely known by name,

3) reproducible,

4) CCITT-ISO compatible,

5) made up of a single character,

6) abstract,

7) immediately recognizable as a diallable character.

A test programme was designed in 1970 to find the most suitable set of four letters. This included a study of auditory and visual confusion between letters and the existing digits and symbols for the pushbuttons 1 to 12. Eight countries participated in the auditory tests and eight in the visual confusion tests. In addition, configuration (layout) tests were performed in seven countries.

The countries participating in the auditory confusion tests were: Australia, Denmark, Finland, Federal Republic of Germany, Japan, Sweden, United Kingdom (British Telecom), and United States of America (AT&T).

The countries participating in the visual confusion tests were: Canada, Denmark, Finland, Federal Republic of Germany, Italy, Sweden, United Kingdom (British Telecom), and United States of America (AT&T).

The countries participating in the configuration (layout) tests were: Canada, Japan, Federal Republic of Germany (Siemens), Netherlands (PTT/IPO), Sweden, United Kingdom (British Telecom), and United States of America (AT&T).

The results of the configuration tests showed a small decrement in the dialling performance with a 16-pushbutton set as compared to a standard 12-pushbutton set which, however, is not statistically significant. In these tests, pushbuttons 13 to 16 were labelled A, B, C, and D.

The results of the three types of tests were examined together with considerations of other desirable properties of the symbol set, e.g.:

1) simplicity for the user,

2) a logical sequence,

3) ease of recognition in as many countries as possible,

4) possibility of extending the set of symbols.

It was then agreed that the series of letters A, B, C, D was the most satisfactory from a general point of view.

Reference

[1] CCITT Recommendation *The use and printing of symbols and separators in national and international telephone numbers*, Vol. II, Fascicle II.2, Rec. E.123.

Recommendation Q.11 *bis* [1]

NUMBERING PLAN FOR THE INTERNATIONAL TELEPHONE SERVICE

1 National numbering plan

1.1 Each telephone Administration should give the most careful consideration to the preparation of a *national numbering plan* [2] for its own network. This plan should be designed so that a subscriber is always called by the same number in the trunk service. It should be applicable to all incoming international calls.

1.2 *Number analysis*

1.2.1 The national numbering plan of a country should be such that an analysis of a minimum number of digits of the national (significant) number (see definitions in Recommendation E.160 [2]):

a) gives the most economical routing of incoming international traffic from various other countries;

b) indicates the charging area in those countries where there are several.

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[1] This Recommendation is also included in the Series E Recommendations under the number E.163 (Fascicle II.2).

[2] See the CCITT manual cited in [1] for a comprehensive study of national numbering plans from the national point of view.

1.2.2 In the case of a country with a two- or three-digit country code, not more than two digits of the national (significant) number should be analyzed for these purposes.

In the case of a country with a one-digit country code, not more than the three digits of the national (significant) number should be analyzed for these purposes.

1.2.3 In the case where an integrated numbering plan covers a group of countries, the digit analysis specified in § 1.2.2 should also determine the country of destination.

1.2.4 For the requirements relating to frontier traffic, see Recommendation D.390 R [3].

2 Limitation of the number of digits to be dialled by subscribers

2.1 *International number*

The CCITT recommended in 1964 that the number of digits to be dialled by subscribers in the automatic international service should not be more than 12 (excluding the international prefix). It is emphasized that this is the maximum number of digits and Administrations are invited to do their utmost to limit the digits to be dialled to the smallest possible number.

2.2 *National (significant) number*

Noting that:

a) the international number (excluding the international prefix) consists of the country code followed by the national (significant) number;

b) the smallest possible number of digits to be dialled in the automatic international service is achieved by limiting the number of digits of the country code and/or of the national (significant) number;

c) in some countries where telephony is already developed to an advanced stage, the national numbering plans in force enable the number of digits of the international number to be limited to less than 12;

d) some other countries which drew up their national numbering plans some time before 1964 have taken steps to ensure that the number of digits of the international number will not exceed 12 and may even be less;

the CCITT recommends that the number of digits of the national (significant) number should be equal to a maximum of $12 - n$, where n is the number of digits of the country code.

3 Digit capacity of international registers

The CCITT considers it advisable to recommend that the digit capacity of registers dealing with international traffic should allow for future conditions that may arise, but not possible to specify at the present time. In this regard, registers dealing with international traffic should have a digit capacity, or a capacity that can be expanded, to cater for more than the maximum 12-digit international number envisaged at present. The increase in the number of digits above 12 is left as a matter of decision to be taken by individual Administrations. Administrations are recommended, when making such a decision, to take account of the new applications likely to be introduced in the international service, and which are now being studied by the CCITT.

4 Prefixes and codes

4.1 *International prefix* [3)]

It is recommended by the CCITT that the Administrations of countries that have not yet introduced automatic international operation, or Administrations that are, for various reasons, revising their numbering plans should adopt an international prefix (a code for access to the international automatic network) composed of the two digits 00.

The reasons for this recommendation are:

– to provide a maximum degree of standardization such that dialling is made as easy as possible for a person travelling in different countries (many countries already use the code 00),

3) See definitions in Recommendation E.160 [2].

- to minimize the number of digits to be dialled in automatic international operation,
- to simplify, for a future time when the use of the international prefix might have become a universal international standard, the format for writing an international telephone number.

4.2 *Country code* [3), 4)]

4.2.1 Country codes will be used:

- in semiautomatic operation, to route calls to the required country when the calls are transit calls or when, on the outgoing positions, there is common dialling access to all the outgoing routes;
- in automatic operation.

4.2.2 A list of country codes was prepared by the CCITT within the framework of a worldwide automatic telephone numbering plan.

This list was set up according to the following principles:

a) The number of digits of the country code is one, two or three according to the foreseeable telephonic and demographic development of the country concerned.

b) The nine digits from 1 to 9 have been allocated as the country code or as the first digit of the country code. These digits define *world numbering zones.*

c) In the case of Europe, owing to the large number of countries requiring two-digit codes, the two digits 3 and 4 have been allocated as the first digit of the country codes.

4.2.3 The list of country codes already assigned is given in Annex A.

4.3 *Assignment of country codes*

4.3.1 The existing world numbering plan should be maintained and codes presently assigned should not be changed, unless consolidation of an existing numbered area yields an advantage in terms of code usage.

4.3.2 All spare country codes will be assigned on a 3-digit basis, as detailed in Annex B. The list of spare country codes for the international semiautomatic and automatic service is given in Annex C.

4.3.3 In the case where all the country codes in a world numbering zone have been assigned and an additional code is required in that zone, a spare country code from another world numbering zone can be used in accordance with the following rules:

4.3.3.1 Preference should be given to the assignment of a spare country code from an adjacent world numbering zone.

4.3.3.2 If spare codes are not available from an adjacent world numbering zone, assignments will be made from the zones with the most spare codes.

4.4 *Codes for new international services*

The introduction of some international services requires the allocation of a country code. In such cases, the assignment of a country code will be determined by the rules detailed in Annex B.

4.5 *Trunk prefix* [3)]

4.5.1 The *national (significant) number* (see definition 6 of Recommendation E.160 [2]) does not include the trunk prefix. Accordingly, in the international service, the trunk prefix of the country of destination must not be dialled.

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3) See definitions in Recommendation E.160 [2].

4) A "country code" may be assigned either to an individual country or to a geographical area.

It should be noted that, in some countries, it is customary to consider *for national purposes* that the trunk prefix is included in the national number [which is then not the national (significant) number]. A careful distinction must therefore be made between such national definition or practice and the CCITT definition, which is internationally valid. In order to avoid misunderstanding, the CCITT definition includes the word "significant" between brackets, reading as follows: "national (significant) number".

4.5.2 It is recommended by the CCITT that the Administrations of countries that have not yet adopted a trunk prefix for access to their national automatic trunk network should adopt a prefix composed of a single digit, preferably 0. Irrespective of what digit is adopted as a trunk prefix, this digit should be precluded from being used also as a first digit of the trunk codes.

The reasons for this recommendation are:

- to provide the maximum degree of standardization of the trunk prefixes used in different countries, so that dialling is made as easy as possible for a person travelling from one country to another,
- to minimize the number of digits to be dialled in the automatic national service,
- to reduce user problems which arise because of the requirement, in automatic international operation, that the trunk prefix of the country of destination must not be dialled.

4.5.3 In the automatic international service, following the international prefix and country code of the called country, the caller should dial the national (significant) number of the called subscriber (i.e. without dialling the trunk prefix).

4.5.4 The use and printing of symbols and separators in national and international telephone numbers is detailed in Recommendation E.123 [4].

ANNEX A

(to Recommendation Q.11 *bis*)

List of country codes incorporating amendments proposed by the World Plan Committee, Paris, 1980

World numbering ZONE 1

Canada	1 [a]	Bermuda	1 [a]
St. Pierre and Miquelon (French Department of)	1 [a]	Bahamas (Commonwealth of the)	1 [a]
United States of America, including		Dominican Republic	1 [a]
Puerto Rico and the Virgin Islands	1 [a]	Grenada	1 [a]
Jamaica	1 [a]	Montserrat	1 [a]
Barbados	1 [a]	St. Kitts	1 [a]
Antigua	1 [a]	St. Lucia	1 [a]
Cayman Islands	1 [a]	St. Vincent	1 [a]
British Virgin Islands	1 [a]		

[a] Integrated numbering area

World numbering ZONE 2

Egypt (Arab Republic of)	20
Morocco (Kingdom of)	21 [a]
Algeria (Algerian Democratic and Popular Republic)	21 [a]
Tunisia	21 [a]
Libya (Socialist People's Libyan Arab Jamahiriya)	21 [a]
Gambia (Republic of the)	220
Senegal (Republic of)	221
Mauritania (Islamic Republic of)	222
Mali (Republic of)	223
Guinea (Revolutionary People's Republic of)	224
Ivory Coast (Republic of the)	225
Upper Volta (Republic of)	226
Niger (Republic of the)	227
Togolese Republic	228
Benin (People's Republic of)	229
Mauritius	230
Liberia (Republic of)	231
Sierra Leone	232
Ghana	233
Nigeria (Federal Republic of)	234
Chad (Republic of the)	235
Central African Republic	236
Cameroon (United Republic of)	237
Cape Verde (Republic of)	238
Sao Tome and Principe Democratic Republic of)	239
Equatorial Guinea (Republic of)	240
Gabon Republic	241
Congo (People's Republic of the)	242
Zaire (Republic of)	243
Angola (People's Republic of)	244
Guinea-Bissau (Republic of)	245
Seychelles (Republic of)	248
Sudan (Democratic Republic of the)	249
Rwanda (Republic of)	250
Ethiopia	251
Somali Democratic Republic	252
Djibouti (Republic of)	253
Kenya (Republic of)	254
Tanzania (United Republic of)	255
Uganda (Republic of)	256
Burundi (Republic of)	257
Mozambique (People's Republic of)	258
Zanzibar (Tanzania)	259
Zambia (Republic of)	260
Madagascar (Democratic Republic of)	261
Reunion (French Department of)	262
Zimbabwe (Republic of)	263
Namibia	264
Malawi	265
Lesotho (Kingdom of)	266
Botswana (Republic of)	267
Swaziland (Kingdom of)	268
Comoros (Federal and Islamic Republic of the)	269
South Africa (Republic of)	27

Spare codes 246, 247
280, 281, 282, 283, 284, 285, 286, 287, 288, 289
290, 291, 292, 293, 294, 295, 296, 297, 298, 299

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[a] *Integrated numbering area with subdivisions:*

- Morocco: 210, 211, 212 (212 in service);
- Algeria: 213, 214, 215;
- Tunisia: 216, 217;
- Libya: 218, 219.

World numbering ZONES 3 and 4

Greece	30
Netherlands (Kingdom of the)	31
Belgium	32
France	33 [a]
Monaco	33 [a]
Spain	34
Hungarian People's Republic	36
German Democratic Republic	37
Yugoslavia (Socialist Federal Republic of)	38
Italy	39
Romania (Socialist Republic of)	40
Switzerland (Confederation of)	41 [a]
Liechtenstein (Principality of)	41 [a]
Czechoslovak Socialist Republic	42
Austria	43
United Kingdom of Great Britain and Northern Ireland	44
Denmark	45
Sweden	46
Norway	47
Poland (People's Republic of)	48
Germany (Federal Republic of)	49
Gibraltar	350
Portugal	351
Luxembourg	352
Ireland	353
Iceland	354
Albania (Socialist People's Republic of)	355
Malta (Republic of)	356
Cyprus (Republic of)	357
Finland	358
Bulgaria (People's Republic of)	359

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[a] Integrated numbering plan.

World numbering ZONE 5

Belize	501	Chile	56
Guatemala (Republic of)	502	Colombia (Republic of)	57
El Salvador (Republic of)	503	Venezuela (Republic of)	58
Honduras (Republic of)	504	Guadeloupe (French Department of)	590
Nicaragua	505	Bolivia (Republic of)	591
Costa Rica	506	Guyana	592
Panama (Republic of)	507	Ecuador	593
Haiti (Republic of)	509	Guiana (French Department of)	594
Peru	51	Paraguay (Republic of)	595
Mexico	52	Martinique (French Department of)	596
Cuba	53	Suriname (Republic of)	597
Argentine Republic	54	Uruguay (Oriental Republic of)	598
Brazil (Federative Republic of)	55	Netherlands Antilles	599

Spare codes 500, 508

World numbering ZONE 6

Malaysia	60	Solomon Islands	677
Australia	61	New Hebrides	678
Indonesia (Republic of)	62	Fiji	679
Philippines (Republic of the)	63	Wallis and Futuna	681
New Zealand	64	Cook Islands	682
Singapore (Republic of)	65	Niue Island	683
Thailand	66	American Samoa	684
Guam	671	Western Samoa	685
Brunei	673	Kiribati Republic	686
Nauru (Republic of)	674	New Caledonia and Dependencies	687
Papua New Guinea	675	Tuvalu	688
Tonga (Kingdom of)	676	French Polynesia	689

Spare codes 670, 672
680
690, 691, 692, 693, 694, 695, 696, 697, 698, 699

World numbering ZONE 7

Union of Soviet Socialist Republics 7

World numbering ZONE 8

Japan	81	Democratic Kampuchea	855
Korea (Republic of)	82	Lao People's Democratic Republic	856
Viet Nam (Socialist Republic of)	84	China (People's Republic of)	86
Hong-Kong	852	Maritime Mobile Service	87 [a]
Macao	853	Bangladesh (People's Republic of)	880 [b]

Spare codes 800, 801, 802, 803, 804, 805, 806, 807, 808, 809
830, 831, 832, 833, 834, 835, 836, 837, 838, 839
850, 851, 854, 857, 858, 859
890, 891, 892, 893, 894, 895, 896, 897, 898, 899

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[a] The country code 87 is reserved for the Maritime Mobile Service. The following three digit country codes are assigned: 871 Marisat (Atlantic), 872 Marisat (Pacific), 873 Marisat (Indian Ocean).

[b] The remaining combinations in series 88 will not be allocated until the stock of spare 3-digit codes for the region is exhausted.

Turkey	90	Kuwait (State of)	965
India (Republic of)	91	Saudi Arabia (Kingdom of)	966
Pakistan (Islamic Republic of)	92	Yemen Arab Republic	967
Afghanistan (Democratic Republic of)	93	Oman (Sultanate of)	968
Sri Lanka (Democratic Socialist Republic of)	94	Yemen (People's Democratic Republic of)	969
Burma (Socialist Republic of the Union of)	95	United Arab Emirates [a]	971
Maldives (Republic of)	960	Israel (State of)	972
Lebanon	961	Bahrain (State of)	973
Jordan (Hashemite Kingdom of)	962	Qatar (State of)	974
Syrian Arab Republic	963	Mongolian People's Republic	976
Iraq (Republic of)	964	Nepal	977
		Iran	98

Spare codes 970, 975, 978, 979
990, 991, 992, 993, 994, 995, 996, 997, 998, 999

[a] E.A.U.: Abu Dhabi, Ajman, Dubai, Fujeirah, Ras Al Khaimah, Sharjah, Umm Al Quwain.

ANNEX B

(to Recommendation Q.11 *bis*)

Rules for the assignment of spare country codes

The rules listed in this annex are provided as a basis for the most effective utilization of the spare country codes.

B.1 Single isolated 3-digit codes should be assigned prior to the assignment of any 3-digit code which is part of a series of more than two consecutive 3-digit codes.

B.2 In zones 2, 6, 8 and 9, a group of 10 consecutive 3-digit codes should be retained as the last choice for assignment, e.g. 690 to 699 inclusively.

B.3 The assignment of spare codes of a zone, both within that zone and also to another zone, will take place as follows:

a) When assigning a code to a country in the same zone:

start with the lowest numbered 3-digit codes in ascending order, e.g. 670, 680 ...

b) When assigning a code to a country in another zone:

start with the highest numbered 3-digit codes in descending order, e.g. 688, 685 ...

c) Within code 87 reserved for the Maritime Mobile Service a third digit will be assigned to codes used for maritime satellite ocean area systems, with the restriction that codes 878 and 879 may not be touched because they are reserved for national purposes.

B.4 Country codes for new international services or for the automation of some existing services should be taken from the world numbering zone with the most spare codes.

ANNEX C

(to Recommendation Q.11 *bis*)

List of spare country codes for the international semiautomatic and automatic service

Spare codes 246, 247
280, 281, 282, 283, 284, 285, 286, 287, 288, 289
290, 291, 292, 293, 294, 295, 296, 297, 298, 299
500, 508
670, 672
680
690, 691, 692, 693, 694, 695, 696, 697, 698, 699
800, 801, 802, 803, 804, 805, 806, 807, 808, 809
830, 831, 832, 833, 834, 835, 836, 837, 838, 839
850, 851, 854, 857, 858, 859
890, 891, 892, 893, 894, 895, 896, 897, 898, 899
970, 975, 978, 979
990, 991, 992, 993, 994, 995, 996, 997, 998, 999

References

[1] CCITT manual *National telephone networks for the automatic service*, ITU, Geneva, 1964, 1968, 1978.

[2] CCITT Recommendation *Definitions relating to national and international numbering plans*, Vol. II, Fascicle II.2, Rec. E.160.

[3] CCITT Recommendation *Accounting system in the international automatic telephone service*, Vol. II, Fascicle II.1, Rec. D.390 R.

[4] CCITT Recommendation *The use and printing of symbols and separators in national and international telephone numbers*, Vol. II, Fascicle II.2, Rec. E.123.

Recommendation Q.11 *ter* [1]

SHIP STATION IDENTIFICATION FOR VHF/UHF AND MARITIME MOBILE-SATELLITE SERVICES

(Geneva, 1980)

1 Introduction

1.1 The purpose of this Recommendation is to specify a method by which an internationally unique ship station identification may be assigned to all the ships participating in the Maritime Mobile Services, and to facilitate the introduction of international automatic VHF/UHF and Satellite Maritime Services.

1.2 *Terminology*

The following terms are used in this Recommendation:

a) **Maritime Mobile (Terrestrial) Service**

F: service mobile maritime (de Terre)

S: servicio móvil marítimo (terrenal)

Conventional Maritime Mobile Services such as the HF Maritime Service, the MF Maritime Service and the VHF Maritime Service (as defined in the *Radio Regulations* [1]).

Maritime Mobile-Satellite Service

F: service mobile maritime par satellite

S: servicio móvil marítimo por satélite

As defined in the *Radio Regulations* [1].

b) **coast station**

F: station côtière

S: estación costera

Radio station on land in the Maritime Mobile (Terrestrial) Service.

shore station

F: station terrienne côtière

S: estación terrena costera

Earth station on land in the Maritime Mobile-Satellite Service.

c) **ship station identity**

F: identité de la station de navire

S: identidad de estación de barco

The ship's identification $X_1, X_2 \ldots X_k$ transmitted on the radio path.

ship station number

F: numéro de station de navire

S: número de estación de barco

The number that identifies a ship for access from a public network and forms part of the international number to be dialled or keyed by a public network subscriber.

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[1] This Recommendation is also included in the Series E and F Recommendations under the numbers E.210 (Fascicle II.2) and F.120 (Fascicle II.4).

d) **coast (shore) station identity**

F: identité de la station côtière (terrienne)

S: identidad de estación costera (terrena costera)

The coast (shore) station identification X_1, X_2 ... X_k transmitted on the radio path.

1.3 *Basic considerations*

The considerations that form the basis of this ship station identification system are:

a) that every ship shall have a unique ship station identity;

b) that the same unique ship station identity should be used in both VHF/UHF and Maritime Mobile-Satellite Systems;

c) that the same unique ship station identity should be used for all telecommunication services, particularly for radiotelex and radiotelephony;

d) that it is desirable that the ship station number and the ship station identity be the same;

e) that the capacity of the ship station identification system shall be sufficient to admit all ships wanting, or required, to participate in the various Maritime Mobile Services at present and in the foreseeable future;

f) that access to Maritime Mobile Services via the existing international network in automatic operation should follow the relevant and appropriate CCITT Recommendations;

g) that the ship identity system shall be a numerical system, and should use the full range of decimal digits;

h) that two or three of the digits, $X_1X_2X_3$, of the ship station identity shall indicate the ship's nationality;

i) that there are important differences in national networks that promote different approaches to automation of Maritime Mobile Services;

j) that a numerical assignment plan should consider current telephone and telegraph network limitations while it permits change to support future requirements.

2 Ship station identification

2.1 *Ship station identity* [2), 3)]

Ship station identity is established as nine digits. It should be assigned to take into account the implications relating to it in the public switched networks.

$$X_1X_2X_3X_4X_5X_6X_7X_8X_9$$

The initial three digits define the nationality of the ship as indicated in the following sections.

2.2 *Ship station number*

The ship station number defines the ship station within the public switched network and this information is transmitted to a coast or shore station. In the VHF/UHF Maritime Service the ship station number may be different from the ship station identity to relate to national network needs.

3 Assignment of ship station identification

3.1 *Assignment of blocks of numbers*

Blocks of numbers should be assigned to countries so that individual Administrations may systematically assign ship station identities within those blocks.

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2) A seven-digit ship station identity is used in the current generation of the Maritime Satellite System.

3) Some international telex centres are limited to seven digits.

3.2 *Identification of ship's geographical region*

The first digit of each ship station identity is intended to identify the geographical region to which the nationality (registry) of the ship relates. Only the digits 2 through 7 are used for this purpose to identify easily the world's regions as follows:

2 – Europe
3 – North America
4 – Asia (except Southeast Asia)
5 – Oceania and Southeast Asia
6 – Africa
7 – South America.

Arrangements may therefore be made to systematically assign a ship station identity to each ship as soon as national blocks are allocated. The digits zero (0), one (1), eight (8) and nine (9) are allocated for other purposes as indicated below.

3.3 *Identification of ship's nationality*

Since blocks of the ship station identities would be systematically assigned by country, a ship's nationality can be determined by analyzing the first three digits of its ship station identity.

The digits to be analyzed are called Nationality Identification Digits (NID). Examples of the nationality identification digits for ships are given in Table 1/Q.11 *ter*.

TABLE 1/Q.11 *ter*

Country	Nationality identification digits (NID)	Ship station identities
P	231	from 231 000 000 to 231 999 999
Q	233, 234	from 233 000 000 to 234 999 999
R	236, 237 238	from 236 000 000 to 238 999 999
S	240 - 249	from 240 000 000 to 249 999 999

4 Assignment of nationality identification digits

Each NID represents a discrete capacity assigned according to a plan that relates assigned capacity to ship population. The plan is to be developed by a competent World Administrative Radio Conference (WARC) and administered by the Secretary-General of the ITU.

5 Group calls

$X_1 = 0$, $X_2 = 1$ to 9 are assigned to indicate a group call to a group of ships having a community of interest. Such calls may be barred in the public switched network and/or at the coast/shore stations. Control of group calls may also be achieved by the use of special group service access to the coast/shore stations.

6 Coast/shore station identity

$X_1 = 0$, $X_2 = 0$ are assigned to indicate coast/shore station identities. The use of such identities may be barred in the public switched network and/or the coast/shore stations.

7 Future expansion of the ship station identification system

X_1 = 1 as in the format 1 XXXXXXXX has been reserved for future expansion.

8 Evolutionary expansion of ship station identities as applied to Maritime Mobile (Terrestrial) Services

8.1 The plan permits the identification of ships whose communications requirements are inter-regional, regional or national. The plan is intended to allow the automation of Maritime Mobile Services on public switched networks, where feasible, as the demand for ship station identities increases for the automatic service. This demand is considered in stages defined by the number of digits in ship station numbers required to satisfy automatic communication needs. A minimum number of digits is used for *ship station numbers* at any given time to permit countries with network restrictions to provide a maximum of automation. Trailing zeros are added to the ship station numbers (received from an automatic network) to form nine-digit ship station identities on the radio path. The $X_1X_2X_3$ digits are shown as nationality identification digits in Table 2/Q.11 *ter*.

TABLE 2/Q.11 *ter*

Stage	Ship station number	Digits on the automatic network	Ship station identity	Digits on the radio path
1	NID $X_4X_5X_6$	6	NID $X_4X_5X_6$ 000	9
2	NID $X_4X_5X_6X_7$	7 a) b)	NID $X_4X_5X_6X_7$ 00	9
3	NID $X_4X_5X_6X_7X_8$	8	NID $X_4X_5X_6X_7X_8$ 0	9

a) Due to network limitations, some countries may choose to withhold the first digit of the NID and insert it automatically at the coast station to retain automatic access to all ships whose NIDs have identical first digits (ships of the same geographical area). However, the application of this technique should be avoided if possible to minimize ambiguity.

b) X_2 = 8 and 9 should only be assigned when requirements have made it absolutely necessary. This will permit those countries that cannot yet transmit a 7-digit ship station number in stage 2 to use the abbreviated regional and national numbers 8Y and 9 according to § 8.3 for as long as the digits X_2 = 8 and 9 have not been assigned in the area of their X_1.

8.2 In stage 1, those countries that would identify VHF/UHF calls and plan to automate VHF in a single stage of subscriber selection would have full access to all ships if they were able to assign six digits to ship station numbering in their networks. The plan contemplates mutual cooperation to extend this stage as long as possible by judicious ship station identity assignments to satisfy requirements for automatic VHF/UHF in the face of network limitations.

8.3 Additional ship station numbering techniques may be used to expand network access to more ship stations in stages 1 and 2. These techniques permit an extension of the time periods during which stages 1 and 2 apply. For example:

Ship station number	*Ship station identity*
8Y $X_4X_5X_6X_7$	$N_yI_yD_y$ $X_4X_5X_6X_7$ 00
9 $X_4X_5X_6X_7X_8$	$N_nI_nD_n$ $X_4X_5X_6X_7X_8$ 0

In this arrangement, the digits 8Y may be 80 to 89 to define as many as ten foreign NIDs (shown as $N_yI_yD_y$) to permit automatic calling of ships of particular nationalities. The coast station would be required to translate a given 8Y to a particular foreign NID. The digit 9 may be used to indicate the nationality identification digits for ships of the same nationality as the network and the coast station. The coast station would be required to translate 9 to one particular national NID (shown as $N_nI_nD_n$). National application of these techniques could be adopted to provide an efficient use of ship station numbers.

9 Ship station identity for the Maritime Mobile-Satellite Service

The international numbering plans would permit up to nine digits for ship station identity and ship station numbering to be used in association with country codes 87X for telephony and destination codes 58X for telex, where X may indicate ocean area or system.

10 Considerations related to ship station identity assignment

An efficient allocation of ship station identity will permit an extension of the time period in which stage 1 applies. The specific manner in which the optional techniques indicated in §§ 8.1 and 8.3 are applied depends on the needs of a given Administration to achieve an optimum result. Special consideration should be given to the assignment of ship station identities for ships engaged in regional and national traffic so that spare capacity remains available for inter-regional traffic when transition from stage 1 to stage 2 takes place.

ANNEX A

(to Recommendation Q.11 *ter*)

National network diversity and automation of VHF/UHF service

A.1 National network numbering and routing requirements provided to satisfy national subscriber population and service needs result in widely varying abilities to support automatic VHF/UHF service. The following diverse approaches have been recognized and should be expected.

A.1.1 The inability of some networks to carry as few as six digits for ship station number purposes will tend to defer automation indefinitely in some instances.

A.1.2 Some countries will find it practical to provide for automation on the basis of six digits for ship station numbering in accordance with the proposed plan in this Recommendation. When seven digits are required (in stage 2) the practice of not dialling the initial digit of the nationality identification digits may be adopted to maintain as much automation as feasible. Refer also to § 8.1.

A.1.3 Some countries may find it practical to use national network numbering to define ship station numbers that are translated to ship station identities at one or more coast stations and perhaps support this with locator services.

A.1.4 Some countries may find it practical to use two-stage selection, e.g. in the telephone service a second stage of subscriber dialling with multifrequency pushbutton equipment may be already available or provided specifically for subscribers particularly interested in maritime services.

A.1.5 Some countries may now, or later, provide for centralized maritime centres that may support automatic location and call routing facilities. The use of such maritime centres would enable the application of ship station numbers of up to nine digits between countries with such centres.

APPENDIX I

(to Recommendation Q.11 *ter*)

I.1 *CCIR draft Recommendation*

ASSIGNMENT AND USE OF MARITIME MOBILE SERVICE IDENTITIES

(Opinion 57, Decision 31)

The CCIR,

CONSIDERING

(a) the need for a unique ship identity for safety and telecommunication purposes;

(b) the need for this identity to be usable in automatic systems;

(c) that, in the interest of having a common address format for automatic systems, identities assigned to ship stations, coast stations and used for establishing group calls should be of a similar nature when transmitted over the radio path;

(d) Article 25 and Appendix 43 of the Radio Regulations;

(e) that it is highly desirable that the code which forms the ship identity or part thereof can be used by subscribers to the public switched networks for calling ships automatically;

(f) that the public switched networks in some countries have restrictions, with respect to the maximum number of digits that may be dialled or keyed to indicate ship station identity;

(g) that CCITT Recommendation Q.11 *ter** describes a ship station identification method which provides for this contingency;

(h) that whatever restrictions may be required should, in the interests of the development of automatic shore-to-ship operations, be as few as possible;

RECOMMENDS

1. that assignment of ship station identities should be in accordance with the Annexes 1 and 2 to this Recommendation;

2. that ship and coast stations using morse telegraphy may continue to use existing alphanumeric call signs;

3. that ship and coast stations using digital selective calling equipment in accordance with Recommendation 493-1 should use their 9-digit numerical identities transmitted as a 10-digit address/self-identity with a digit 0 added at the end of the identity;

4. that Administrations issuing 5-digit numbers according to Radio Regulation 5390/783A should, if possible, assign 9-digit numerical identities and 5-digit numbers in such a way that there is a clear relation between them;

5. that the present octal numbering system in use in an existing maritime mobile satellite system should be converted as early as feasible to a decimal system with 9-digit ship station identities;

6. that any future international automatic maritime telecommunication system should be designed to use the 9-digit ship station identities on the radio path.

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* This CCITT Recommendation will appear as an appendix to the present Recommendation. Reciprocally, the present Recommendation of the CCIR on the assignment and use of Maritime Mobile Service identities will appear as an appendix to the CCITT Recommendation on ship station identification for VHF/UHF and Maritime Mobile-Satellite Services.

ANNEX 1

(to the CCIR draft Recommendation)

ASSIGNMENT OF SHIP STATION IDENTIFICATION

1. Introduction

1.1 Every ship participating in the various maritime radio services shall be assigned a nine digit unique ship station identity in the format $N_1I_2D_3X_4X_5X_6X_7X_8X_9$ wherein the first three digits represent the Nationality Identification Digits.

1.2 Restrictions may apply with respect to the maximum number of digits which can be transmitted on some national telex and/or telephone networks for the purpose of ship station identification.

1.3 At present, the maximum number of digits that are able to be transmitted over the national networks of many countries for the purpose of determining ship station identity is six. The digits carried on the network to represent the ship station identity are referred to as the "ship station number" in this text and in the relevant CCITT Recommendation. The use of the techniques described below should make it possible for the coast stations of such countries to engage in the automatic connection of calls to ship stations.

1.4 To obtain the required nine digit ship station identity a series of trailing zeros is added to the ship station number by the coast station for shore originated automatic services, e.g.:

Ship station number	*Ship station identity*
$N_1I_2D_3X_4X_5X_6$	$N_1I_2D_3X_4X_5X_6 0_7 0_8 0_9$

2. As long as the restrictions in Section 1 apply in one's own network limiting ship station numbers to 6 digits, ships that intend to receive automatic network traffic from national coast stations only, should be assigned identities wherein X_9, but not X_8, = 0. This assumes that "9" is used to abbreviate the national NID for such ships for network purposes.

Ship station number	*Ship station identity*
$9\ X_4X_5X_6X_7X_8$	$N_nI_nD_nX_4X_5X_6X_7X_8 0_9$

$N_nI_nD_n$ are the Nationality Identification Digits of one's own country. If a country has more than one NID, only one may be used for this purpose.

3. As long as the restrictions in paragraph 1 apply it may be useful for some Administrations to expand the capacity for numerical ship station identification by using as many as ten "8Y" abbreviations for NIDs.

Such a technique may allow the assignment of ship station identities wherein trailing zeros are applied only to X_8 and X_9.

Ship station number	*Ship station identity*
$8Y\ X_4X_5X_6X_7$	$N_1I_2D_3X_4X_5X_6X_7 0_8 0_9$

The usefulness of this technique to a given Administration may depend on whether its abbreviation (e.g. 83) of its own NID is duplicated in other Administrations in which some of its ships have a community of interest. When such is the case the ship in question can be called using the same ship station number in all the automatic networks of interest to that ship. As an example, a group of up to ten countries, with community of interest, might agree to assign the same abbreviation for their respective NIDs. The abbreviation should always relate to the numerically lowest NID, when more than one is assigned to a given country.

Country	*"8Y" Assignment*
A	80
B	81
C	82
D	83
E	84
F	85
G	86
H	87
I	88
J	89

(All countries recognize a particular 8Y abbreviation as associated with a particular country)

For example a coast station in any of the countries A to J receiving "83" as the first two digits of a ship station number would transmit the NID of country D.

4. As long as the restrictions in Section 1 apply, ships that require regular automatic communications from foreign coast stations additional to those that may conform to the abbreviation arrangement noted in Section 3 shall only be assigned ship station identities with $X_7X_8X_9 = 000$ to support 6 digit ship station numbers.

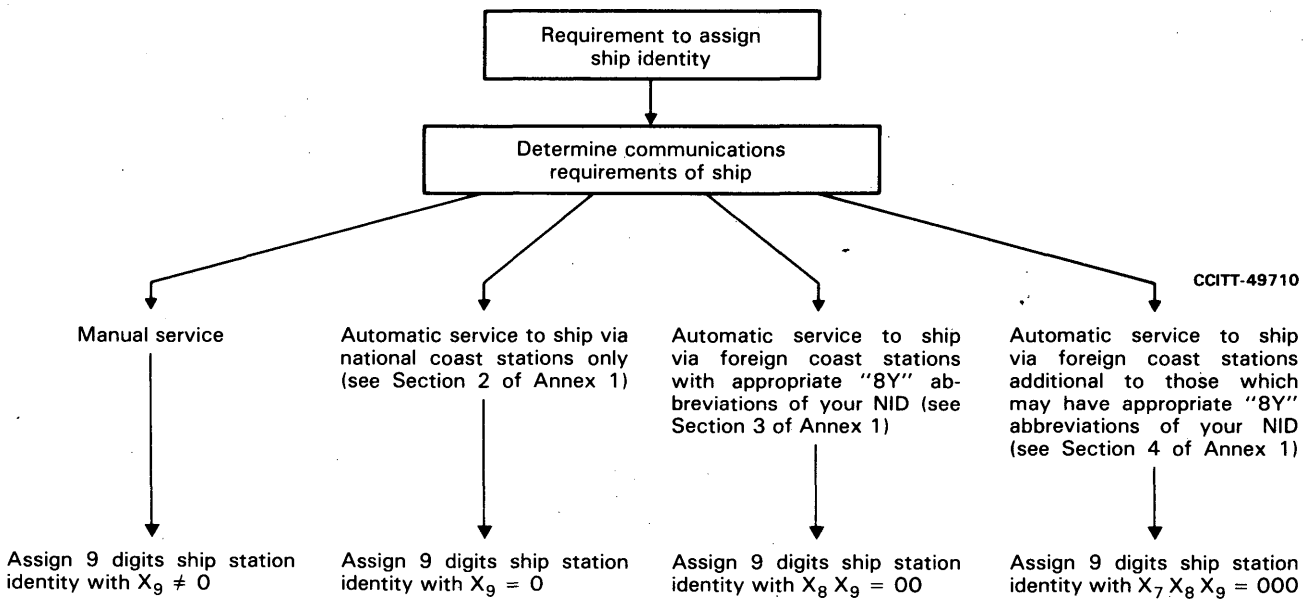
5. When it becomes necessary to progress to stage 2 *, in the ship station identity scheme, the format of ship station identities in Section 4 would change from $N_1I_2D_3X_4X_5X_6 0_7 0_8 0_9$ to $N_1I_2D_3X_4X_5X_6X_7 0_8 0_9$. If "8Y" abbreviations are used in stage 1 **, some ship station identity assignments will already have taken the $N_1I_2D_3X_4X_5X_6X_7 0_8 0_9$ format. It would therefore be useful to reserve at least one value in the X_7 digit position if ship station identity assignments are made on the basis of "8Y" network abbreviations:

Ship station number	*Ship station identity*
8Y $X_4X_5X_6X_7$	$N_1I_2D_3X_4X_5X_6X_7 0_8 0_9$

ANNEX 2

(to the draft CCIR Recommendation)

PROCEDURE FOR SELECTING NUMERICAL SHIP STATION IDENTITIES AS LONG AS NETWORK RESTRICTIONS APPLY



Reference

[1] *Radio Regulations*, ITU, Geneva, edition 1976, revised in 1979.

* Seven digit ship station numbers for automatic shore originated traffic.

** Six digit ship station numbers for automatic shore originated traffic.

Recommendation Q.11 *quater* [1]

NUMBERING AND DIALLING PROCEDURES FOR VHF/UHF AND MARITIME MOBILE-SATELLITE TELEPHONE SERVICES

(Geneva, 1980)

1 Introduction

1.1 *Purpose*

The purpose of this Recommendation is to standardize:

a) the numbering and dialling procedures for subscribers in the public switched telephone network calling ship stations in the VHF/UHF and Maritime Mobile-Satellite Telephone Services, and

b) the procedures for calling a subscriber, or an operator, in the public switched telephone network from ship stations. Adoption of such procedures will facilitate the introduction and development of automatic VHF/UHF and Maritime Mobile-Satellite Services.

1.2 *Related CCITT Recommendations*

Q.11 *ter*	(Recommendation on ship station identification).
E.160 [1] Q.11 Q.11 *bis*	(Numbering plan).
Q.13	(Routing plan).
Q.104	(Language or discriminating digit).

1.3 *Basic considerations*

The following basic considerations were taken into account when formulating the Recommendation:

i) Each ship will be allocated a unique 9-digit ship station identity according to the numbering scheme in Recommendation E.210 [2].

ii) It will be necessary to transmit the ship station identity, or part thereof (ship station number), through a diverse range of national and international telephone networks to facilitate automation of maritime mobile systems.

iii) Any routing and numbering technique adopted should require as little change as possible to national and international public switched telephone networks.

iv) It is desirable that a ship should possess one ship station identity for all telecommunications services (e.g. telephony, telex) and all maritime mobile systems (e.g. VHF/UHF and satellite).

2 Maritime Mobile-Satellite Service

2.1 *General*

2.1.1 Maritime Mobile-Satellite Services are international in nature and international procedures will be adopted to provide access to these services. For some purposes, a maritime mobile-satellite system can be regarded as analogous to a national network and the ship terminals as subscribers within that network.

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[1] This Recommendation is also included in the Series E Recommendations under the number E.211 (Fascicle II.2).

For automatic shore-originated calls, international dialling procedures will be adopted using an international prefix number, the 87 "country code" and a ship station number.

2.1.2 For automatic ship-originated calls to terrestrial subscribers, international dialling procedures will be used, including a standardized prefix, i.e. all ships in all ocean areas will use the same prefix to identify an automatic international call.

In addition, prefixes will be adopted to identify other functions for the satellite system.

Table 1/Q.11 *quater* lists the allocation of the prefixes for use when automatic ship-to-shore telephone service is introduced. Additional prefixes may be required and these can be added, using the spare decimal numeric combinations.

It is desirable to have one set of prefixes for all services (telephone, telex and data). The prefixes listed in Table 1/Q.11 *quater* can be used where applicable for telex and data services and if necessary, additional prefixes for these services may be assigned by the competent Study Group. Close cooperation between the competent Study Groups will be necessary when assigning new prefixes.

The use of some prefixes could be barred to some customers.

2.1.3 The prefixes will be sent over the radio path to the shore station but would not be used outside the satellite system. Hence, a prefix sent to the shore station would not be used in the international network.

2.2 *Procedures for shore-to-ship calls*

2.2.1 A shore based subscriber calling a ship in a maritime mobile-satellite system will dial a numbering sequence as follows:

Pi	International prefix
87	Maritime international code
S	Ocean area and satellite system
$NIDX_4$-X_n	Ship station number.

2.2.2 A discrimination digit will be inserted in the normal manner and will be regarded as following a 3-digit maritime country code (87S).

2.2.3 The numbering sequence requires the subscriber to know the satellite coverage area in which the ship is located.

2.2.4 The ship station number can be identical to the ship station identity.

2.3 *Procedures for ship-to-shore calls*

2.3.1 *Calling a terrestrial subscriber*

2.3.1.1 A shipboard subscriber will dial the prefix 00 followed by the full international telephone number required, whether or not the shore station is located in the called subscriber's country. Hence, the numbering sequence dialled by a ship board subscriber will be of the form:

00	Prefix for automatic call
I_1 I_2 I_3	1, 2 or 3 digit country code
N_1-N_n [2]	National significant number.

[2] The existing maritime mobile satellite system requires the use of an end-of-pulsing signal after the last digit of the national significant number.

TABLE 1/Q.11 *quater*

Allocation of telephone prefixes and telex access codes

Category	Prefix or Access code		Application	Remarks
	Digit 1	Digit 2		
Automatic calls (international)	0	0	Automatic calls using international number	
Automatic calls (national)	0		Automatic calls using national (significant) number	Not to be used for maritime satellite systems
Operator	1	1	International outgoing operator	These codes may be followed by 1-, 2- or 3-digit country codes (on an optional basis)
	1	2	International information service	
	1	3	National operator	For VHF/UHF use. Other applications are for further study
	1	4	National information service	
	1	5	Radiotelegram service	For further study
Automatic facilities	2 2	1 2	Reserved for telex service	
	2	3 - 9	Reserved for future use	
Specialized assistance	3	1	Maritime enquiries	Ship location, authorization, all telegrams, etc.
	3 3	2 3	Medical advice, etc. Technical assistance	Precise procedures to be specified after further study
	3 3	4 5	Person-to-person calls Collect calls	For telephone use only
	3 3	6 7	Credit card calls Time and charges requested at end of call	
	3 3	8 9	Medical assistance Maritime assistance TOW	Precise procedures to be specified after further study
Ship reporting facilities	4 4 4	1 2 3	Meteorological reports Navigational hazards and warnings Ship position reports	Precise procedures to be specified after further study
Information retrieval	5 5 5 5 5 5	1 2 3 4 5 6	Meteorological forecasts Navigational warnings VIDEOTEX (international) over telephone VIDEOTEX (national) over telephone network News (international) News (national)	Precise procedures to be specified after further study
Specialized use	6		Administration specialized use, e.g. leased lines	Digits following digit 6 will be allocated on a national basis
	7		Spare	
	8		Spare	
Test	9	X	Reserved for test numbers	

2.3.1.2 The maritime mobile terminal will permit the choice of shore station identity through which the call is to be routed. Convenient land-line routings (e.g. use of the shore station nearest the destination country) could be encouraged by tariff considerations.

2.3.1.3 A discrimination digit will be inserted automatically at the shore station according to Recommendation Q.104.

2.3.2 *Calling an operator* (see Recommendation Q.102)

2.3.2.1 A shipboard subscriber will dial an operator prefix, the second digit identifying the type of operator required.

2.3.2.2 The table below illustrates the principle involved for two types of operator:

Prefix		Optional	Type of Operator
Digit 1	*Digit 2*	Digits	
1	1	I_1 I_2 I_3	International outgoing operator
1	2	I_1 I_2 I_3	International information service.

Some Administrations may wish to operate a system whereby shipboard subscribers insert after the operator prefix a country code (I_1, I_2, I_3). The insertion of the country code will allow the call to be routed to a relevant operator. If an Administration operating such a system receives an operator prefix without the optional digits, then the call must still be connected to an appropriate operator. Similarly, if an Administration not operating such a system receives an operator prefix followed by optional digits, then the optional digits should be ignored and the call connected to the operator denoted by the prefix alone.

2.3.2.3 Each Administration may decide which operators to provide, where they are to be located and how the call would be routed. If a request is received from a ship for a type of operator that the Administration does not provide, then the call will be routed to an operator convenient for that Administration.

2.3.3 *Other prefixes in Table 1/Q.11 quater*

Each Administration may decide which services to provide and how the call would be routed. If a request is received from a ship for a service that the Administration does not provide, then the call will be routed to a location convenient for that Administration.

2.4 *Procedures for ship-to-ship calls*

2.4.1 Dialling procedures for ship-to-ship calls will be similar to those for ship-to-shore calls, using the maritime country code 87S. The numbering sequence dialled by the shipboard subscriber will be of the form:

00	Prefix for automatic call
87	Maritime international code
S	Ocean area and satellite system
NIDXXXXXX	Ship station number

This format will be used whether or not the ships are in the same ocean area.

2.4.2 Each Administration operating a shore station may decide whether to switch ship-to-ship traffic within an ocean area at the shore station or at an international switching centre.

3 VHF/UHF Maritime Mobile Service

3.1 *General*

VHF/UHF maritime mobile services are more localized than maritime mobile-satellite services. National procedures will be adopted to provide access to the VHF/UHF maritime mobile services.

3.2 *Procedures for shore-to-ship calls*

Individual Administrations will wish to automate their maritime services in their own timescales and to suit their own service requirements and network limitations. However, any scheme adopted by an Administration should be compatible with other schemes and should not inhibit progression towards a worldwide maritime service. In view of the restrictions imposed by national networks on shore originated calls, three levels of operation have been identified to ensure that future evolution of the service can take place.

3.2.1 *Level 1: Manual or single-operator service operation*

3.2.1.1 Some Administrations will operate the VHF/UHF service on a manual or single-operator basis (a single-operator service is one in which the coast station operator in one country corresponds with subscribers of another country or vice versa).

3.2.1.2 It will be necessary to ensure that the facilities are compatible with essential functions, e.g. distress, in any automatic scheme. Additional equipment could be required to cater for new ship calling arrangements and use of a worldwide numbering scheme.

3.2.2 *Level 2: Minimum automation*

3.2.2.1 The caller controls access to the relevant coast station and forwards the number of the required ship, i.e. there is no intelligent system in the network able to indicate the location of the ship. Hence, the customer is required to identify the location of the ship.

3.2.2.2 The level of automation requires a minimum of equipment, the required functions mainly consisting of interfacing with the network, call control, signalling over the radio channels and operational control of the radio channels. There would be a requirement to permit coexistence of the manual service and the automatic service.

3.2.2.3 An example of such a numbering sequence is given below. Access to coast stations is provided by dedicated number combinations taken from the national numbering plan.

Pi	International prefix
$I_1\ I_2$	1 or 2 digit country code
$N_1\ N_2$	Code to identify VHF/UHF service
$S_1\ S_2$	Code to identify coast station
NIDXXX	Ship station number.

The number of digits in the code $N_1\ N_2\ S_1\ S_2$ will vary from one country to another, but the maximum international significant number length of 12 digits must be taken into account. In the example given, a subscriber in one country is calling a ship off the coast of another country. If the ship was off the coast of the subscriber's own country, the national prefix would be dialled instead of the international prefix and country code.

3.2.3 *Level 3: Automatic national ship location*

3.2.3.1 The caller controls the access to a particular country (or part of a country or a group of countries) and dials the number of the required ship i.e. an intelligent system is contained in the network so that it can indicate the location of the ship. The network is then responsible for routing the call on the basis of a known ship's position. All ships participating within the relevant area must periodically report their position to a coast station, preferably on an automatic basis.

3.2.3.2 Equipment additional to level 2 of operation would be necessary, particularly in relation to the network's responsibility for locating the ship.

3.2.3.3 A numbering sequence suitable for this level of operation is:

Pi	International prefix
$I_1\ I_2\ I_3$	1, 2 or 3 digit country code
$N_1\ N_2\ N_3$	Code(s) to identify VHF/UHF service
NIDXXX	Ship station number.

The code(s) $N_1\ N_2\ N_3$ will vary in length from one country to another. The example given concerns a subscriber in one country calling a ship off the coast of another country. If the ship was off the coast of the subscriber's own country, the national prefix would be dialled instead of the international prefix and country code.

3.3 *Implementation of automatic schemes in national networks – Shore-originated calls*

There are variations of the numbering schemes given in §§ 3.2.2 and 3.2.3. Some examples of these variations are given below.

3.3.1 *Two-stage selection*

3.3.1.1 Some countries may find it necessary to use a two-stage selection technique. A subscriber would dial a coast station or maritime centre and would be offered a second stage of dialling to facilitate the insertion of the ship station number. Numbering sequences for provision of access to the coast station or maritime centre would be the same as for an ordinary telephone call in that country. The second stage of dialling could be associated with multi-frequency pushbutton equipment already available or specifically provided for subscribers requiring maritime service calls.

3.3.1.2 If the first stage of dialling is used to provide access to a particular coast station, the scheme would be associated with level 2 of operation. If the first stage of dialling is used to provide access to a maritime centre that is able to locate the ship, then levels 2 or 3 of operation would be appropriate.

3.3.2 *Digit insertion [(1 + 6) arrangement]*

3.3.2.1 When ship station numbers become seven digits in length (stage 2 of the numbering plan), some countries will be unable to transmit the full seven digits through their national networks. As the first digit of an NID indicates the zone (continent) in which a country is located, a technique may be adopted on a zonal (continental) basis in which the first digit of the NID is not dialled by the subscriber. The digit would then be inserted at the coast station (and/or maritime centre), on the assumption that the NID is allocated to a country in the same zone as the coast station (and/or maritime centre).

3.3.2.2 Access to ships registered in countries outside the zone in which the coast station is located would be given on a manual basis by countries operating the 1 + 6 system.

3.3.2.3 The digit insertion technique can be associated with levels 2 and 3 of operation.

3.3.3 *National numbering and conversion arrangement*

3.3.3.1 Some countries may find it necessary to temporarily allocate ship's numbers compatible with their national numbering plans. An example of such a technique is given below.

3.3.3.2 When a ship enters the service area of a VHF/UHF coast station, the ship station's identity would be forwarded by the coast station to its parent Maritime Centre. The Maritime Centre would then assign, temporarily, a national telephone number which would correspond to the ship station identity of the ship. This pair of numbers would be stored at the Maritime Centre and the coast station.

3.3.3.3 A shore-based subscriber calling this ship would access the Maritime Centre and use the ship station number to obtain the corresponding temporary national telephone number. Once this is available, the call could be completed automatically from the Maritime Centre. Alternatively, the call could be completed by the caller either on a manual, semiautomatic or automatic basis as appropriate.

3.3.3.4 The temporary national telephone number would be used for routing the call to the serving VHF/UHF coast station. At that point the corresponding ship station identity, which would be stored at the coast station, would be sent over the radio path to extend the connection to the ship.

3.3.4 *VHF/UHF system using 87S*

This scheme can be used in national networks where the subscriber does not need to know the location of the ship. The national subscriber would dial the international prefix of the country, the maritime international code (87), a digit to identify the VHF/UHF service and the ship station number (which in this case is the same as the ship station identity). This method can be used by the subscribers belonging to a national network to reach ships which are in the coverage area of the coast stations of that national network. As long as no internationally coordinated location registration of ships is implemented, a subscriber in another country would follow the procedure described in § 3.2.3.

3.4 *Procedures for ship-to-shore calls*

Ship-originated calls are less restricted than shore-originated calls by national network limitations and no levels of operation are required. The prefixes defined in Table 1/Q.11 *quater* will be used. This table is applicable to both the Maritime Mobile-Satellite Service and Maritime Mobile VHF/UHF Service. Application of the prefix scheme will be similar to the satellite service as shown in §§ 2.1.2 and 2.1.3.

To standardize dialling procedures for VHF/UHF ship-originated calls, international dialling procedures will be adopted and automatic coast stations throughout the world will act upon such numbering sequences. To allow for ships that rarely leave the coast of a particular country, another technique has been identified whereby national dialling procedures can also be used. Whether or not to adopt this technique would be decided by each Administration.

3.4.1 *Calling a terrestrial subscriber*

3.4.1.1 A shipboard subscriber will dial the prefix 00 followed by the required international number, whether or not the coast station is located in the required subscriber's country. Hence, the numbering sequence will be of the form:

00	Prefix for automatic call
$I_1\ I_2\ I_3$	1, 2 or 3 digit country code
N_1-N_n	National (significant) number.

3.4.1.2 Where national procedures are used, a shipboard subscriber will dial the prefix 0 followed by the required number belonging to the country of the coast station through which the call is being connected. Hence, the numbering sequence would be of the form:

0	Prefix for automatic call of the coast station country
N_1-N_n	National (significant) number.

3.4.2 *Calling an operator*

3.4.2.1 A shipboard subscriber will dial an operator prefix, the second digit identifying the type of operator required.

3.4.2.2 The table below illustrates the principle involved:

Prefix		Optional	Type of operator
Digit 1	*Digit 2*	Digits	
1	1	$I_1\ I_2\ I_3$	International outgoing operator
1	2	$I_1\ I_2\ I_3$	International information service
1	3		National operator
1	4		National information service

The use of the optional digits is the same as described in § 2.3.2.2.

3.4.2.3 Each Administration may decide which operators to provide, where they are to be located and how the call would be routed. If a request is received from a ship for a type of operator that the Administration does not provide, then the call will be routed to another operator convenient for that Administration.

3.5 *Procedures for ship-to-ship calls (via coast station)*

3.5.1 If the two ships are not off the coast of the same country, the shipboard subscriber will dial the prefix 00 and the appropriate procedure outlined in §§ 3.2 and 3.3 will be followed.

3.5.2 If the ships are off the coast of the same country, then the coast station would act upon the above procedure, but the national procedure of dialling the prefix 0 followed by the national number of the ship could be adopted.

4 Instructions to telephone subscribers

This subject requires further study.

References

[1] CCITT Recommendation *Definitions relating to national and international numbering plans*, Vol. II, Fascicle II.2, Rec. E.160.

[2] CCITT Recommendation *Ship station identification for VHF/UHF and maritime mobile-satellite telephone services*, Vol. II, Fascicle II.2, Rec. E.210.

SECTION 3

ROUTING PLAN FOR INTERNATIONAL SERVICE

Recommendation Q.12

OVERFLOW-ALTERNATIVE ROUTING-REROUTING-AUTOMATIC REPEAT ATTEMPT [1)]

1 When a call cannot find a free circuit in one group of circuits (first choice), technical arrangements can be made to route the call automatically via another group of circuits (second choice), at the same exchange; this process is called *overflow*. There may also be overflow, at the same exchange, from a second choice group of circuits to a third choice group of circuits, etc.

2 When the group of circuits over which the overflow traffic is routed involves at least one exchange not involved in the previous choice route, the process is called *alternative routing*.

3 It should be noted that overflow can occur without alternative routing for cases such as, when there are in one relation two groups of circuits, one group reserved for one-way operation and the other group used for both-way operation. In this case, when all one-way circuits are busy, the call can overflow to the both-way circuit group.

4 When congestion occurs at a transit exchange, arrangements can be made in some signalling systems, at the outgoing international exchange on receipt of a busy-flash signal or a congestion signal sent by the transit exchange, to reroute the call automatically from the outgoing international exchange over another route. This process is called *re-routing*. The use of rerouting is not envisaged in the International Routing Plan.

. . . . . .

5 When a difficulty is encountered in the setting-up of a connection – such as double seizure on both-way circuits or error detection – arrangements can be provided to make another attempt to set up the connection for that call from the point where the first attempt took place. This process is called *automatic repeat attempt*.

An automatic repeat attempt may take place:

- on the same circuit; or
- on another circuit of the same group of circuits; or
- on a circuit in another group of circuits.

Reference

[1] CCITT Recommendation *Overflow – Alternative routing – Rerouting – Automatic repeat attempt*, Vol. II, Fascicle II.2, Rec. E.170.

1) This Recommendation is an extract of Recommendation E.170 [1].

Recommendation Q.13 [1)]

INTERNATIONAL ROUTING PLAN

This plan is under complete revision by the CCITT. In this respect refer to Question 13/II [1]. For its full text, refer to *Orange Book*, Volume II-2, Geneva 1977. However, it should be noted that the hierarchical CT structure (i.e. CT1, CT2, CT3) is not appropriate for current practices.

Reference

[1] CCITT Question 13/II, Contribution COM II-No. 1 Study Period 1981-1984, Geneva, 1981.

Recommendation Q.14

MEANS TO CONTROL THE NUMBER OF SATELLITE LINKS IN AN INTERNATIONAL TELEPHONE CONNECTION

Recommendation Q.41 states that connections with a mean one-way propagation time in excess of 400 ms should be avoided apart from exceptional circumstances. Means should therefore be provided in international switching centres to prevent the multiple connection of satellite links whenever possible.

The following principles should apply in controlling such connections:

a) If an exchange can determine the prior connection of a satellite link in a connection by:

- information relating to the incoming circuit,
- receipt of the Nature of Circuit Indicator: "One satellite included",

the exchange should forward the call on a terrestrial circuit. A satellite circuit may be used in the following exceptional circumstances:

- where no terrestrial circuits are provided to the required destination,
- where only a few terrestrial circuits are provided on a final route and the loss of quality of service of a double satellite connection (echo problems and "double-talk") is preferable to the degradation of grade of service that would be caused by the exclusion of the satellite circuits.

A Nature of Circuit Indicator "One satellite included" should be forwarded on the outgoing circuit where possible.

b) If an exchange can determine by an analysis of the call destination that a satellite link will definitely or most probably be included at a later point in the call connection, it should give priority to terrestrial links in its outgoing circuit selection. Special attention is drawn to the analysis of country code 87S which may indicate that the call will include a maritime satellite link. (For the use of the S digit, see Recommendations Q.11 *bis* and Q.11 *quater*).

The above principles apply to all international exchanges and to all national exchanges which may connect to circuits via domestic satellite systems.

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1) This Recommendation is also included in the Series E Recommendations under the number E.171 (Fascicle II.2).

SECTION 4

GENERAL RECOMMENDATIONS RELATIVE TO SIGNALLING AND SWITCHING SYSTEMS (NATIONAL OR INTERNATIONAL)

4.1 Power limits of signals of a signalling system

Recommendation Q.15

NOMINAL MEAN POWER DURING THE BUSY HOUR [1]

To simplify calculations when designing carrier systems on cables or radio links, the CCITT has adopted a *conventional* value to represent the *mean absolute power level* (at a zero relative level point) of the speech plus signalling currents, etc., transmitted over a telephone channel in one direction of transmission during the busy hour.

The value adopted for this mean absolute *power* level corrected to a zero relative level point is −15 dBm0 (mean power = 31.6 microwatts); this is the mean with time and the mean for a large batch of circuits.

The reference to "the busy hour" above is to indicate that the limit (of −15 dBm0) applies when transmission systems and telephone exchanges are at their busiest so that the various factors concerning occupancy and activity of the various services and signals are to be those appropriate to such busy conditions.

It is not intended to suggest that an integrating period of one hour may be used in the specification of the signals emitted by individual devices connected to transmission systems. This could lead to insupportably high short-term power levels being permitted which give rise to interference for durations of significance to telephony and other services.

Note 1 – This conventional value was adopted by the CCIF in 1956 after a series of measurements and calculations had been carried out by various Administrations between 1953 and 1955. Reference [2] reproduces the documentation assembled. The adopted value of about 32 microwatts is based on the following assumptions:

- mean power of 10 microwatts for signalling and tones;
- mean power of 22 microwatts for other currents, namely:
  - speech currents, including echoes, assuming a mean activity factor of 0.25 for one telephone channel in one direction of transmission;
  - carrier leaks [3], [4], [5], [6], [7];
  - telegraph signals, assuming that few telephone channels are used for VF telegraphy systems (output signal power 135 microwatts [8]) or photo-telegraphy (amplitude modulated signal with a maximum signal power of about 1 milliwatt [9]).

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[1] This Recommendation is, basically, an extract of Recommendation G.223 [1].

On the other hand, the power of pilots in the load of modern carrier systems has been treated as negligible.

Hence, the maximum *energy* which may be transmitted by all the signals and tones [2] during the busy hour is:

36 000 microwattseconds for one direction of transmission;

72 000 microwattseconds for both directions of transmission.

Note 2 – The question of revising the assumptions leading to the conventional value of −15 dBm0 arose in 1968 for the following reasons:

- changes in the r.m.s. power of speech signals, due to the use of more modern telephone sets, to a different transmission plan, and perhaps also to some change in subscriber habits;
- change in the mean activity factor of a telephone channel due, inter alia, to different operating methods;
- increase in the number of VF telegraphy bearer circuits and sound-programme circuits;
- introduction of circuits used for data transmission, and rapid increase in their number.

During several Study Periods these points have been under study and various Administrations carried out measurements of speech signal power and loading of carrier systems. The results are shown in Reference [11]. These results indicate that at this point in time there is no sufficiently firm information to justify an alteration to the conventional mean value of −15 dBm0 (32 μW0) for the long-term mean power level per channel.

Indeed the steps envisaged by Administrations to control and reduce the levels of non-speech signals indicate a tendency to limit the effect of the increase in the non-speech services.

The economic aspects of changing (in particular, increasing) the conventional mean value of the load per channel would need to be thoroughly investigated before a change could be recommended.

Nevertheless there are sufficient indications that the study of all relevant factors must continue. Accordingly, the Question has been retained in revised form (Question 1 and 5/CMBD) for the Study Period 1981-1984 [12].

As regards the subdivision of the 32 μW into 10 μW signalling and tones and 22 μW speech and echo, carrier leaks, and telegraphy, again there is no evidence which would justify proposals to alter this subdivision.

As a general principle, it should always be the objective of Administrations to ensure that the *actual* load carried by transmission systems does not significantly differ from the *conventional* value assumed in the design of such systems.

References

[1] CCITT Recommendation *Assumptions for the calculation of noise on hypothetical reference circuits for telephony*, Vol. III, Fascicle III.2, Rec. G.223.

[2] *CCITT collected documents on the volume and power of speech currents transmitted over international telephone circuits*, Blue Book, Vol. III, Part 4, Annex 6, ITU, Geneva, 1965.

[3] CCITT Recommendation *12-channel terminal equipments*, Vol. III, Fascicle III.2, Rec. G.232, § 5.

[4] CCITT Recommendation *Recommendations concerning translating equipments*, Vol. III, Fascicle III.2, Rec. G.233, § 11.

[5] CCITT Recommendation *16-channel terminal equipments*, Vol. III, Fascicle III.2, Rec. G.235, § 5.

[6] CCITT Recommendation *Characteristics of group links for the transmission of wide-spectrum signals*, Vol. III, Fascicle III.4, Rec. H.14, § 2.3.

[2] See Reference [10] for a calculation of the energy transmitted for the national tones and signals.

[7] CCITT Recommendation *Characteristics of supergroup links for the transmission of wide-spectrum signals*, Vol. III, Fascicle III.4, Rec. H.15, § 2.3.

[8] CCITT Recommendation *Basic characteristics of telegraph equipments used in international voice-frequency telegraph systems*, Vol. III, Fascicle III.4, Rec. H.23, § 1.2.

[9] CCITT Recommendation *Phototelegraph transmission on telephone-type circuits*, Vol. III, Fascicle III.4, Rec. H.41, § 2.3.

[10] *Report on the entry transmitted by control signals and tones*, Green Book, Vol. VI-4, Supplement No. 1, ITU, Geneva, 1973.

[11] *Measurement of the load of telephone circuits*, White Book, Vol. III, Supplement No. 5, ITU, Geneva, 1969.

[12] CCITT Questions 1 and 5/CMBD, Contribution COM CMBD-No. 1, Study Period 1981-1984, Geneva, 1981.

Recommendation Q.16

MAXIMUM PERMISSIBLE VALUE FOR THE ABSOLUTE POWER LEVEL OF A SIGNALLING PULSE [1)]

The CCITT recommends that, for crosstalk reasons, the absolute power level of each component of a short duration signal should not exceed the values given in Table 1/Q.16.

The values given in this table result from a compromise between the characteristics of various existing channel filters.

TABLE 1/Q.16

Maximum permissible value of power at a zero relative level point

Signalling frequency (Hz)	Maximum permissible power for a signal at a zero relative level point (microwatts)	Corresponding absolute power level. Decibels referred to 1 mW (dBm0)
800	750	−1
1200	500	−3
1600	400	−4
2000	300	−5
2400	250	−6
2800	150	−8
3200	150	−8
If the signals are made up of two different frequency components, transmitted simultaneously, the maximum permissible values for the absolute power levels are 3 decibels below the above figures.		

Reference

[1] CCITT Recommendation *Maximum permissible value for the absolute power level (power referred to one milliwatt) of a signalling pulse*, Vol. III, Fascicle III.2, Rec. G.224.

1) This Recommendation also appears as Recommendation G.224 [1].

4.2 Signalling in the speech frequency band and outside the speech frequency band

Recommendation Q.20

COMPARATIVE ADVANTAGES OF "IN-BAND" AND "OUT-BAND" SYSTEMS

Signalling over telephone circuits may be effected *in* the frequency band used for speech ("in-band" signalling), or *outside* it ("out-band" signalling). In the latter case, the same channel carries both the signalling and speech frequency bands, the signalling band being separate from the speech band, and signalling equipment is an integral part of the carrier system.

In a further type of out-band signalling, a circuit, not used for speech, can be used to effect the signalling requirements of a number of speech circuits. This may be termed "separate channel signalling". The separate channel may be:

a) a channel in a carrier system used to effect the signalling requirements of the remaining channels in the same carrier system which are used for speech, signalling equipment being an integral part of the carrier system: this may be termed "built-in separate channel signalling";

b) completely separate, in which case signalling equipment is not an integral part of the carrier system; this may be termed "completely separate channel signalling".

1 Advantages of in-band signalling

1.1 In-band signalling can be applied to any type of line plant. The application of out-band signalling, and built-in separate channel signalling, is limited to carrier systems.

1.2 Through-signalling can be employed at transit points, and at carrier system terminals when a telephone circuit comprises two or more carrier links. No direct current repetition and thus no delay and no distortion of signals arises at such points. Out-band signalling and built-in separate channel signalling require a direct current repetition at such points.

1.3 Replacement of a faulty line section is easy. In the case of completely separate channel signalling, replacement of a faulty line section is based on security arrangements.

1.4 It is impossible to set up a connection on a faulty speech path. In the case of completely separate channel signalling, a continuity check of the speech path is required.

1.5 The full bandwidth of the speech channel is available for signalling. This facilitates the use of more than one signalling frequency. Normally the full bandwidth permits faster signalling than with a smaller signalling bandwidth. With in-band signalling, realization of this advantage is limited to those signals not required to be protected against signal imitation due to speech currents.

2 Advantages of out-band signalling

2.1 Relative freedom from disturbances due to speech currents; freedom from disturbances due to echo-suppressors; freedom from disturbances which might arise from connections to other signalling systems. With in-band signalling it is necessary to take steps to guard against such disturbances.

2.2 Possibility of signalling, during the setting-up of the call, by either discontinuous or continuous transmission, and the possibility of transmitting those signals during speech. Signalling during speech is not compatible with in-band signalling.

2.3 Simplicity of terminal equipment due to § 2.1 above and to the possibility of continuous signalling.

Out-band signalling (where the same channel carries both speech and signalling) also has the advantage of § 1.3 of in-band signalling.

Built-in separate channel signalling has the advantages of §§ 2.1, 2.2 and 2.3 of out-band, and the advantage of § 1.3 of in-band signalling.

Completely separate channel signalling has the advantages of §§ 2.1 and 2.2 of out-band signalling and, compared with out-band signalling and built-in separate channel signalling, has the additional advantages that no direct current repetition is necessary, and no distortion of signals arises, at carrier system terminals when a circuit comprises two or more carrier links.

Recommendation Q.21

SYSTEMS RECOMMENDED FOR OUT-BAND SIGNALLING

When Administrations wish to make mutual agreements to use out-band signalling systems, the CCITT considers it desirable, from the transmission viewpoint, for them to use one of the types of signalling systems (outside the speech band) defined in the following annexes:

Annex A: Normal carrier systems with 12 channels per group;

Annex B: Carrier systems with 8 channels per group.

ANNEX A

(to Recommendation Q.21)

Out-band signalling systems for carrier systems with 12 channels per group

(The signal levels are quoted in terms of absolute power level at a zero relative level point in dBm0.)

A.1 *Type I* (discontinuous signals)

Frequency: virtual carrier (zero frequency).
Level: high,
for example −3 dBm0.

A.2 *Type II*

1) (discontinuous signals)

Frequency: 3825 Hz.
Level: high,
for example −5 dBm0.

2) (semi-continuous signals)

Frequency: 3825 Hz
Level: low,
for example −20 dBm0.

A.3 The *Type I* signalling system is compatible with only those group and supergroup reference pilots having a displacement from the virtual carrier frequency (zero frequency) of 140 Hz.

Types II-1 and II-2 are compatible with only those group and supergroup reference pilots having a displacement from the virtual carrier frequency (zero frequency) of 80 Hz.

ANNEX B

(to Recommendation Q.21)

Out-band signalling systems for carrier systems with 8 channels per group

[The signal levels are quoted in terms of absolute power level (reference 1 mW) at a zero relative level point.]

Frequency: 4.3 kHz ± 10 Hz.
Level:
- discontinuous signals: −6 dBm0;
- semi-continuous signals: value between −20 dBm0 and −17.4 dBm0.

Recommendation Q.22

FREQUENCIES TO BE USED FOR IN-BAND SIGNALLING

To reduce the risk of signal imitation by speech currents, the frequencies for an in-band signalling system should be chosen from the frequencies in the band in which speech signal power is lowest, i.e. frequencies above 1500 Hz.

The desirability of this was confirmed by tests carried out in London, Paris and Zűrich in 1946 and 1948 to choose the signalling frequencies of systems standardized by the CCITT. These tests led to the conclusion that, if relative freedom from false signals was to be obtained other than by undue increase in signal duration, frequencies of at least 2000 Hz would have to be used.

4.3 Signalling frequencies for push-button telephone sets

Recommendation Q.23

TECHNICAL FEATURES OF PUSH-BUTTON TELEPHONE SETS

1 The introduction of push-buttons on telephone sets may have an effect on the operation of international circuits:

a) owing to the greater dialling speed, the post-dialling may be longer, since national and international networks will only be gradually adapted to allow for this greater speed;

b) when pressing the buttons after an international call has been set up, the signalling frequencies for push-button sets may cause interference to foreign signalling systems on the connection. However, the subscriber can be warned of the possible disadvantages of touching the buttons in conditions different from those prescribed.

2 There can be no doubt that, owing to the high dialling speed which can be obtained with push-button sets, their use is bound to spread widely and rapidly and it is desirable for the signalling methods for such sets to be internationally standardized.

One factor in favour of such standardization is the advantage it offers for countries which have to import their equipments from various other countries. This argument, admittedly, applies to any type of telephone equipment.

Other advantages of standardization are:

- the possibility of using the push-button of such sets for signalling directly from one subscriber to another subscriber via a national and/or international connection;
- the standardized allocation of signalling frequencies for push-button sets facilitates the choice of signalling frequencies in the frequency band of a telephone circuit for any other use (data transmission, telephone signalling system, etc.) for which provision might have to be made. The risk of mutual interference among the signalling systems (see Recommendation Q.25) makes it necessary to have an orderly arrangement of the spectrum of frequencies used for signalling.

3 The general use of push-button sets for purposes other than telephone dialling is envisaged by some Administrations. However, some Administrations observe that it would seem advisable to reserve such uses for a network of relatively limited extent; in their view the reliability of standards for data transmission should not make any demands on the push-button set system other than those required for the transmission of telephone numerical information to the local exchange, if the design of push-button sets is to remain within economical limits compatible with their widespread use.

However, the CCITT considered, at Mar del Plata in 1968 that, even if the transmission of data from a push-button telephone set is at present to be envisaged in international traffic on a limited scale only, it would nonetheless be wise not to rule out the possibility of such transmission of data on a general scale.

4 In choosing a signalling system for push-button sets, Administrations may be guided by conditions which vary considerably from one country to another. Economic considerations may, for instance, lead them to prefer a direct current system which might be less expensive than a voice-frequency system. The numerical dialling information would then be transmitted only as far as the telephone exchange to which the subscriber is connected. There are no tones that could affect the connection after its establishment. Data would not be transmitted from the push-button sets unless a suitable converter were used in the exchange.

Standardization of a direct current system for signalling from push-button sets does not seem justified at the international level; it may depend on the conditions peculiar to the local networks of the country concerned.

5 The signalling system for push-button sets recommended by the CCITT applies solely to voice-frequency signals.

A multifrequency code for such signalling is recommended in which the dialling signal is composed of two frequencies emitted simultaneously when a button is pressed. It is planned to have 10 decimal digits and 6 reserve signals, making 16 signals in all. The two frequencies composing each signal are taken from two mutually exclusive frequency groups of four frequencies each, a code known as the "2 (1/4) code".

6 The low group frequencies of this 2 (1/4) code are:

697, 770, 852, 941 Hz.

The high group frequencies are:

1209, 1336, 1477 and 1633 Hz.

The allocation of frequencies to the various digits and symbols of a push-button set appears in Figure 1/Q.23.

7 The frequency variation tolerances and the permissible intermodulation products are defined as follows:

7.1 each transmitted frequency must be within ± 1.8% of the nominal frequency;

7.2 the total distortion products (resulting from harmonics or intermodulation) must be at least 20 dB below the fundamental frequencies.

8 The CCITT determined, at Mar del Plata in 1968, that it was not practicable to specify a standardization of the levels for the frequencies transmitted when a push-button is pressed, as these level conditions depend essentially on national transmission plans which are not the same in all countries.

However, the sending level conditions must be such that on an international connection they do not exceed the values specified in Recommendation Q.16 (maximum permissible value for the absolute power level of a signalling pulse).

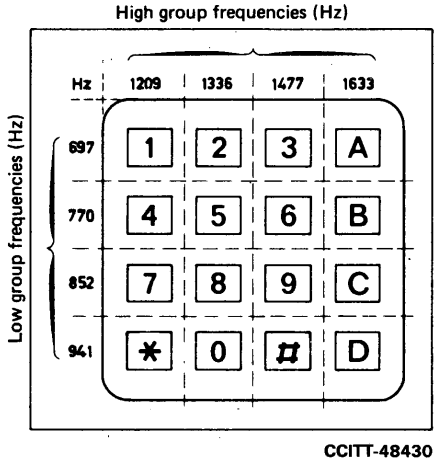

FIGURE 1/Q.23

Allocation of frequencies to the various digits and symbols of a push-button set

4.4 Protection of "in-band" signalling systems against each other

Recommendation Q.25

SPLITTING ARRANGEMENTS AND SIGNAL RECOGNITION TIMES IN "IN-BAND" SIGNALLING SYSTEMS

1 General

In each "in-band" signalling system precautions should be taken so that, when the signalling in that system is taking place:

1.1 no interference in the voice-frequency range from outside the system can pass into the system (i.e. into the transmission path between the sending end and the receiving end of the voice-frequency signals), and

1.2 as far as possible, no signalling current used in the system can pass into other systems, connected in tandem.

2 Sending-end splitting arrangements

2.1 In order to satisfy the condition in § 1.1 above, care should be taken that the correct operation of the signal receiver at the other end of the circuit is not disturbed by:

- surges (transient currents) caused by the opening or closing of direct current circuits connected to the speech wires of the switching equipment, whether these surges precede or follow the sending of a signal;
- noise, speech currents, etc., coming from tandem switched circuits, preceding or during the sending of a signal.

2.2 For this reason the following arrangements have been made in the Signalling Systems No. 4, and No. 5 for the transmission of voice-frequency signals on the international circuit:

i) The exchange side of the circuit shall be disconnected 30 to 50 ms before a voice-frequency signal is sent over the circuit.

ii) The exchange side of the circuit will not be reconnected for 30 to 50 ms following the end of the sending of a voice-frequency signal over the circuit.

2.3 Arrangements of the same type are required on System R1 and on national in-band systems [see § 3.4.1 b) below].

3 Receiving-end splitting arrangements

3.1 *General*

3.1.1 In order to satisfy the condition in § 1.2 above, the length of the part of a signal which passes into another system is limited by splitting the speech wires beyond the signal receiver when a signal is received and detected by this receiver.

The time during which the first part (sometimes called *spill-over*) of a received signal passes into another system, until the splitting becomes effective, is called "splitting time".

Too long a splitting time may result in interference to signalling on a tandem system depending on the signal recognition time on the tandem system.

Too short a splitting time may result in an increase in the number of false operations of the splitting device by speech currents (*signal imitation*) and so impair speech transmission.

The splitting time must therefore be a compromise between the above two factors.

The splitting device also serves to limit the duration of signals on one path of the 4-wire circuit from returning over the other path by reflections at the termination; these reflections may give rise to faulty operation of signalling equipment on the other path.

3.1.2 The protection against mutual interference between in-band signalling systems in international service involves limitations of the length of any part of:

3.1.2.1 the *international* signal that may be able to pass:

a) from the international signalling system into a national signalling system (protection of the national system);

b) from one international signalling system into another international signalling system, when they are switched in tandem (protection of the international systems);

c) from one international circuit into another international circuit of the same system when they are switched in tandem in the case of link-by-link signalling.

3.1.2.2 the *national* signal that may be able to pass:

a) from the national signalling system into an international signalling system (protection of the international system);

b) from one national signalling system into the national signalling system of another country via an international connection (protection of the national system).

3.2 *Protection of national and international systems against international systems*

Conditions in § 3.1.2.1 above are met because international signalling systems have a splitting device on each circuit. The splitting times of such systems are:

55 milliseconds for the compound signal element in System No. 4;
35 milliseconds for a signal in System No. 5;
20 milliseconds for a signal in System R1.

3.3 *Protection of the international system against national systems*

The condition in § 3.1.2.2 a) above is generally covered because:

- the values given in the specifications of the CCITT standard systems as the minimum recognition time of a line signal are in general greater than the splitting times of national systems (see the tables giving the basic characteristics of national signalling systems in Supplement No. 3 at the end of this fascicle;
- the signalling frequencies used in the international systems are, in the majority of countries, different from those used in national systems.

It may be necessary, if the splitting time of a national signalling system is greater than the minimum signal recognition time of an international system and the signalling frequencies used in the national system and international system are the same or nearly the same, to insert a device at the international exchange which will prevent a part of the national signal from passing into the international circuit for longer than this recognition time.

3.4 *Interference between national signalling systems when they are interconnected via an international circuit*

3.4.1 To ensure protection of national signalling systems one against the other [protection defined under § 3.1.2.2 b) above], it has been recommended by the CCITT since 1954 that new national in-band signalling systems should comply with the following two clauses:

a) not more than 35 milliseconds of a national signal should be able to pass into another country;

b) the connection between an international circuit and a national circuit should be split on the national circuit at the international exchange 30 to 50 milliseconds before that exchange sends any signal over the national signalling system.

Note – The object of these two clauses is to avoid interference, especially in conditions that may exist on international automatic connections.

3.4.2 The requirement of § 3.4.1 a) permits the signalling system used in country A to have a minimum signal recognition time based on this value of 35 milliseconds. It will then be possible to ensure, without taking any other precautions at the incoming end of an international circuit, that no fraction of a signal coming from country B, and being of the same, or nearly the same, frequency as that used in country A, will be wrongly recognized as a signal in country A.

One method of meeting the requirement of § 3.4.1 a) is to adopt a splitting time of less than 35 milliseconds for the national systems.

Another method exists which does not involve such a limitation in the splitting times of national systems, and which might be preferred when the design of the national signalling system is such that a short splitting time is not normally justified for that system alone. This second method involves the introduction, in the international exchange, of an arrangement for limiting the length of national signals which are liable to pass into the international circuit. Such an arrangement would be used only on circuits to those countries where there is a danger that interference might arise.

3.4.3 The requirement of § 3.4.1 b) avoids the false operation of the guard circuit of a signal receiver situated at the distant end of a national circuit.

4.5 Miscellaneous provisions

Recommendation Q.26

DIRECT ACCESS TO THE INTERNATIONAL NETWORK FROM THE NATIONAL NETWORK

The choice of the method of access to an outgoing international exchange from the national network is a purely national matter. Nevertheless, if an international connection is set up by automatic switching from an exchange other than the international exchange which is the outgoing point of the international circuit used, arrangements should be made in the national network to transmit over the international circuit at least the signals required to ensure the satisfactory setting-up, control and clearing-down of the international connection.

In addition, where a group of national circuits used in the above manner carries both semi-automatic and automatic traffic, means should be provided for distinguishing between these two classes of traffic for the purposes of international accounting [1].

Reference

[1] CCITT Recommendation *Basic technical problems concerning the measurement and recording of call durations*, Vol. II, Fascicle II.2, Rec. E.260, § 2.

Recommendation Q.27

TRANSMISSION OF THE ANSWER SIGNAL

It is essential for the answer signal to be transmitted with a minimum of interference to the transmission of speech currents, because the called subscriber may already be announcing his presence at this stage of the call.

On a connection which has been set up, the answer signal generally entails, at a certain number of points:

a) repetitions and conversions, which delay transmission; and

b) splitting of the speech path, where in-band signalling is used.

It is therefore desirable to minimize the delays and the duration of the interruption of the speech path. Minimization of the latter can be achieved by:

- short send line splitting;
- short duration of the signal; and
- fast termination of the sending and receiving splits on cessation of the signal.

Recommendation Q.28

DETERMINATION OF THE MOMENT OF THE CALLED SUBSCRIBER'S ANSWER IN THE AUTOMATIC SERVICE

1 Arrangements should be made in the national signalling system of the incoming country to determine (in the outgoing international exchange) the moment when the called subscriber replies; this information is necessary in the international service for the purposes of:

- charging the calling subscriber [1];
- measuring the call duration [2].

2 Where subscribers in an outgoing country have direct access to an operator's position (in a manual exchange, for instance) in a public exchange of an incoming country, arrangements should be made in the national network of the incoming country to ensure that – in the outgoing country – the calling subscriber is charged, and the call duration measured, only from the moment when the called subscriber replies. This means that an answer signal is not sent when the operator in a public exchange of the incoming country replies. These provisions are set out in detail for CCITT standardized systems (see Recommendation Q.102).

References

[1] CCITT Recommendation *Chargeable duration of calls*, Vol. II, Fascicle II.2, Rec. E.230.

[2] CCITT Recommendation *Basic technical problems concerning the measurement and recording of call durations*, Vol. II, Fascicle II.2, Rec. E.260.

Recommendation Q.29

CAUSES OF NOISE AND WAYS OF REDUCING NOISE IN TELEPHONE EXCHANGES

Circuit noise may be classified as follows:

1) power supply noise,

2) noise generated in the speech path circuit,

3) noise induced in the speech path circuit.

1 Power supply noise

1.1 *Power sources*

The interference resulting from the harmonics, ripple and current fluctuation of machines, rectifiers and batteries.

This noise may be reduced by d.c. generators with low harmonics and good regulation and rectifiers with good regulation, effective filters, and batteries with large capacity (i.e. with low internal impedance).

1.2 *Supply leads*

The interference in the speech circuits of an exchange due to power supply equipment originates mainly in the common impedances of the supply paths of speech and switching circuits, and is caused mainly by the sudden fluctuation of the current resulting from the sudden operation and release of the different relays, magnets and contacts.

These common impedances may be reduced by:

a) the use of common power supply leads of sufficiently low resistance, the use of large capacitors fitted at apparatus ends of supply leads with minimum impedances, e.g. minimum distance between bus bars, or coaxial feeders. Another method employs close-spaced cables with alternate polarity;

b) the use of a common battery with separate power supply leads for speech and switching circuits. Better results may be obtained at an increased cost by independent batteries adequately separated;

c) the arrangement of the cells of the battery in a U formation.

1.3 *Earth returns*

Independent earth returns should be used for signalling-frequency supply circuits.

2 Noise generated in the speech circuit

2.1 *Contact noise caused by vibration*

This kind of noise is caused by contact resistance variations of the various commutator, switch and relay contacts due to mechanical vibration.

This contact noise may be reduced by:

a) the use of damping devices to reduce the generation of vibration caused in particular by relay sets, mechanical and electromagnetic clutches;

b) the use of multiple brushes, spring or resilient mountings to reduce the transmission of vibration;

c) a suitable choice of contact materials;

d) the use of the best contact shape and of twin contacts;

e) maintaining atmospheric conditions at an appropriate relative humidity and the use of air filters; use of dust covers on equipment, arranging design of columns, window sills, radiators and floor to avoid harbouring dust;

f) careful maintenance cleaning and lubrication in accordance with specifications.

2.2 *Frying noise*

In speech circuits some contact materials are liable to cause frying noise.

This noise may be reduced by the use of suitable contact materials and by keeping an appropriate relative humidity.

2.3 *Contact noise caused by wetting currents*

Speech circuits without d.c. currents are liable to fading due to contact resistance fluctuations. Fading may be reduced by wetting. However, wetting currents may introduce frying noise on the lines.

2.4 *Charge and discharge clicks*

Clicks may frequently be caused by the charging or discharging of capacities (cable capacity) by switches when rotating over occupied and non-occupied terminals.

Objectionable clicks are also likely to result from sudden battery reversals, dialling and other abrupt changes in the current flowing in the speech circuits.

These effects may be reduced:

a) by disconnecting the speech circuits from the brushes during the hunting period of the switch;

b) by the use of twisted pairs, by limiting the length of cabling and also by locating relays as close as possible to the selectors they control.

2.5 *Unsound contacts*

Objectionable noise may be due to unsound contacts on distribution frames, particularly when work is in progress such as adding or changing jumpers, etc. Such unsound contacts may be due to "dry" contacts inadequately soldered, poorly wrapped joints, or to the use of distribution frame equipment having inadequate contact pressure. It is suspected that this type of trouble is responsible for most of the "hits" and "misses" and usually for an increase in noise.

2.6 *Tapping losses*

When lines are tapped for service interception, observation, etc., the tapping circuit should be designed to give the minimum of unbalance to earth and the transmission loss introduced should be a minimum. Semi-permanent connections should be used in preference to base-metal sliding connections at the tapping point.

2.7 *Reduction of the number of switching contacts*

Circuits should be designed so that at each switching stage there is a minimum number of contacts in the speech circuit in order to reduce the risk of microphonic noise from "dry" contacts.

3 Noise induced in the speech circuit

3.1 *Noise induced in the speech circuit may be due to*:

a) speech crosstalk;
b) signalling frequency crosstalk;
c) induction from tone supplies;
d) direct current pulses;
e) clicks caused by abrupt changes in inductive and capacitive circuits.

Clicks may be reduced at the source by the use of spark quench devices or other means to reduce the steepness of the interfering wave-front concerned. In addition, noise may be reduced by balancing, by using twisted pairs and/or by screening.

3.2 *Noises due to unbalanced transmission bridge circuits*

A well-balanced circuit is necessary for the transmission bridge to avoid noise interference. This can be achieved by:

a) the use of balanced components;

b) the separation of components used for speech from those used for control and switching;

c) the separation of individual transmission bridges by screening or spacing;

d) the addition of balancing components, e.g. balancing transformers of retardation coils;

e) taking the precautions listed at the end of § 3.1 above.

3.3 *Low-level speech circuits*

Low-level electronic speech circuits are particularly susceptible to noise induction and should therefore be screened.

3.4 *Longitudinal interference*

Such noise may be induced into the speech circuit from the line by power distribution systems and traction circuits or by earth potential differences.

These may be reduced by balancing the line or by the addition of transformers.

Note – Interference which is sufficiently severe to cause unwanted operation of relays, etc., may be overcome by the use of loop circuits which should also reduce noise.

Recommendation Q.30

IMPROVING THE RELIABILITY OF CONTACTS IN SPEECH CIRCUITS

The following methods can be used for improving the reliability of contacts in speech circuits:

a) use of precious metals such as platinum, palladium, gold, silver, or alloys of these metals. If, for one reason or another, it is not desired to "wet" the contacts, or if enough contact pressure cannot be provided, it is preferable to use the metals or alloys mentioned above, with the exception of pure silver;

b) use of high contact pressure;

c) double contacts;

d) lubrication (with suitable oils) of certain non-precious metal contacts in the case of sliding contacts;

e) direct current "wetting" of contacts, care being taken to avoid the introduction of noise due to transients when the contacts are made or broken;

f) air filtration or other protective measures to avoid dust;

g) the maintenance of suitable humidity;

h) the use of protective covers;

i) protection against fumes, vapours and gases;

j) avoidance of the use, near contacts, of materials likely to be detrimentral to the contacts.

When voice-frequency signals are sent over a transmission path, as it is not possible to use direct current wetting for the voice-frequency signal transmitting contacts due to the surges which occur on closing and opening the contact, it is preferable to use static modulators with rectifier elements.

Recommendation Q.31

NOISE IN A NATIONAL 4-WIRE AUTOMATIC EXCHANGE

It is desirable that the requirements concerning noise conditions for a national 4-wire automatic exchange be the same as for an international exchange (see Recommendation Q.45, § 5.).

Recommendation Q.32

REDUCTION OF THE RISK OF INSTABILITY BY SWITCHING MEANS

Arrangements should be made in the incoming country to reduce the risk of instability:

- during the period between the moment when the speech path is established and the moment when the called suscriber answers; and
- also the period between the moment when the called subscriber clears and the moment when the circuits are released.

This can be achieved in principle by any of the methods *a), b)* or *c)* shown in Figure 1/Q.32.

It is recommended that, whatever method is used, the measures are taken in the incoming (in the traffic sense) country. Taking into account experience already acquired and also the stability calculations referred to in [1], it is considered sufficient to arrange for the stability [1)] of the 4-wire chain of circuits (made up of international circuits and national extension circuits, interconnected on a 4-wire basis) to be augmented by 3.5 dB.

This recommendation applies to all signalling and switching (national or international) systems which could be used on international connections.

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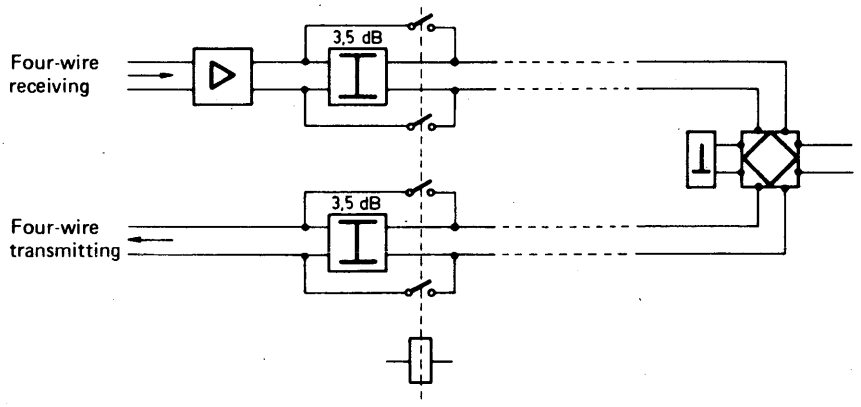
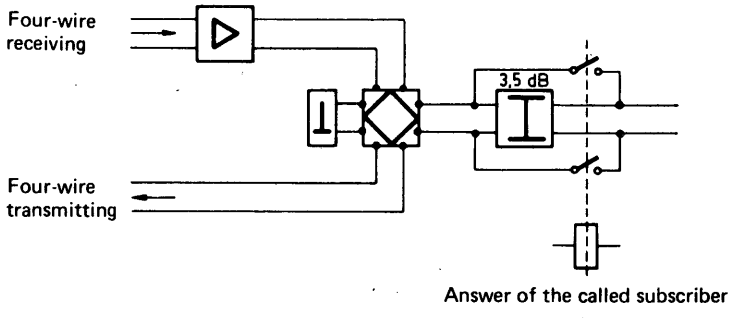
1) It should be noted that Recommendation Q.32 always refers to *stability* [2] and never to *singing margin* [3] which is approximately double the stability. The methods described in Figure 1/Q.32 are examples of possible means of increasing the stability of the 4-wire chain of circuits by 3.5 dB.

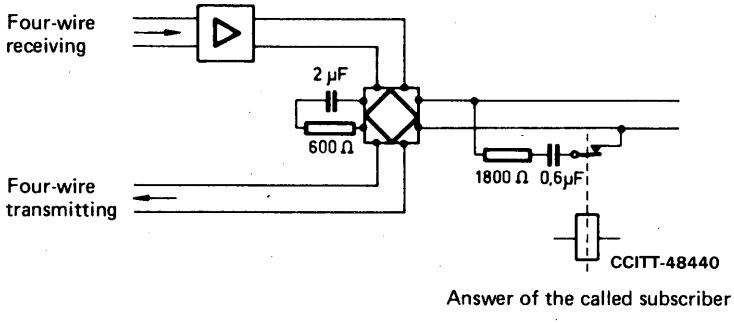


Note – In principle, the attenuators may be inserted in any of the exchanges, e.g. the incoming international centre.

Method a) Inserting an attenuator in each channel of the 4-wire chain of the connection



Method b) Inserting an attenuator in the 2-wire extension of the connection



Method c) Bridging a terminating impedance across the 2-wire extension of the connection

FIGURE 1/Q.32

Possible methods for reducing the risk of instability

References

[1] CCITT Recommendation *Stability and echo*, Vol. III, Fascicle III.1, Rec. G.131.

[2] CCITT Definition: *Stability*, Vol. X, Fascicle X.1 (Terms and Definitions).

[3] CCITT Definition: *Singing margin*, Vol. X, Fascicle X.1 (Terms and Definitions).

PROTECTION AGAINST THE EFFECTS OF FAULTY TRANSMISSION ON GROUPS OF CIRCUITS

Although certain signalling systems may have the capability to provide an indication when an individual circuit is faulty, in order to maintain the required availability of the public network, it is considered necessary to provide alarm facilities to alert maintenance staff when a group of circuits provided by multiplex transmission system is faulty.

It is considered desirable if the faulty circuits could be removed from service automatically and restored to service automatically when the fault condition no longer exists.

Failure of an FDM system can possibly be indicated by means of pilot supervision.

Failure of a PCM system is indicated at both ends by the loss of frame alignment (or multiframe alignment as appropriate) [1] [2].

These failure indicators provide the means whereby the circuits affected can be removed from service and restored automatically by the switching control of an international exchange.

References

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

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

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SECTION 5

TONES FOR NATIONAL SIGNALLING SYSTEMS

Recommendation Q.35 [1]

CHARACTERISTICS OF THE DIAL TONE, RINGING TONE, BUSY TONE, CONGESTION TONE, SPECIAL INFORMATION TONE AND WARNING TONE [2]

1 General

Administrations are reminded of the advantages of standardizing audible tones as far as possible so that subscribers and operators may quickly recognize any tone transmitted of whatever origin [3].

Guidance on the application of tones and recorded announcements in various situations is given in [2].

In considering the degree of standardization, the CCITT took account of the nature of the various tones already in use. It was also considered that Administrations introducing new tones would find it helpful to know the preferred limits of cadence frequency and level.

Limits for tone cadences and frequencies are set forth below, all working tolerances being included in the limits.

Besides the limits applying to specifications, limits have been laid down for application to existing exchanges.

These latter limits are herein called *accepted* limits, while those for new equipment are called *recommended* limits.

2 Power levels for tones

For international purposes, the levels of the ringing tone, the busy tone, the congestion tone, the special information tone and the warning tone have to be defined at a zero relative level point at the incoming (in the traffic direction) end of the international circuit.

The level of tones so defined must have a nominal value of -10 dBm0. The recommended limits should be not more than -5 dBm0 nor less than -15 dBm0 measured with continuous tone.

For the special information tone, a difference in level of 3 dB is tolerable between any two of the three frequencies which make up the tone.

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1) This Recommendation is also included in the Series E Recommendations under the number E.180 (Fascicle II.2).

2) See [1] for particular values of tone cadences and frequencies in actual use.

3) Reference [3] specifies the information which could be given to users to facilitate recognition of foreign tones.

3 Dial tone

3.1 It is recommended that dial tone should be a continuous tone.

3.2 It is recommended that dial tone should be:

- *either* a single frequency tone in the range 400-450 Hz,
- *or* a combined tone composed of up to three frequencies, with at least one frequency in each of the ranges 340-425 Hz and 400-450 Hz. The difference between any two frequencies should be at least 25 Hz.

3.3 Recognizing the local nature of "normal" use of dial tone, as well as the technical and economic consequences and consequences on customer habits of changes in dial tone, the full range of existing dial tones, including non-continuous tones as in [1] are considered acceptable.

3.4 Where digital tone generation is applied, the frequencies for dial tone should be "*x*" Hz [4].

3.5 When determining the electrical characteristics (frequency, level, harmonic content, etc.), the risk of interference with the frequencies recommended for pushbutton telephone sets in Recommendation Q.23 has to be taken into account.

4 Ringing tone

4.1 Ringing tone is a slow period tone, in which the tone period is shorter than the silent period.

The *recommended* limits for the tone period (including tolerances) are from 0.67 to 1.5 seconds. For existing exchanges, the *accepted* upper limit for the tone period is 2.5 seconds.

The *recommended* limits for the silent period separating two tone periods are 3 to 5 seconds. For existing exchanges, the *accepted* upper limit is 6 seconds.

The first tone period should start as soon as possible after the called subscriber's line has been found.

Figure 1/Q.35 shows the recommended and accepted limits for the ringing tone periods.

4.2 The ringing tone cadence should be similar to the cadence used for applying ringing current to the called subscriber's telephone set, but these two cadences need not be synchronized. The electrical parameters of the ringing current must be evaluated by the Administration concerned to prevent shock hazard.

4.3 The recommended frequency for the ringing tone is between 400 and 450 Hz. The accepted frequency should be not less than 340 Hz, nor more than 500 Hz. Frequencies between 450 and 500 Hz in the accepted frequency range should, however, be avoided.

The ringing tone frequency may be modulated by a frequency between 16 and 100 Hz, but such modulation is not recommended for new equipment. If the accepted frequency is more than 475 Hz, no modulation by a lower frequency is allowed.

Where digital tone generation is applied, the frequency for ringing tone should be "*x*" Hz [4].

5 Busy tone and congestion tone

5.1 The (subscriber) busy tone and the (equipment or circuit group) congestion tone are *quick* period tones in which the tone period is theoretically equal to the silent period. The total duration of a complete cycle (tone period E + silent period S) should be between 300 and 1100 milliseconds.

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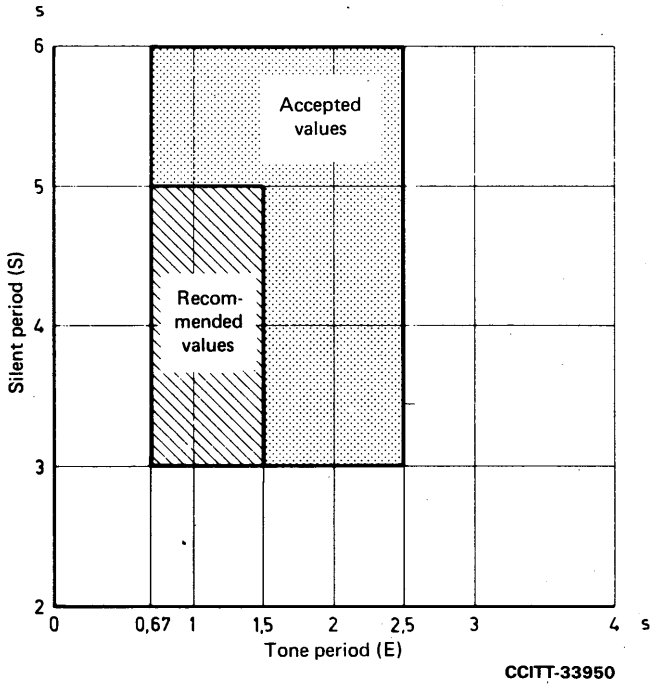
[4] The value of "*x*" is under study in Study Group XI; this value will be within the range recommended for analogue generated tones.



Frequency:
– recommended interval: 400-450 Hz
– accepted interval: 340-500 Hz

FIGURE 1/Q.35

Ringing tone

The ratio E/S of the tone period to the silent period should be between 0.67 and 1.5 (*recommended* values).

For existing exchanges, or for tones to be used in a special way, it is *accepted* that the tone period may be up to 500 milliseconds shorter than the silent period ($E \geqslant S - 500$ milliseconds). In no circumstances should the tone period be shorter than 100 milliseconds.

Figure 2/Q.35 shows the recommended and the accepted areas for the busy tone and the congestion tone periods.

5.2 The busy tone (of the called subscriber) and the congestion tone (of switching equipment or circuit groups) can be identical or almost identical, providing that this does not create any serious problems for the network and does not cause the subscriber to become confused. However, a distinction between these two tones is desirable:

- to allow Administrations to assess the quality of service,
- for the convenience of experienced subscribers.

5.3 Where a distinct congestion tone is used, it is recommended that:

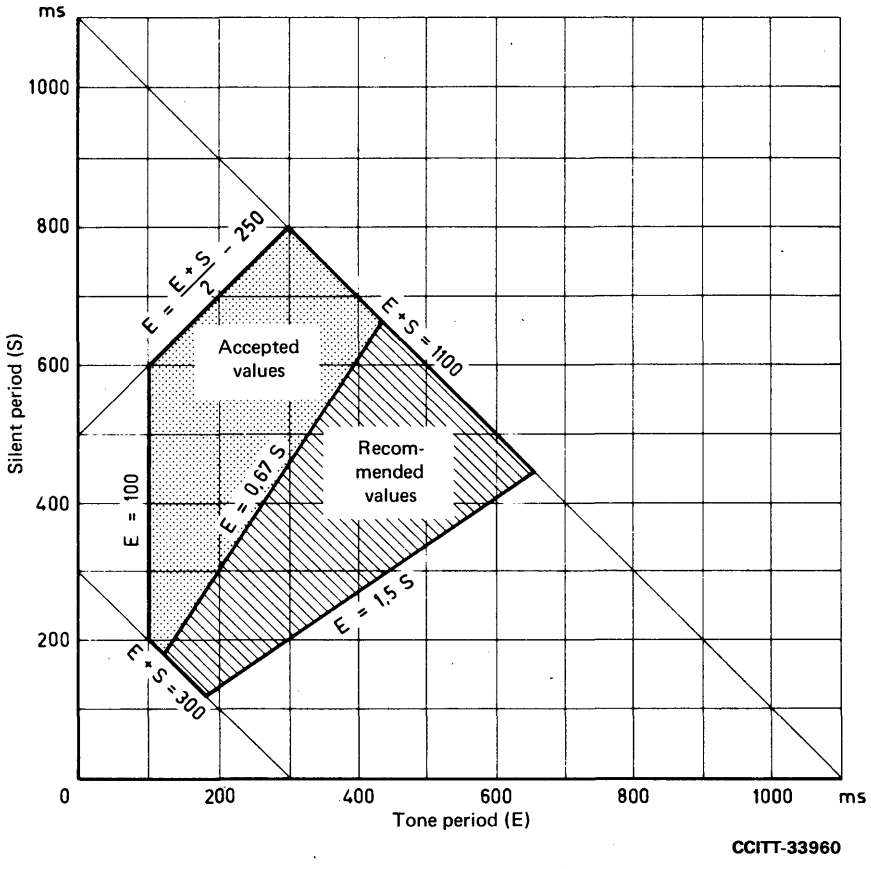
a) the same *frequency* should be used for the busy tone and the congestion tone;

b) the busy tone should have a slower cadence than the congestion tone, but both cadences should be within the limits mentioned in § 5.1 above.

5.4 The *recommended* frequency for the busy tone and for the congestion tone must be between 400 and 450 Hz. The *accepted* frequency must not be less than 340 nor more than 500 Hz. Frequencies between 450 and 500 Hz in the accepted frequency range should, however, be avoided.

Where digital tone generation is applied, the frequency for busy and congestion tones should be "x" Hz [4].

[4] The value of "x" is under study in Study Group XI; this value will be within the range recommended for analogue generated tones.



Frequency:
– recommended interval: 400-450 Hz
– accepted interval: 340-500 Hz

FIGURE 2/Q.35

(Subscriber) busy tone and (equipment or circuit group) congestion tone

6 Special information tone

6.1 The special information tone is provided for all cases in which neither the busy nor the congestion tone can give the required information to the calling subscriber in the case of call failure. There are three ways in which it may be used:

a) when in special cases no provision is made for recourse either to a recorded announcement or to an operator, the equipment at the point which the calls have reached must:

1) *either* connect the special information tone to the call,

2) *or* preferably, if technically available, send an appropriate backward signal such that connection to the special information tone will be made by equipment which is nearer to the caller.

b) when the call is connected to a recorded voice machine; the tone is then given during the silent intervals between transmissions of the announcement;

c) under arrangements made at manual positions serving lines which have been abnormally routed so that by operating a key the operators may send the special information signal when, for example, the calling subscriber fails to understand the operator;

When the special information tone is applied with or without a recorded announcement, it should be recognized that customers may refer to an operator if they fail to understand the meaning of the recorded announcement and/or the special information tone.

6.2 The special information tone has a tone period theoretically equal in length to the silent period.

Tone period – The tone period consists of three successive tone signals, each lasting for 330 ± 70 milliseconds. Between these tone signals there may be a gap of up to 30 milliseconds.

Silent period – This lasts for 1000 ± 250 milliseconds.

6.3 The frequencies used for the three tone signals are: 950 ± 50 Hz; 1400 ± 50 Hz; 1800 ± 50 Hz, sent in that order.

7 Warning tone to indicate that a conversation is being recorded

Where a conversation is being recorded at a subscriber's station, it is recommended that the Administration require the use of a warning tone to indicate that the conversation is being recorded. When such a tone is applied, it is recommended that:

a) it consist of a 350-500 ms pulse every 15 ± 3 seconds of recording time, and

b) the frequency of the tone should be 1400 Hz ± 1.5%.

8 Machine recognition of tones

The CCITT appreciates the value of machine recognition of tones for the purpose of service observations, maintenance, testing or for the collection of statistics where equivalent electrical signals do not exist. However, the CCITT considered, at Mar del Plata in 1968, that such machine recognition should not be a substitute for electrical signals. Where machine recognition of audible tones is to be introduced, the tone frequencies and cadences must be within close limits of precision.

References

[1] *Various tones used in national networks*, Vol. II, Fascicle II.2, Supplement No. 2.

[2] CCITT Recommendation *Application of tones and recorded announcements in telephone services*, Vol. II, Fascicle II.2, Rec. E.182.

[3] CCITT Recommendation *Customer recognition of foreign tones*, Vol. II, Fascicle II.2, Rec. E.181.

Recommendation Q.36 [1]

CUSTOMER RECOGNITION OF FOREIGN TONES

1 In order to facilitate recognition of foreign ringing and busy tones by a subscriber dialling an automatic international call, the information given to subscribers:

1) should emphasize that a slow repetition rate of the tone means "ringing" whereas a rapid repetition rate means "busy";

2) should indicate that in some countries the ringing tone may be heard as a sequence of two short tones, pause, two more short tones, pause, and so on.

In addition, it may be useful for the purpose of educating subscribers:

– to provide auditory samples of such tones by tape recording or other means, or

– to include detailed descriptions of tones in directories.

2 Modern international signalling systems are capable of exchanging signals corresponding to indications normally given to subscribers by means of audible tones (busy, congestion, ringing, etc.). Administrations are encouraged to arrange their networks so that these information signals can be sent between countries in order that they can be recognized and converted into tones or announcements as near to the calling subscriber as practical. This procedure could significantly reduce the language problems arising from the growing use of recorded announcements.

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[1] This Recommendation is also included in the Series E Recommendations under the number E.181 (Fascicle II.2).

Note – This Recommendation is complementary to Recommendation Q.35 on the standardization of tones in the international telephone network. Whilst standardization is of primary importance, telephone users need information to assist them in recognizing foreign tones until such time as standardization is complete.

This is the purpose of § 1 of the present Recommendation which, as extensive human factor experiments show, should greatly reduce subscriber confusion.

The measure mentioned in § 2 does not eliminate the need for tone standardization as well, but can reduce customer difficulties in cases where standardization may be impractical for a long period but sophisticated exchanges arrangements are available.

SECTION 6

GENERAL CHARACTERISTICS FOR INTERNATIONAL TELEPHONE CONNECTIONS AND INTERNATIONAL TELEPHONE CIRCUITS

6.0 General

Recommendation Q.40

THE TRANSMISSION PLAN [1]

1 Principles

The transmission plan of the CCITT established in 1964 (Geneva) was drawn up with the object of making use, in the international service, of the advantages offered by 4-wire switching.

. . . . . .

However, the recommendations in the plan are to be considered as met if the use of technical means other than those described below gives an equivalent performance at the international exchange.

Recommendation G.122 [1] describes the conditions to be fulfilled by a national network for this transmission plan to be put into effect.

Note 1 – From the point of view of the transmission plan, no distinction is made between intercontinental circuits and other international circuits.

Note 2 – Short trans-frontier circuits are not covered by this plan and should be the subject of agreement between the Administrations concerned.

. . . . . .

2 Definition of the constituent parts of a connection

2.1 *The international chain and the national systems*

A complete international telephone connection consists of three parts, as shown in Figure 1/Q.40.

- *An international chain* made up of one or more 4-wire international circuits. These are interconnected on a 4-wire basis in the international transit centres and are also connected on a 4-wire basis to national systems in the international centres.
- *Two national systems*, one at each end. These may comprise one or more 4-wire national trunk circuits with 4-wire interconnection, as well as circuits with 2-wire connection up to terminal exchanges and to the subscribers.

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[1] This Recommendation is an extract of Recommendation G.101 [2]. The suspensive points show where a passage in Recommendation G.101 has not been reproduced under Q.40.

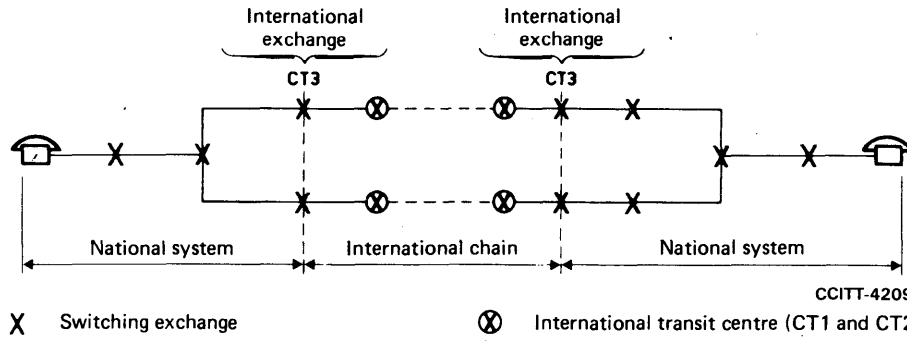


FIGURE 1/Q.40

Definition of the constituent parts of an international connection

A 4-wire circuit is defined by its *virtual analogue switching points* in an international transit exchange or an international exchange. These are theoretical points with specified relative levels (see Figure 2/Q.40; for further details see [3].

The difference between the sending and receiving nominal relative levels at the reference frequency is, by definition, *the nominal transmission loss* of the 4-wire circuit *between virtual analogue switching points.*

In an international exchange, the division between the international chain and the national system is determined by the virtual analogue switching points of the international circuit.

The virtual analogue switching points may not be the same as the points at which the circuit terminates physically in the switching equipment. These latter points are known as the *circuit terminals*; the exact position of these terminals is decided in each case by the Administration concerned.

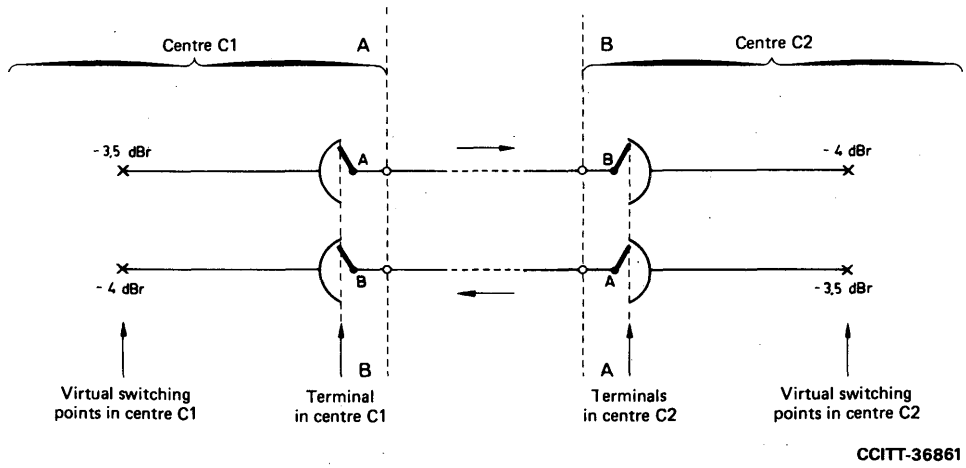


FIGURE 2/Q.40

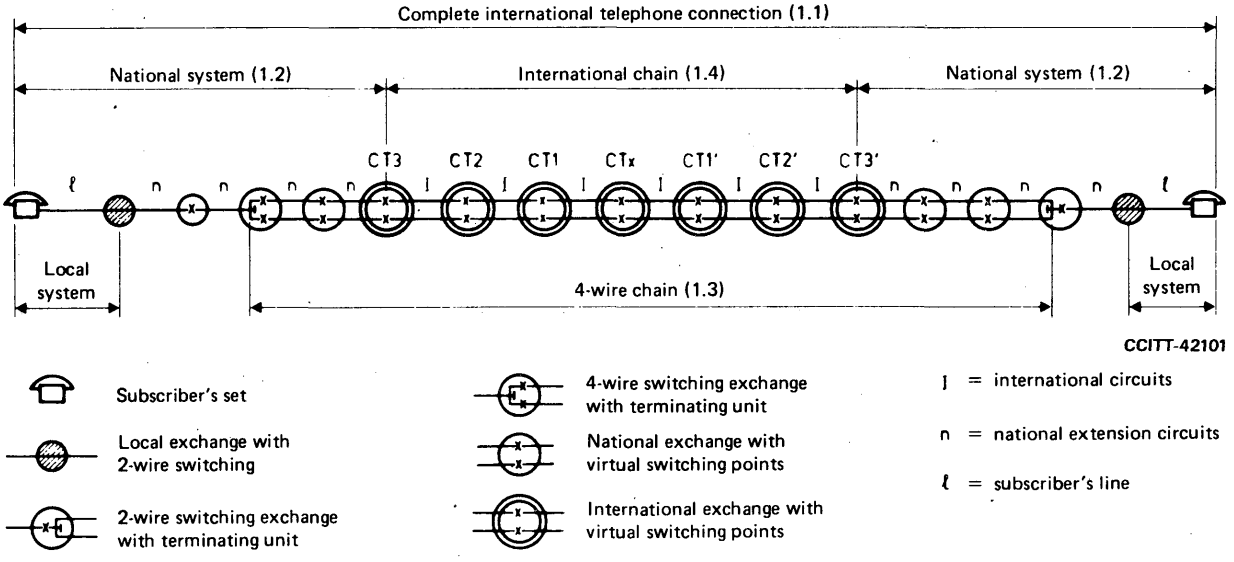
Definitions for an international circuit

2.2 *National extension circuits: 4-wire chain*

When the maximum distance between an international exchange and a subscriber who can be reached from it does not exceed about 1000 km or, exceptionally, 1500 km, the country concerned is considered as of average size. In such countries, in most cases, not more than three national circuits are interconnected on a 4-wire basis between each other and to international circuits. These circuits should comply with Recommendations G.141 [4] and G.142 [5].

In a large country, a fourth and possibly a fifth national circuit may be included in the 4-wire chain, provided it has the nominal transmission loss and the characteristics recommended for international circuits used in a 4-wire chain (see Recommendations G.151 [6], G.152 [7] and G.153 [8] as well as the Recommendation cited in [9].

Note – The abbreviation "a 4-wire chain" (see Figure 3/Q.40) signifies the chain composed of the international chain and the national extension circuits connected to it, either by 4-wire switching or by some equivalent procedure (as understood in § 1 above).



Note – The arrangements shown for the national systems are examples only. The numbers given in brackets refer to the subsection of Section 1 of Fascicule III.1 in which Recommendations may be found relevant to that part of the connection. In addition, the circuits making up this chain must individually meet the requirements of Subsection 1.5 of Fascicule III.1 (Recommendations G.151 [6], G.152 [7] and G.153 [8]).

FIGURE 3/Q.40

An international connection to illustrate the nomenclature adopted

3 Number of circuits in a connection

3.1 *National circuits*

It seems reasonable to assume that in most countries any *local exchange* can be connected to the international network by means of a chain of 4 (or less) national circuits. Five national circuits may be needed in some countries, but it is unlikely that any country may need to use more than 5 circuits. Hence the CCITT has reached the conclusion that 4 circuits is a representative figure to assume for the great majority of international connections.

In most modern national networks, the four circuits will probably include three 4-wire amplified circuits (usually set up on carrier systems) and one 2-wire circuit, probably unamplified. In some instances, however, local exchanges will be reached by 4 circuits, all of which may be 4-wire circuits.

The representative maximum international connection considered by the CCITT for the study of transmission performance (see Figure 3/Q.40 and Figure 1/G.103 [10]) thus includes 8 national circuits, besides the international ones. The cumulative distortion of these 8 circuits is likely to be large, and close to the maximum allowable value. Consequently, the international circuits must not introduce any further appreciable deterioration. This principle has been borne in mind during the drafting of the Recommendations dealing with such circuits.

3.2 *International circuits*

Implementation of the routing plan for automatic and semi-automatic international telephone traffic (Recommendation Q.13) presupposes that the transmission plan is applied. In the routing plan, the CCITT has defined three classes of international centres, CT1, CT2 and CT3, and has arranged to restrict *the number of international circuits to five* or, exceptionally, to six or seven. The CT3s connect international and national circuits; the CT2s and CT1s interconnect international circuits. In some connections, an international centre designated CTX, as well as the CT1s, may be encountered as shown in Figure 3/Q.40. Certain exceptional routings, moreover, involve a seventh international circuit.

3.3 *Hypothetical reference connections*

(See Recommendations G.103 [11] and G.104 [12].)

References

[1] CCITT Recommendation *Influence of national networks on stability and echo losses in national systems*, Vol. III, Fascicle III.1, Rec. G.122.

[2] CCITT Recommendation *The transmission plan*, Vol. III, Fascicle III.1, Rec. G.101.

[3] *Ibid.*, § 5.

[4] CCITT Recommendation *Transmission losses, relative levels and attenuation distortion*, Vol. III, Fascicle III.1, Rec. G.141.

[5] CCITT Recommendation *Transmission characteristics of exchanges*, Vol. III, Fascicle III.1, Rec. G.142.

[6] CCITT Recommendation *General performance objectives applicable to all modern international circuits and national extension circuits*, Vol. III, Fascicle III.1, Rec. G.151.

[7] CCITT Recommendation *Characteristics appropriate to long-distance circuits of a length not exceeding 2500 km*, Vol. III, Fascicle III.1, Rec. G.152.

[8] CCITT Recommendation *Characteristics appropriate to international circuits more than 2500 km in length*, Vol. III, Fascicle III.1, Rec. G.153.

[9] CCITT Recommendation *The transmission plan*, Vol. III, Fascicle III.1, Rec. G.101, § 4.

[10] CCITT Recommendation *Hypothethical reference connections*, Vol. III, Fascicle III.1, Rec. G.103, Figure 1/G.103.

[11] CCITT Recommendation *Hypothetical reference connections*, Vol. III, Fascicle III.1, Rec. G.103.

[12] CCITT Recommendation *Hypothetical reference connections (digital network)*, Vol. III, Fascicle III.1, Rec. G.104.

6.1 General characteristics of a complete international telephone connection

Recommendation Q.41

MEAN ONE-WAY PROPAGATION TIME [1]

1 Limits for a connection

It is necessary in an international telephone connection to limit the propagation time between two subscribers. As the propagation time is increased, subscriber difficulties increase, and the rate of increase of difficulty rises, see b) below. Relevant evidence is given in the bibliography of Recommendation G.114 [1].

[1] This Recommendation is an extract of Recommendation G.114 [1]. The suspensive points show where a passage in Recommendation G.114 has not been reproduced under Q.41.

As a network performance objective, CCITT therefore *recommends* the following limitations on mean one-way propagation times [2] when echo sources exist and appropriate echo control devices, such as echo suppressors and echo cancellers, are used:

a) 0 to 150 ms, acceptable.

Note – Echo suppressors specified in Reference [2] may be used for delays not exceeding 50 ms (see Reference [3]).

b) 150 to 400 ms, acceptable, provided that increasing care is exercised on connections as the mean one-way propagation time exceeds about 300 ms, and provided that echo suppressors designed for long delay circuits are used.

c) above 400 ms, unacceptable. Connections with these delays should not be used except under the most exceptional circumstances.

. . . . . .

2 Values for circuits

In the establishment of the general interconnection plan within the limits in § 1 the one-way propagation time of both the national extension circuits and the international circuits must be taken into account. The propagation time of circuits and connections is the aggregate of several components; e.g. group delay in cables and in filters encountered in FDM modems of different types. Digital transmission and switching also contribute delays. The conventional planning values given in § 2.1 may be used to estimate the total propagation time of specified assemblies which may form circuits or connections.

2.1 *Conventional planning values of propagation time*

Provisionally, the conventional planning values of propagation time in Table 1/Q.41 may be used.

TABLE 1/Q.41

Transmission medium	Contribution to one-way propagation time	Remarks
Terrestrial coaxial cable or radio relay system; FDM and PCM transmission	4 μs/km	Allows for delay in repeaters and regenerators
Submarine coaxial cable-system	6 μs/km	
Satellite system – 14 000 km altitude – 36 000 km altitude	 110 ms 260 ms	 Between earth stations only
FDM channel modulator or demodulator	0.75 ms[a]	Half the sum of propagation times in both directions of transmission
PCM coder or decoder	0.3 ms[a]	
Transmultiplexer	1.5 ms	
Digitally switched exchange, digital-digital	0.45 ms[b]	

[a] These values allow for group-delay distortion around frequencies of peak speech energy and for delay of intermediate higher order multiplex and through-connecting equipment.

[b] This is a mean value; depending on traffic loading, higher values can be encountered, e.g. 0.75 ms with 0.95 probability of not exceeding.

[2] Means of the times in the two directions of transmission.

2.2 *National extension circuits*

The main arteries of the national network should consist of high-velocity propagation lines. In these conditions, the propagation time between the international centre and the subscriber farthest away from it in the national network will probably not exceed:

$$12 + (0.004 \times \text{distance in kilometres}) \text{ ms.}$$

Here the factor 0.004 is based on the assumption that national trunk circuits will be routed over high-velocity plant (250 km/ms). The 12 ms constant term makes allowance for terminal equipment and for the probable presence in the national network of a certain quantity of loaded cables (e.g. three pairs of channel translating equipments plus about 160 km of H 88/36 loaded cables). For an average-sized country the one-way propagation time will be less than 18 ms.

2.3 *International circuits*

International circuits will use high-velocity transmission systems, e.g. terrestrial cable or radio-relay systems, submarine systems or satellite systems. The planning values of § 2.1 may be used.

The magnitude of the mean one-way propagation time for circuits on high altitude communication satellite systems makes it desirable to impose some routing restrictions on their use. Details of these restrictions are given in Recommendation Q.13.

References

[1] CCITT Recommendation *Mean one-way propagation time*, Vol. III, Fascicle III.1, Rec. G.114.

[2] CCITT Recommendation *Definitions relating to echo suppressors and characteristics of a far-end operated, differential, half-echo suppressor*, Blue Book, Vol. III, Rec. G.161, ITU, Geneva, 1965.

[3] CCITT Recommendation *Stability and echo*, Vol. III, Fascicle III.1, Rec. G.131, § 2.2.

6.2 General characteristics of national systems forming part of international connections

(See Recommendations G.121 to G.125, Fascicle III.1.

6.3 General characteristics of the "4-wire chain" formed by the international telephone circuits and national extension circuits

(Overall characteristics for the 4-wire chain are defined in Recommendation Q.40, § 2.)

Recommendation Q.42

STABILITY AND ECHO (ECHO SUPPRESSORS)

(See Recommendation G.131 in Fascicle III.1 and Recommendation Q.115)

6.4 General characteristics of the 4-wire chain of international circuits; international transit

Recommendation Q.43

TRANSMISSION LOSSES, RELATIVE LEVELS [1)]

. . . . . .

5.3 *Definitions*

5.3.1 **transmission reference point**

F: point de référence pour la transmission

S: punto de referencia para la transmisión

A hypothetical point used as the zero relative level point in the computation of nominal relative levels. At those points in a telephone circuit the nominal mean power level (−15 dBm) defined in the Recommendation cited in [2] shall be applied when checking whether the transmission system conforms to the noise objectives defined in Recommendation G.222 [3].

Note – For certain systems, e.g. submarine cable systems (Recommendation G.371 [4]), other values apply.

Such a point exists at the sending end of each channel of a 4-wire switched circuit preceding the virtual switching point; on an international circuit it is defined as having a signal level of +3.5 dB above that of the virtual switching point.

In frequency division multiplex equipment, a hypothetical point of flat zero relative level (i.e. where all channels have the same relative level) is defined as a point where the multiplex signal, as far as the effect of intermodulation is concerned, can be represented by a uniform spectrum random noise signal with a mean power level as defined in the Recommendation cited in [5]. The nominal mean power level in each telephone channel is −15 dBm as defined in the Recommendation cited in [2].

5.3.2 **relative (power) level**

F: niveau relatif de puissance

S: nivel relativo (de potencia)

5.3.2.1 The *nominal relative level* at a point in a transmission system characterizes the signal power handling capacity at this point with respect to the conventional power level at a zero relative level point.

If, for example, at a particular point the mean power handling capacity per telephone channel corresponds to an absolute power level of S dBm, the relative level associated with this point is $(S + 15)$ dBr. In particular, at a 0 dBr point, the conventional mean power level referred to one telephone channel is −15 dBm.

Note – The nominal relative levels at particular points in a transmission system (e.g. input and output of distribution frames or of equipment like channel translators) are fixed by convention, usually by agreement between manufacturers and users.

The Recommendations of the CCITT are defined in such a way that the absolute power level of any testing signal to be applied at the input of a particular transmission system, to check whether it conforms to these Recommendations, is clearly defined as soon as the nominal relative level at this point is fixed.

5.3.2.2 The *actual relative level* at a point on a circuit is the expression $10 \log_{10} (P/P_0)$ dBr, where P represents the power of a sinusoidal test signal at the point concerned and P_0 the power of that signal at the transmission reference point. This quantity is independent of the value of P_0, it is a level difference indicating a circuit gain.

Note – When a transmission system is set up, equipment must be assembled so as to ensure compatibility between the nominal and actual relative levels as imposed by the individual equipment. The diagram showing the relative levels of a circuit set up within a system is thus defined by the equipment used in it.

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1) This Recommendation is an extract of Recommendation G.101 [1]. The suspensive points show where a passage in Recommendation G.101 has not been reproduced under Q.43.

5.3.2.3 The relationship between the 0 dBr point and the level of T_{max} in PCM encoding/decoding processes standardized by the CCITT is set forth in Recommendation G.711 [6]. Figure 1/Q.43 illustrates the principle of how the relative level at the input and output analogue points of a "real" codec can be determined. In particular, if the minimum nominal send reference equivalent of local systems referred to a point of 0 dBr of a PCM encoder is not less than 2.5 dB and the value of T_{max} of the process is set at +3 dBm0 (more accurately 3.14 dBm0 for A-law and 3.17 for μ-law), then in accordance with the Recommendation cited in [7] the peak power of the speech will be suitably controlled.

When the signal load is controlled as outlined above, the 0 dBr points of FDM and PCM circuits may be directly connected together and each will respect the other's design criteria. This is of particular importance when points in the two multiplex hierarchies are connected together by means of transmultiplexers, codecs or modems.

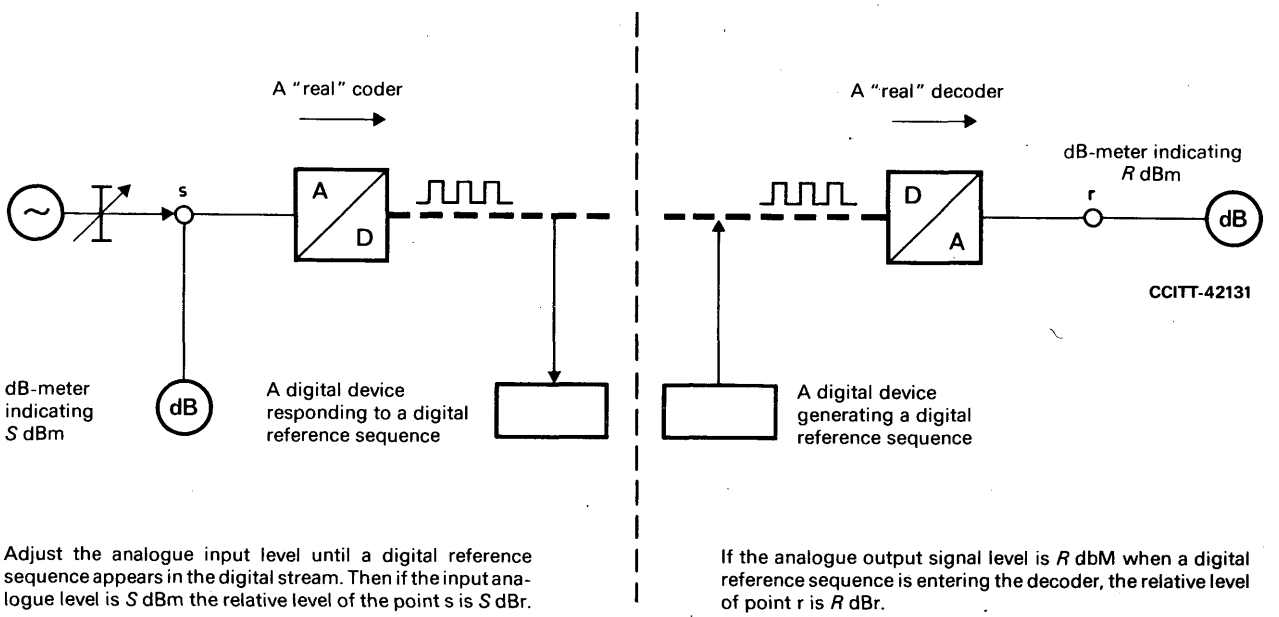


FIGURE 1/Q.43

Set-up for determining the relative level at the input and output analogue points of a "real" codec using digital reference sequences

5.3.3 PCM digital reference sequence (DRS)

F: séquence numérique de référence MIC

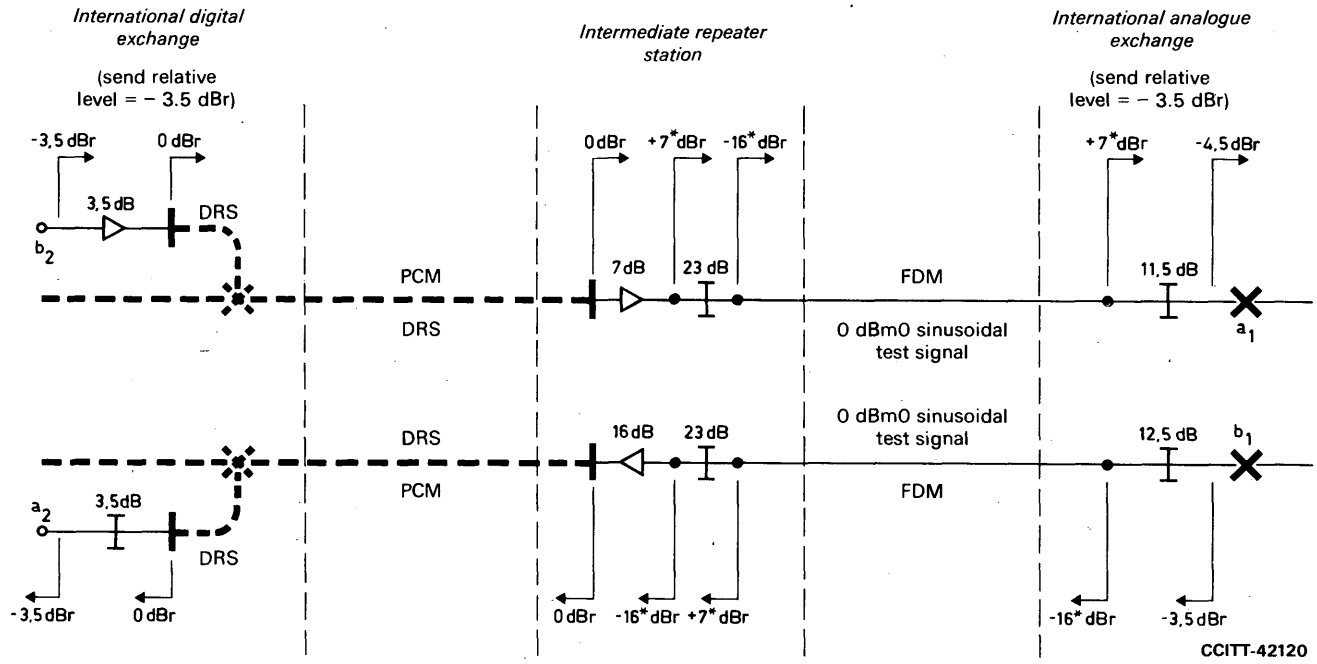
S: secuencia de referencia digital MIC (SRD)

5.3.3.1 A PCM digital reference sequence is one of the set of possible PCM code sequences that, when decoded by an ideal decoder, produces an analogue sinusoidal signal at the agreed test reference frequency (i.e. a nominal 800 or 1000 Hz signal suitably offset) at a level of 0 dBm0.

Conversely an analogue sinusoidal signal at 0 dBm0 at the test reference frequency applied to the input of an ideal coder will generate a PCM digital reference sequence.

Some particular PCM digital reference sequences are defined in Recommendation G.711 [6] in respect to A-law and μ-law codecs.

5.3.3.2 In studying circuits and connections in mixed analogue/digital networks, use of the digital reference sequence can be helpful. For example, Figure 2/Q.43 shows the various level relationships that one obtains (conceptually) on a Type 2 international circuit where one end terminates at a digital exchange and the other end at an analogue exchange. In the example of Figure 2/Q.43, the analogue portion is assumed to require a loss of 0.5 dB and that provision for this loss is made by introducing a 1.0 dB pad (0.5 dB for each direction of transmission) in the receive direction at the analogue exchange. This has been deliberately chosen to illustrate the utility of the concept of a digital reference sequence.



DRS Digital reference sequence
PCM PCM channel
FDM FDM channel
* one of the set of VF relative levels cited in [8] for the purpose of illustration
—●— Multiplex VF input/output point

Transmission loss: $b_2 - a_1 = 1.0$ dB
$b_1 - a_2 = 0$ dB

Note – For meaning of other symbols, see legend for Figure 5/G.101 [9].

FIGURE 2/Q.43

Use of a digital reference sequence in the design and line-up of a Type 2 international circuit

5.3.4 *Circuit test access point*

The CCITT has defined circuit test access points as being "4-wire test-access points so located that as much as possible of the international circuit is included between corresponding pairs of these access points at the two centres concerned". These points, and their relative level (with reference to the transmission reference point), are determined in each case by the Administration concerned. They are used in practice as points of known relative level to which other transmission measurements will be related. In other words, for measurement and lining-up purposes, the relative level at the appropriate circuit test access point is the relative level with respect to which other levels are adjusted.

5.3.5 *Measurement frequency*

For all international circuits 800 Hz is the recommended frequency for single-frequency maintenance measurements. However, by agreement between the Administrations concerned, 1000 Hz may be used for such measurements.

A frequency of 1000 Hz is in fact now widely used for single-frequency measurements on some international circuits.

Multifrequency measurements made to determine the loss/frequency characteristic will include a measurement at 800 Hz and the frequency of the reference measurement signal for such characteristics can still be 800 Hz.

Note 1 – Definitions 5.3.1 and 5.3.2 are used in the work of Study Group XVI. Definitions 5.3.4 and 5.3.5, taken from Recommendations M.640 [10] and M.580 [11], are included for information.

Note 2 – In order to take account of PCM circuits and circuit sections, the nominal frequencies 800 Hz and 1000 Hz are in fact offset by appropriate amounts to avoid interaction with the sampling frequency. Details can be found in Supplement No. 3.5 to Volume IV [12].

5.4 *Interconnection of international circuits in a transit centre*

In a transit centre, the virtual analogue switching points of the two international circuits to be interconnected are considered to be connected together directly without any additional loss or gain. In this way a chain of international circuits has a nominal transmission loss in transit equal to the sum of the individual circuit losses.

References

[1] CCITT Recommendation *The transmission plan*, Vol. III, Fascicle III.1, Rec. G.101.

[2] CCITT Recommendation *Assumptions for the calculation of noise on hypothetical reference circuits for telephony*, Vol. III, Fascicle III.2, Rec. G.223, § 1.

[3] CCITT Recommendation *Noise objectives for design of carrier-transmission systems of 2500 km*, Vol. III, Fascicle III.2, Rec. G.222.

[4] CCITT Recommendation *FDM carrier systems for submarine cable*, Vol. III, Fascicle III.2, Rec. G.371.

[5] CCITT Recommendation *Assumptions for the calculation of noise on hypothetical reference circuits for telephony*, Vol. III, Fascicle III.2, Rec. G.223, § 2.

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

[7] CCITT Recommendation *Corrected reference equivalents (CREs) of national systems*, Vol. III, Fascicle III.1, Rec. G.121, § 3.

[8] CCITT Recommendation *12-channel terminal equipments*, Vol. III, Fascicle III.2, Rec. G.232, § 11.

[9] CCITT Recommendation *The transmission plan*, Vol. III, Fascicle III.1, Rec. G.101, Figure 5/G.101.

[10] CCITT Recommendation *Four-wire switched connections and four-wire measurements on circuits*, Vol. IV, Fascicle IV.1, Rec. M.640.

[11] CCITT Recommendation *Setting up and lining up an international circuit for public telephony*, Vol. IV, Fascicle IV.1, Rec. M.580.

[12] *Test frequencies on circuit routed over PCM systems*, Vol. IV, Fascicle IV.4, Supplement No. 3.5.

Recommendation Q.44

ATTENUATION DISTORTION [1]

1 The design objectives recommended for carrier terminal equipment by the Recommendation cited in [3] are such that for a chain of six circuits, each equipped with a single pair of channel translating equipments in accordance with that Recommendation, the network performance objective for the attenuation distortion given by Figure 1/Q.44 will in most cases be met. The distortion contributed by the seven international centres is thereby included.

Note – To assess the attenuation distortion of the international chain, the limits indicated for international circuits in the Recommendation cited in [4] must not be added to the limits for international centres mentioned in Recommendation Q.45. In fact, on the one hand, some exchange equipment would be counted twice if this addition were made; on the other, the specifications limits of Recommendation Q.45 apply to the worst possible connection through an international exchange, while the maintenance limits of the Recommendation cited in [4] apply to the poorest international circuit. The specifications of the various equipments are such that the mean performance will be appreciably better than could be estimated by the above-mentioned addition.

[1] Recommendation Q.44 is an extract of Fascicle III.1; § 1 originates from Recommendation G.141 [1] and § 2 originates from Recommendation G.132 [2].

2 The network performance objectives for the variation with frequency of transmission loss in terminal condition of a worldwide 4-wire chain of 12 circuits (international plus national extensions), each one routed over a single group link, are shown in Figure 1/Q.44 which assumes that no use is made of high-frequency radio circuits or 3-kHz channel equipment.

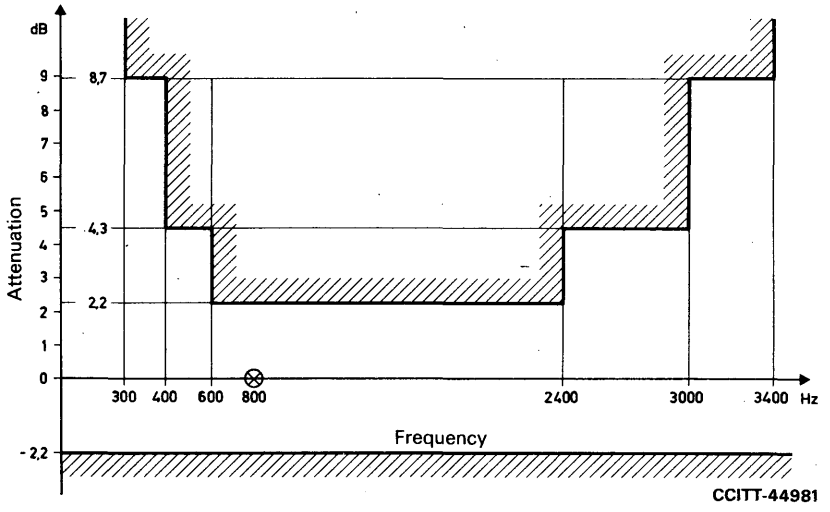


FIGURE 1/Q.44

Permissible attenuation variation with respect to its value measured at 800 Hz (objective for worldwide 4-wire chain of 12 circuits in terminal service)

References

[1] CCITT Recommendation *Transmission losses, relative levels and attenuation distortion*, Vol. III, Fascicle III.1, Rec. G.141.

[2] CCITT Recommendation *Attenuation distortion*, Vol. III, Fascicle III.1, Rec. G.132.

[3] CCITT Recommendation *12-channel terminal equipments*, Vol. III, Fascicle III.2, Rec. G.232, § 1.

[4] CCITT Recommendation *General performance objectives applicable to all modern international circuits and national extension circuits*, Vol. III, Fascicle III.1, Rec. G.151, § 1.

Recommendation Q.45

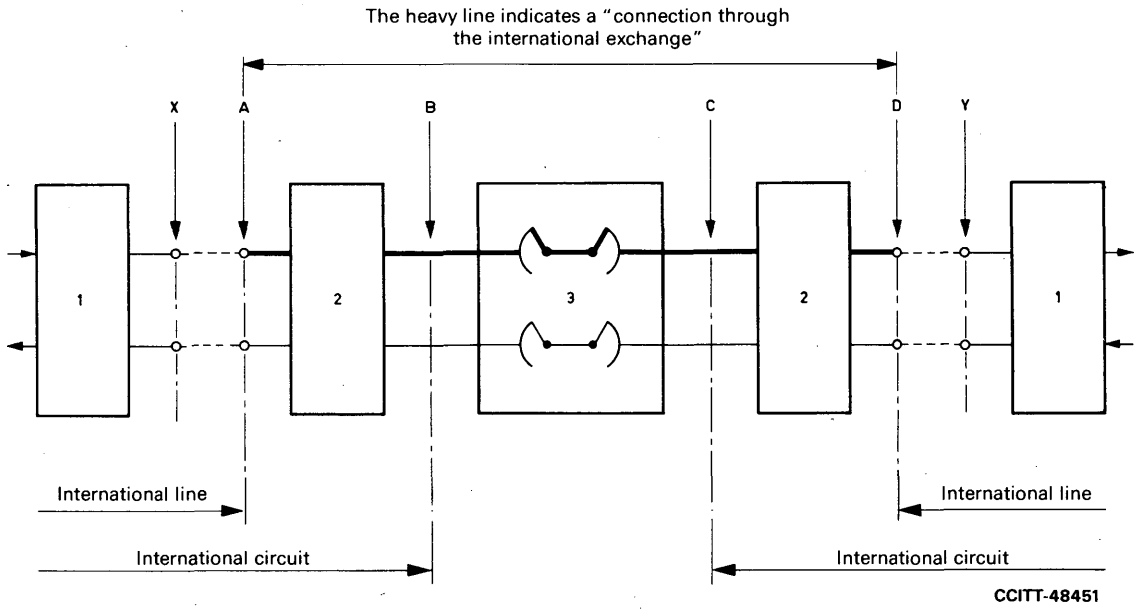
TRANSMISSION CHARACTERISTICS OF AN INTERNATIONAL EXCHANGE

1 Introduction

1.1 For the purposes of this Recommendation, an international exchange is a collection of equipment regarded as an entity by the Administration concerned. In the case of an international transit centre, it extends from the end of the incoming international line to the beginning of the outgoing international line (e.g. between such points as A and D in Figure 1/Q.45 or any other suitable pair of points).

In the absence of an international agreement on the choice of the points delimiting an international exchange, it has proved impossible to draw up model specifications showing the limits to be observed for quantities measured between these points. The CCITT recommendations given hereafter have been issued regardless of the actual arrangement.

Automatic international exchanges should be provided with circuit test access points (see Recommendation M.700 [1]) complying with the Recommendation cited in [2]. This Recommendation will ensure that circuit line-up and maintenance testing procedures are referred to points at or near the switchblock (Points B and C of Figure 1/Q.45).



1 = channel translating equipment
2 = incoming and outgoing relay set
3 = automatic switching equipment

Note – Between points X and A and points D and Y, there may be equipment such as echo suppresors, compandors, equalizers, line signal receivers, etc., in addition to the cabling.

FIGURE 1/Q.45
International exchange

1.2 The essential transmission requirements for an international exchange are:

a) The *transmission loss* through the centre should be substantially constant with time and independent of the routing through the centre.

b) *Crosstalk and noise* should be negligible.

c) The *distortions* introduced should be small. These include attenuation distortion, non-linear distortion and intermodulation products.

d) *Impedance* and *balance with respect to earth* at the points in the international exchange to which the lines are connected should be closely controlled.

1.3 The following recommendations apply to new automatic 4-wire international exchanges of the electro-mechanical type. It is desirable that they should apply to new national 4-wire exchanges. They may also be applicable to electronic exchanges having metallic contact crosspoints.

These recommendations are intended to be used only as type tests, acceptance tests, or for special investigations. They do not constitute a complete specification. Generally the recommended tests should be conducted on a sampling basis.

2 Definitions

2.1 *Definition of a "connection through an exchange"*

Crosstalk and noise conditions for a 4-wire international exchange are defined by reference to a "connection through this exchange". By **connection through an exchange** is to be understood the pair of wires corresponding to one direction of transmission (GO direction or RETURN direction) and connecting the input point of one circuit incoming in the exchange and the output point of a different circuit outgoing from the exchange (these input or output points are often taken at the test-jack frame).

A connection through the international exchange is shown by a heavy line in Figure 1/Q.45.

2.2 *Definition of switching equipment input and output points*

Although the virtual switching points, which are points at which the two circuits are considered to be directly connected, are theoretical points, in practice it will always be possible to choose a point considered as the *switching equipment input* for the receive channel of a circuit and a point considered as the *switching equipment output* for the transmit channel of a circuit.

The exact position of each of these points depends on national practice and it is unnecessary for the CCITT to define it. Only the national authority responsible for each international transit centre can fix the position of these points in each case.

The switching equipment input point associated with a receive channel may be such that the nominal relative level is different from −4.0 dBr. Let this nominal relative level be R [1].

The switching equipment output point associated with a transmit channel may be such that the nominal relative level is different from −3.5 dBr. Let this nominal relative level be S [1].

Consider a circuit between the switching centre concerned and the adjacent centre. Let T be the nominal transmission loss between virtual switching points at the two ends of the channel of this circuit, which is the receive channel in the centre concerned.

When a transit connection is established through a centre by connecting the receive and transmit channels of one circuit to the transmit and receive channels respectively of another circuit, in order to ensure that the virtual switching points have been connected together with additional loss or gain, the *nominal* value of the attenuation (loss) to be introduced between the switching equipment input and the switching equipment output is $R - S + T$.

2.3 *Definition of the net switching loss*

Let the actual value of the attenuation introduced between the switching equipment input and output points be A. The **net switching loss** is defined to be equal to the difference between this *actual* value and the *nominal* value of the attenuation. Thus:

Net switching loss = actual loss − nominal loss = $A - (R - S + T)$.

3 Recommendations concerning transmission loss

3.1 *Net switching loss*

Ideally, the net switching loss of an international exchange would always be zero. That is, the *actual* loss (A) should equal the *nominal* loss ($R - S + T$).

Example − The relationship between the actual switching points and the virtual switching points in a practical international exchange is illustrated in Figure 2/Q.45.

In this arrangement:

$R = +7$ dBr,
$S = -16$ dBr,
and T is assumed to be 0.5 dB

so that the nominal transmission loss needed between the +7 and −16 dBr points is:

$$(+7) - (-16) + (0.5) = 23.5 \text{ dB}.$$

In practice, different connections established by the switching equipment will introduce different values of net switching loss so that a distribution of net switching losses will arise. The mean value of this distribution should be very close to zero but does not need to be specified.

3.2 *Loss dispersion*

According to the Recommendation cited in [2], circuit test-access points are located at or near the switchblock (points B and C of Figure 1/Q.45). Moreover, the dispersion of loss is mainly due to the diversity of paths in the switchblock. It is therefore only necessary to consider the dispersion of loss between the points B and C.

The standard deviation of loss measured at 800 Hz of all possible paths between points B and C should be as small as possible. For purposes of calculation a value of 0.2 dB may be assumed.

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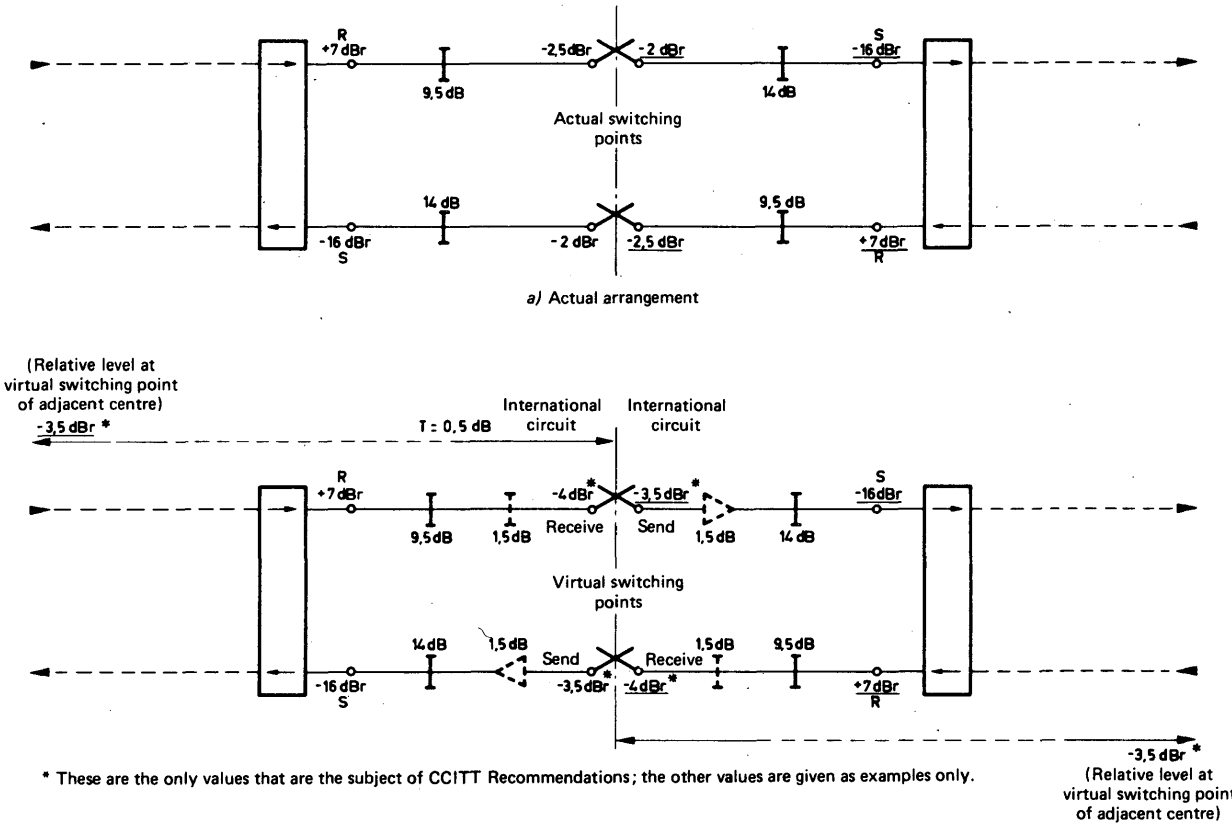
[1] If the value of R is chosen to be higher than the value of S, the level difference can be used to offset any inherent transmission loss in the switching equipment and the requirements of the transmission plan can be met without any need to install supplementary audio-frequency amplifiers.



Note – Underlined values of relative level refer to the circuit on the right of the point concerned. Values of relative level not underlined refer to the circuit on the left of the point concerned. In an actual switching centre the virtual switching points would not physically exist.

FIGURE 2/Q.45

Example showing a simplified representation of a transit connection in an international exchange with actual arrangement and possible location of virtual switching points

In order to conform to this value, it is considered sufficient that, for purposes of design and acceptance testing, the difference between the losses at 800 Hz of the shortest and longest paths from point B to point C in no case exceeds 0.8 dB. For a practical assessment of the average value of net switching loss, the contribution from the switchblock can be taken as the mean of the maximum and minimum values of loss between points B and C.

These values apply for connections routed directly, and once only, through the switchblock. Due to the fact that the switchblock contains only switches and associated cabling, the actual loss between points B and C in any case can only have positive values.

If special re-entrant trunking arrangements are used, requiring the connection to pass through the switchblock twice (this may be a convenient way to extend the availability of the switching network or to introduce additional equipment, e.g. echo suppressors), the maximum loss and loss dispersion will be increased. In view of this, the re-entrant technique should not be used to such an extent as to increase significantly the mean net switching loss of the exchange.

3.3 *Nonlinear distortion*

The transmission loss measured on any "connection through the international exchange" should not vary by more than 0.2 dB when the level of the test-tone is varied from −40 dBm0 to +3.5 dBm0.

3.4 *Loss-frequency distortion referred to 800 Hz*

The difference between the transmission loss measured on any "connection through the international exchange" over the frequency bands indicated below and that measured at 800 Hz [2], should lie within the following limits:

300- 400 Hz: −0.2 dB to +0.5 dB,
400-2400 Hz: −0.2 dB to +0.3 dB,
2400-3400 Hz: −0.2 dB to +0.5 dB.

4 Crosstalk recommendations

4.1 Crosstalk should be measured in exchanges at a frequency of 1100 Hz in accordance with Recommendation G.134 [3].

4.2 *Crosstalk between connections established (between points A and D)*

In an international 4-wire exchange the signal to crosstalk ratio measured at points A and D between any two "connections through the international exchange" (see definition in § 2.1 above) should be 70 dB or better.

This limit of 70 dB should normally apply to the most unfavourable case, in which two "connections" have parallel paths throughout the international exchange. It should be noted that this does not occur in practice, because normal cabling layout is such that when, at one switching stage, two "connections" use adjacent switches, in the following stage the two "connections" generally use switches which are not adjacent.

4.3 *GO to RETURN crosstalk of the same path (between points A and D)*

The signal-to-crosstalk ratio between the two "connections" which constitute the GO and RETURN channels of a 4-wire path established through the international exchange should be 60 dB or better.

5 Noise recommendations

For a 4-wire international exchange, noise measurements should be performed on a "connection through the exchange" during the busy-hour. (The *busy-hour* is defined in [4].) Each channel of the connection should be terminated at points A and D of Figure 1/Q.45, in 600 ohms. The noise should be measured at the downstream end of each channel and should be referred to a point zero relative level in that channel. Thus, in Figure 1/Q.45 the noise in the upper channel is measured at D and the noise in the lower channel is measured at A.

5.1 *Mean noise power during the busy-hour*

The mean of the noise over a long period during the busy-hour should not exceed the following values:

- Psophometrically weighted noise: −67 dBm0p (200 pW0p),
- Unweighted noise: −40 dBm0 (100 000 pW0) measured with a device with a uniform response curve throughout the band 30-20 000 Hz.

Note – A sufficient variety of connections should be chosen to ensure that the measurements are representative of the various possible routes through the exchange.

5.2 *Impulsive noise during the busy-hour*

Noise counts should not exceed 5 counts in 5 minutes at a threshold level of −35 dBm0 (see Annex A to this Recommendation for measurement procedure).

Note – Figure 3/Q.45 shows the maximum number of impulsive noise counts acceptable on a 5-minute period.

[2] 1000 Hz is an acceptable alternative frequency.

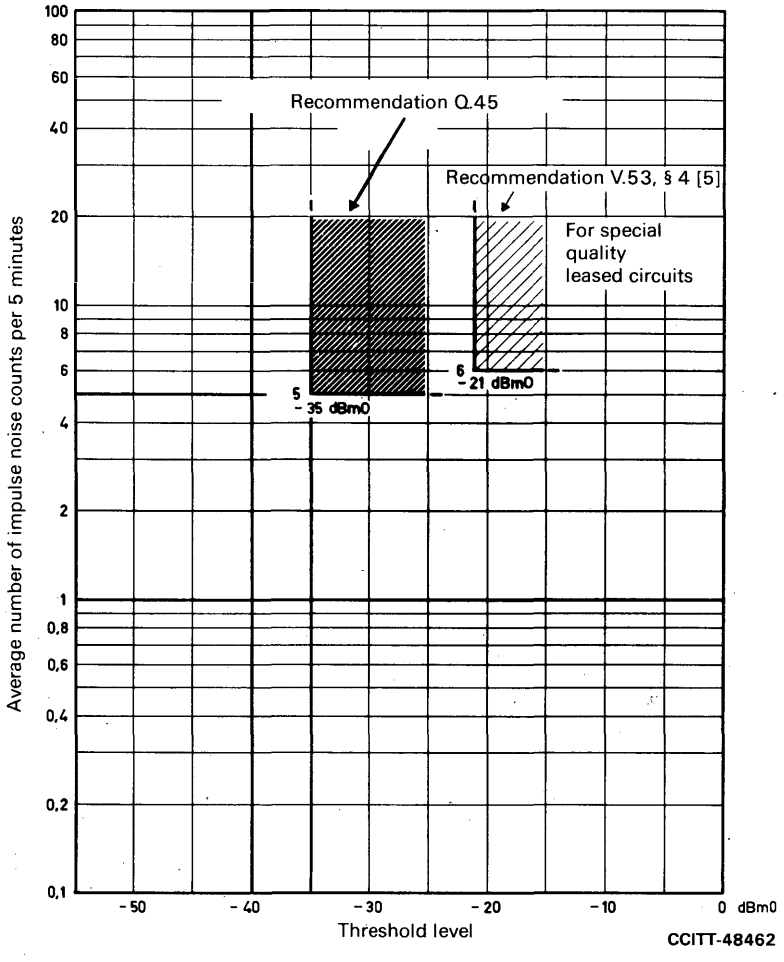


FIGURE 3/Q.45

Impulsive noise requirements for 4-wire exchanges

6 Other transmission recommendations

6.1 *Intermodulation products (measured at A and D)*

The intermodulation products to be taken into account for end-to-end multifrequency signalling and for data transmission are those of the third order, of type $(2f_1 - f_2)$ and $(2f_2 - f_1)$ where f_1 and f_2 are two signalling frequencies.

For a measurement of the intermodulation products, the two frequencies to be used are 900 Hz and 1020 Hz (see [6]). With each frequency f_1 and f_2 at a level of -6 dBm0, the difference between the level of either frequency f_1 or f_2 and the level of either of the intermodulation products at $(2f_1 - f_2)$ or $(2f_2 - f_1)$ should be at least 40 dB.

6.2 *Group delay distortion (measured between A and D)*

The group delay distortion measured on any "connection through the international exchange" over the band 600-3000 Hz should not exceed 100 microseconds.

6.3 *Return loss (measured at A and D, from A towards D and from D towards A)*

At any frequency from 300-600 Hz the return loss measured against 600 ohms should be not less than 15 dB. The corresponding value from 600-3400 Hz should be not less than 20 dB.

6.4 *Impedance unbalance to earth*

6.4.1 The impedance unbalance to earth measured, at points A and D, should not be worse than:

300-600 Hz: 40 dB;
600-3400 Hz: 46 dB.

Note – Some Administrations guided by their knowledge of local conditions may feel a need to specify a figure for a lower frequency, for instance, 50 Hz.

6.4.2 The degree of unbalance to earth is defined as the ratio u/U measured as shown in a) and b) of Figure/Q.45 and is expressed in decibels as the reciprocal of this ratio in transmission units.

The diagrams of Figure 4/Q.45 used for measurement of unbalance differ only in respect of the presence or absence of an earth at the mid-point of the termination. Unbalance measurements according to 4a) and b) of Figure 4/Q.45 can give quite different results according to the nature of the unbalance.

6.4.3 The CCITT has recommended in 1968 that the set of limit values of § 6.4.1 above should be met for unbalance to earth measured with *both* measuring diagrams according to Figure 4/Q.45.

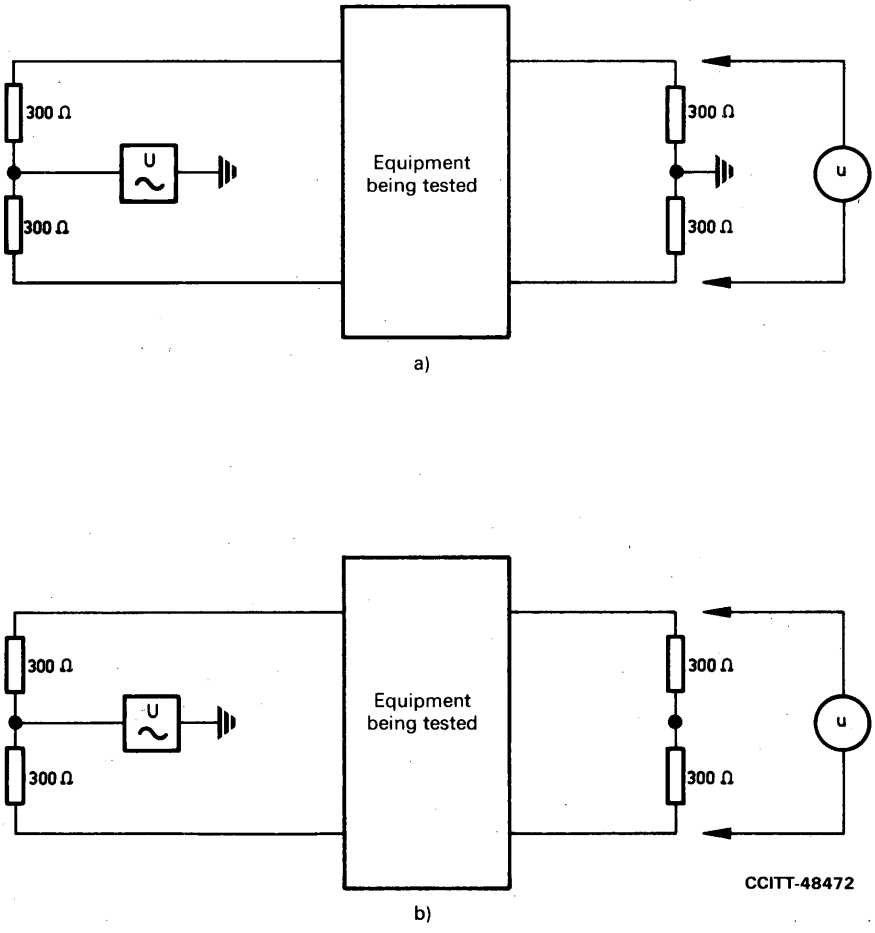


FIGURE 4/Q.45
Measurement of the degree of unbalance to Earth

7 Use of cables specified by the IEC

The cables for telephone exchanges in accordance with IEC (International Electrotechnical Commission) publication cited in [7] will meet the electrical characteristics required by the CCITT (especially as regards crosstalk) for ordinary exchanges, but this may no longer hold good for larger exchanges with considerable lengths of cable.

In accordance with Recommendation G.231 [8], it will be for the Administrations or the contractors to check whether standard cables will be satisfactory in equipping an exchange which requires telephone cables of exceptional length.

ANNEX A

(to Recommendation Q.45, § 5.2)

Procedure for impulsive noise measurements

A.1 A test circuit should be formed by setting up a connection across the switching unit and terminating the connection on one side of the exchange by the appropriate closing impedance and on the other by the impulse measuring device in parallel to the closing impedance. Those terminating points should be points A and D in the diagram of Figure 1/Q.45 (or equivalent points) to include the switching equipment of the exchange. Where it is the desire of an Administration, measurements may be made at points X and Y if precautions are taken to ensure that the results apply only to the automatic switching equipment, signalling equipment, echo suppressors, relay sets, pads and cabling of the exchange.

A.2 The measurements should be made using the device specified in Recommendation O.71 [9]. The 600-3000 Hz filter network described in [10] should be in the circuit.

A.3 The measurements should be made at times when the probability of noise occurring is at its highest, that is normally during the busy-hour.

A.4 The time of observation for each test should be five minutes.

Note – The number of different test circuits set up across the exchange for measuring should take into account the size and complexity of the switching unit and should be a number sufficient to represent the various possible types of calls and routes through the exchange.

See also the document cited in [11].

References

[1] CCITT Recommendation *Definitions for the maintenance organization*, Vol. IV, Fascicle IV.1, Rec. M.700.

[2] CCITT Recommendation *Four-wire switched connections and four-wire measurements on circuits*, Vol. IV, Fascicle IV.1, Rec. M.640, § 2.

[3] CCITT Recommendation *Linear crosstalk*, Vol. III, Fascicle III.1, Rec. G.134.

[4] CCITT Definitions: *Busy hour*, Vol. X, Fascicle X.1 (Terms and Definitions).

[5] CCITT Recommendation *Limits for the maintenance of telephone-type circuits used for data transmission*, Vol. VIII, Fascicle VIII.1, Rec. V.53, § 4.

[6] CCITT Recommendation *Characteristics of compandors for telephony*, Vol. III, Fascicle III.1, Rec. G.162, § 5.2.

[7] Publication 189 of the I.E.C.

[8] CCITT Recommendation *Arrangement of carrier equipment*, Vol. III, Fascicle III.2, Rec. G.231.

[9] CCITT Recommendation *Specification for an impulsive noise measuring instrument for telephone-type circuits*, Vol. IV, Fascicle IV.4, Rec. O.71.

[10] *Ibid.*, § 3.5.

[11] *Measurements of impulsive noise in a four-wire telephone exchange*, Green Book, Vol. VI-4, Supplement No. 7, ITU, Geneva, 1973.

SECTION 7

PCM MULTIPLEX EQUIPMENT AND UTILIZATION OF CCITT SIGNALLING SYSTEMS ON PCM LINKS

Recommendations Q.46 and Q.47

CHARACTERISTICS OF PRIMARY PCM MULTIPLEX EQUIPMENT OPERATING AT 2048 kbit/s AND 1544 kbit/s

Two primary PCM multiplex equipments are recommended by the CCITT, viz:

- a primary PCM multiplex equipment operating at 2048 kbit/s, which is described in Recommendation G.732 [1]; and
- a primary PCM multiplex equipment operating at 1544 kbit/s, which is described in Recommendation G.733 [2].

References

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

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

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SECTION 8

SIGNALLING FOR SATELLITE SYSTEMS

Recommendation Q.48

DEMAND ASSIGNMENT SIGNALLING SYSTEMS [1)]

1 The term "demand assignment" (abbreviated as DA) should be taken as meaning that the assignment is on a per call basis.

Note – Satellite circuits with demand assigned multiple access are those circuits which may be set up by assignment of a satellite link to operate between specified earth stations when the actual demand arises.

The origin, destination, or both of the satellite link can be varied. The link is assigned to set up the required telephone circuit according to the call.

This defines the following concepts:

1) variable destination satellite link;

2) variable origin satellite link;

3) fully variable satellite link (the origin and destination of which may both be varied).

The Recommendation covers, when applicable, fully variable and variable destination types of DA systems.

2 The DA signalling system shall be capable of interworking with all currently standardized CCITT signalling systems and shall have the capacity to carry all the telephony signals currently provided by these CCITT signalling systems and shall in addition provide reserve capacity.

Any currently standardized CCITT signalling system shall be able to be applied to any access link. Different CCITT signalling systems may be applied to the various access links at the same time.

3 Account should be taken of the fact that particular earth stations may have special signalling requirements to suit the CTs using these earth stations (e.g. joint use of an earth station by a number of CTs, long distances between CT and earth station, CTs with access to more than one earth station).

4 The DA signalling system shall be an integrated signalling system used both for:

a) signalling for setting up the DA speech circuit; and

b) transfer of the information flow for telephony.

5 The DA signalling system shall be capable of transmitting address information in both the *en bloc* and the overlap mode of operation. The transmission of address information by the outgoing DA system terminal should be such as to result in minimum delay to these signals in the DA system.

The manner of transmitting signals over the DA signalling system shall be independent of the type of signalling system to be encountered in the access link at the far end.

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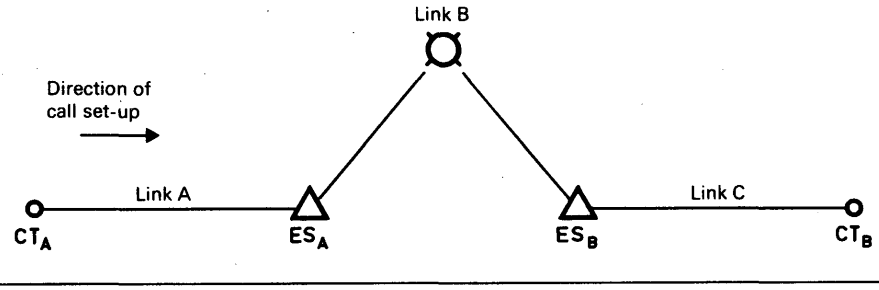
1) See also the reference cited in [1].

Accordingly, the interworking arrangements described in Table 1/Q.48 are recommended. (For definitions of "*en bloc*" and "*en bloc* overlap" see the definitions in Recommendation Q.151.)

TABLE 1/Q.48

Interworking arrangements for DA signalling systems



	Case 1	
En bloc – system No. 6	En bloc	En bloc – system No. 5 En bloc – system No. 6
	Case 2	
En bloc – system No. 6	En bloc	Overlap – system R2
	Case 3	
En bloc – system No. 5	En bloc-overlap or en bloc	En bloc – system No. 5 En bloc – system No. 6
	Case 4	
En bloc – system No. 5	En bloc-overlap or en bloc	Overlap – system R2
	Case 5	
Overlap – system No. 6 Overlap – system R2	Overlap	En bloc – system No. 5
	Case 6	
Overlap – system No. 6 Overlap – system R2	Overlap	Overlap – system No. 6 Overlap – system R2

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6 The DA signalling system shall send out address digits from ES_B to CT_B in the correct order, that is, the order of dialling.

7 Means shall be provided for preventing spillover of signals between successive calls, which use the same satellite channel through the DA signalling system.

8 The DA signalling system should be capable, for the sequence *re-answer signal-clear back signal* of correctly extending to CT_A from ES_A, the last state representing the final position of the called party's switch hook.

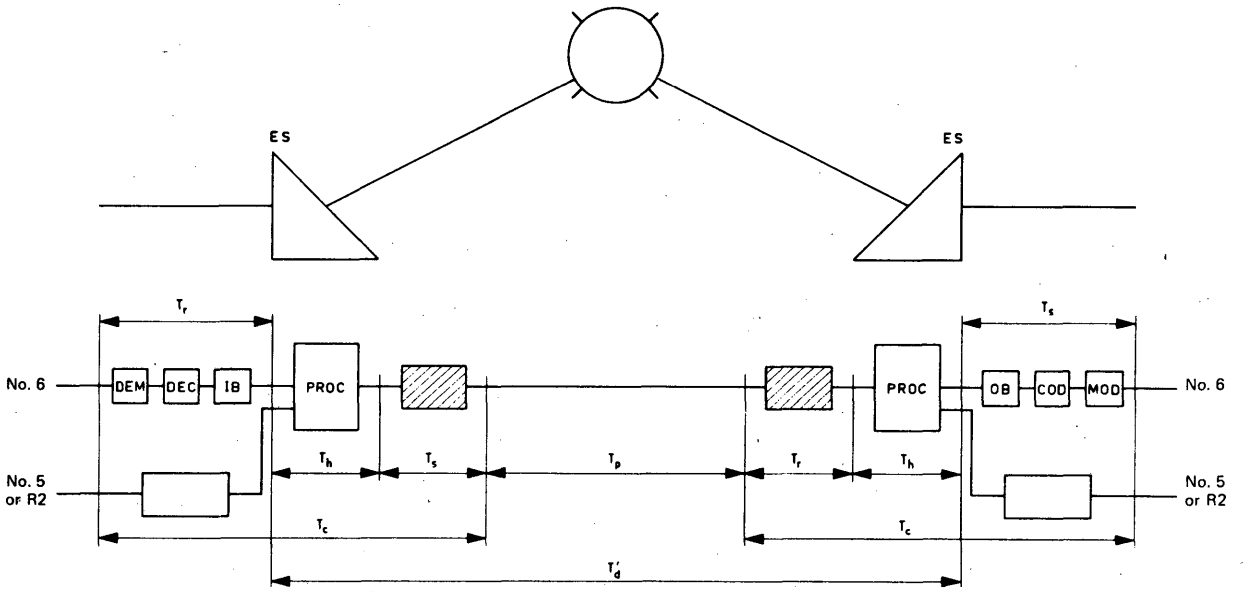
9 The message structure of the demand assignment signalling system should be such that one message will contain all the information necessary for one event (e.g. answer signal for one particular circuit). Single unit and multi-unit messages should be catered for. Each signal unit should contain both information and check bits.

10 All time-outs for both normal and abnormal conditions in the DA signalling system should be designed according to the recommendations concerning the relevant CCITT signalling systems.

11 Signal transfer time through the DA signalling system should be fast. While no firm time requirements in regard to the various components of signal transfer time have been established, design objectives in terms of average and 95% level values for the signal transfer time (T_d) for answer signals, other one-unit messages and the initial address message are given. These figures are to be viewed as reasonable objectives and not as firm requirements.

11.1 *Signal transfer time in the DA signalling system*

A signal transfer time in the DA signalling system is specified. This signal transfer time is called T'_d in the diagram of Figure 1/Q.48.



$$T'_d = 2T_h + T_s + T_r + T_p = T_h + T_c + T_p$$

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T'_d = Signal transfer time in DA signalling system.
(For other symbols, see Recommendation Q.252 [3].)

To facilitate the calculation of the total signal transfer time of the DA system, it is assumed that the time Tr as well Ts respectively of the terrestrial and satellite transmission links are equal.

FIGURE 1/Q.48

Functional signal transfer time diagram

The value $T_d = T'_d - T_p$ should be used as the design objective for the DA signalling system. The values of T_d calculated for the design of the system are shown in Table 2/Q.48.

Note – These figures have to be interpreted as reasonable estimates and not as firm requirements.

TABLE 2/Q.48

Values of signal transfer times for design of a DA signalling system

Design objectives for T_d

$T_d = T'_d - T_p$

T_d in ms	Type of message	Answer	Other one-unit message	IAM of 5 SU
	AV	52	85	145
	95% level	85	175	235

For calculation use the following relations:

$$T_d = 2T_h + T_s + T_r = T_c + T_h \quad \text{(11-1)}$$

$$T_{d(AV)} = T_{c(AV)} + T_{h(AV)} \quad \text{(11-2)}$$

$$T_{d(95\%)} = T_{d(AV)} + \sqrt{(\Delta T_c)^2 + (\Delta T_h)^2} \quad \text{(11-3)}$$

where:

$$\Delta T_c = T_{c(95\%)} - T_{c(AV)} \quad \text{(11-4)}$$

$$\Delta T_h = T_{h(95\%)} - T_{h(AV)} \quad \text{(11-5)}$$

For basis of calculation, see [4].

12 Dependability requirements

The requirements specified for System No. 6 (see [5]) are recommended as the objectives for the DA signalling system.

12.1 *Signal transfer dependability* (see [6])

"*b)* Signal units of any type which give rise to wrongly accepted signals due to undetected errors and causing false operation (e.g. false clear-back signal):

not more than one error in 10^8 of all signal units transmitted, and

c) As in item *b)* but causing serious false operation (e.g., false metering or false clearing of a connection):

not more than one error in 10^{10} of all signal units transmitted."

12.2 *Error correction by retransmission* (see [7])

Although the bit error rate in the DA signalling system has not been determined, the design of the system should be made such that a design objective "not more than one in 10^4 signal units carrying telephone information is allowed to be delayed as a consequence of error correction by retransmission."

12.3 *Interruption of the signalling service* (see [8])

System No. 6 requirements are:

- interruption of duration between 2 seconds and 2 minutes: not more than once a year;
- interruption of duration exceeding 2 minutes: not more than once in 10 years.

Since the speech circuits and the signalling channel in the DA system normally will be interrupted simultaneously, it is understood that the above figures are related to the signalling equipment and not to the transmission media common to both the signalling channel and the speech circuits.

References

[1] *Signalling for demand assignment satellite systems*, Green Book, Vol. VI-4, Supplement No. 8, ITU, Geneva, 1973.

[2] CCITT Recommendation *Signal code for register signalling*, Vol. VI, Fascicle VI.2, Rec. Q.151.

[3] CCITT Recommendation *Signal transfer time definitions*, Vol. VI, Fascicle VI.3, Rec. Q.252.

[4] CCITT Recommendation *Signal transfer time requirements*, Vol. VI, Fascicle VI.3, Rec. Q.287, Annex A.

[5] CCITT Recommendation *Service dependability*, Vol. VI, Fascicle VI.3, Rec. Q.276, § 6.6.1.

[6] *Ibid.*, § 6.6.1, b) and c).

[7] *Ibid.*, § 6.6.1, a).

[8] *Ibid.*, § 6.6.1, d).

SECTION 9

AUTOMATIC TESTING EQUIPMENT

Recommendation Q.49

SPECIFICATION FOR THE CCITT AUTOMATIC TRANSMISSION MEASURING AND SIGNALLING TESTING EQUIPMENT ATME No. 2

(The specification for ATME No. 2, appears in Recommendation O.22, Fascicle IV.4)

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PART III

Recommendations Q.60 to Q.62

INTERWORKING WITH THE MARITIME MOBILE-SATELLITE SERVICE

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Recommendation Q.60

GENERAL REQUIREMENTS FOR THE INTERWORKING OF THE TERRESTRIAL TELEPHONE NETWORK AND THE MARITIME MOBILE-SATELLITE SERVICE

1 Introduction

1.1 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.

1.2 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.

1.3 More specific interworking requirements applicable to a chosen signalling system (i.e. System No. 5, System R2, or other signalling systems including new signalling systems to be standardized in the future) will also be developed by CCITT as a separate Recommendation.

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 shore station [1] and operate as an independent international switching centre connected to one or more transit centres (CTs) 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*, Q.11 *quater* 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 for 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

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[1] This term used for the purpose of this Recommendation is defined as *coast earth station* in [1].

4 Sending sequence of numerical (or address) signals

4.1 *Calls toward mobile terminal*[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 mobile subscriber (ship-to-shore)*

The desired MSSC is selected at the mobile terminal 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 mobile terminal 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.

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*

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.

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[2] This term used for the purpose of this Recommendation is defined as *ship earth station* in [2].

5.3 *Seizure of a terrestrial circuit from 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 *Release of the satellite link*

The clear-back/re-answer sequence may not apply for ship 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 mobile terminal in order to avoid unintentional clearing.

5.5 *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 satellite 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 (½ second on, ½ second off)
Congestion tone:	425 Hz (¼ second on, ¼ second off)
Special information tone:	as defined in Recommendation Q.35

7 Control of echo suppressors

Since all calls to and from a mobile terminal 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 mobile terminal 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 CT end of each MSSC-CT 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 originated 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 for 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 CT, (or MSSC) and the incoming CT (or national incoming switching centre) does not normally require the use of echo suppressors, the outgoing CT (or MSSC) should enable (or insert) an incoming half-echo suppressor associated with the satellite link.

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

b) When the international connection between the outgoing CT and the incoming CT (or MSSC) normally requires the use of echo suppressors, the incoming CT (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:

$$87S0X_2X_3 \ldots . X_k$$

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 CT 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 CT 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 CT 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 CT should avoid forwarding the call on an outgoing circuit which includes a satellite link. If, however, the signalling system employed between the outgoing CT and the next CT in the connection contains such signals, the outgoing CT should insert the required information. The outgoing CT could base its procedure upon incoming route identification.

References

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

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

Recommendation Q.61

INTERWORKING WITH SIGNALLING SYSTEM R2

1 Introduction

It is necessary to specify the interworking of Signalling System R2 and the signalling systems used in the Maritime Mobile-Satellite Service. This is because:

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

b) the signalling systems 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 a CT utilising either the analogue or digital versions of System R2 signalling.

For description of the INMARSAT signalling system, see Annex A to Recommendation Q.62.

2 Calls from Signalling System R2 to the maritime satellite system (see Figure 1/Q.61)

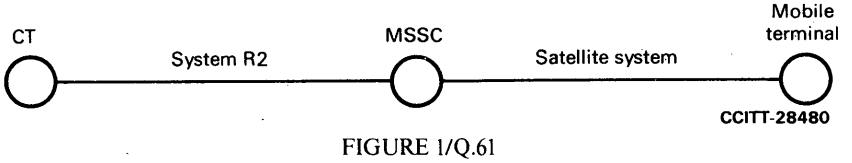

FIGURE 1/Q.61

[1] For definition, see Recommendation Q.60.

2.1 The CT 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 CT then continues to send further address signals which are acknowledged in compelled cycles with A-1 at the MSSC.

2.1.2 Signal I-14 followed by the country code 87S when the country code is 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 CT continues to send 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 occurs in the MSSC;
- A-3 may, for example, be used in order to indicate to the CT 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 mobile terminal 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 CT;
- the received number does not belong to any mobile terminal. 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 Coordinating Station (NCS) in order to obtain a satellite channel (see Annex A to Recommendation Q.62).

If no reply to this request is received within 4 seconds or if a *Congestion* message is received from the NCS, the MSSC sends the pulsed A-4 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 mobile terminal 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 mobile terminal 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 mobile terminal 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 mobile terminal, the MSSC must send the answer signal as soon as possible to the CT.

2.6 When the MSSC detects the clear forward from the terrestrial network, the terrestrial and satellite links 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].

3 Calls from the maritime satellite system to Signalling System R2 (see Figure 2/Q.61)

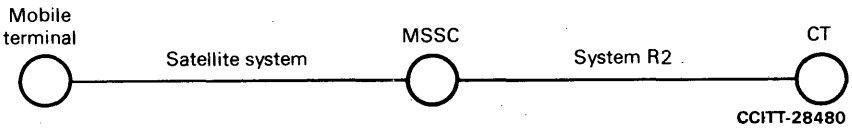

FIGURE 2/Q.61

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 CT 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 CT.
- 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 CT, 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 CT, 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 CT, 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 I-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 mobile terminal.

3.5 The tones sent by the MSSC to the mobile terminal in response to Group B signals received from the terrestrial network should comply with Recommendation Q.474 [3].

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 timeout of Recommendation Q.118, § 4.3.2 shall be started. The satellite and terrestrial links will be cleared either by the mobile terminal or by expiry of the 1-2 minute timeout.

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].

References

[1] CCITT Recommendation *Logic procedures for incoming Signalling System R2*, Vol. VI, Fascicle VI.5, Rec. Q.616.

[2] CCITT Recommendation *Miscellaneous procedures*, Vol. VI, Fascicle VI.4, Rec. Q.480.

[3] CCITT Recommendation *Use of group B signals*, Vol. VI, Fascicle VI.4, Rec. Q.474.

[4] CCITT Recommendation *Logic procedures for outgoing Signalling System R2*, Vol. VI, Fascicle VI.5, Rec. Q.626.

Recommendation Q.62

INTERWORKING WITH SIGNALLING SYSTEM No. 5

1 Introduction

It is necessary to specify the interworking of Signalling System No. 5 and the signalling system used in the Maritime Mobile-Satellite Service. This is because:

a) it may be desirable that a Maritime Satellite Switching Center (MSSC) [1] be connected to a transit centre (CT) by employing System No. 5 on circuits between the MSSC and the CT.

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 a CT utilizing System No. 5.

The interworking between the INMARSAT system and System No. 5 is shown in Annex A.

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[1] For definition, see Recommendation Q.60.

2 Calls from Signalling System No. 5 to the maritime satellite system (see Figure 1/Q.62)

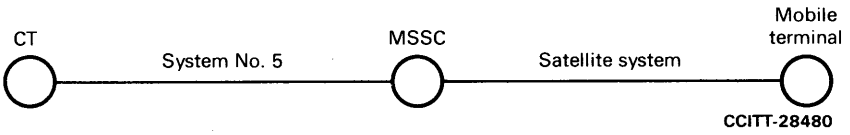

FIGURE 1/Q.62

2.1 The CT 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 mobile terminal 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 mobile terminal 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.

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.

2.5 If the called mobile terminal 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 mobile terminal does not respond to the call;

b) the called mobile terminal is excluded from participating in the service;

c) the received number does not belong to any mobile terminal;

d) the received number is an unauthorized group call;

e) the called mobile terminal 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].

3 Calls from the maritime satellite system to Signalling System No. 5 (see Figure 2/Q.62)

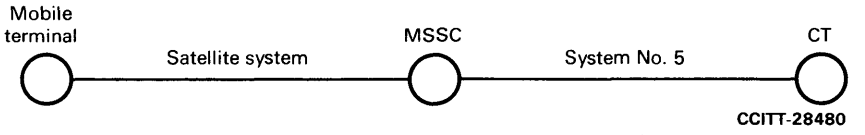

FIGURE 2/Q.62

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 mobile terminal 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 mobile terminal 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 No. 5, see Recommendation Q.622 [4].

ANNEX A

(to Recommendation Q.62)

Interworking between the INMARSAT system [1] and a CT using Signalling System No. 5

A.1 *Introduction*

This annex describes the signalling in the INMARSAT System in a multiple Maritime Satellite Switching Centre (MSSC) configuration, i.e., there is more than one MSSC serving an ocean region, and how it interworks with a transit centre (CT) using Signalling System No. 5. Automatic call set-up and the clearing of calls is 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 *Mobile terminal originated calls*

The normal call set-up procedure for automatic call processing from a mobile terminal is shown in Figure A-1/Q.62. The mobile terminal transmits an out-of-band *request* message, which includes the type of call desired, the MSSC with which the terminal wishes to communicate and the identification number of the mobile terminal.

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[1] This annex describes the INMARSAT signalling system in its current state. The annex will be updated when the final INMARSAT specification becomes available.

The requested MSSC, upon receiving the *request* message, sends a *Request for Assignment* message to the Network Coordinating 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 requesting MSSC and mobile terminal. Both the MSSC and mobile terminal receive the *assignment* message, and

i) automatically select the correct frequency, and

ii) begin to transmit a carrier and a 2600 Hz tone.

The MSSC, on receipt of the mobile terminal's carrier and 2600 Hz tone, stops sending its tone and the mobile terminal responds by cutting its tone. At this time, the MSSC sends a dial tone pulse to the mobile terminal. The mobile terminal subscriber then dials in the desired prefix, country code and national significant number followed by an end-of-selection signal.

When the end-of-selection signal is received at the MSSC, it proceeds to select a terrestrial trunk and follows the standard System No. 5 signalling sequences (Figure A-1/Q.62). The ringing tone from the terrestrial network is allowed to pass directly to the mobile terminal subscriber. When the terrestrial party answers the call, the CT and the MSSC exchange the normal answer and answer acknowledge signals and the international connection is established.

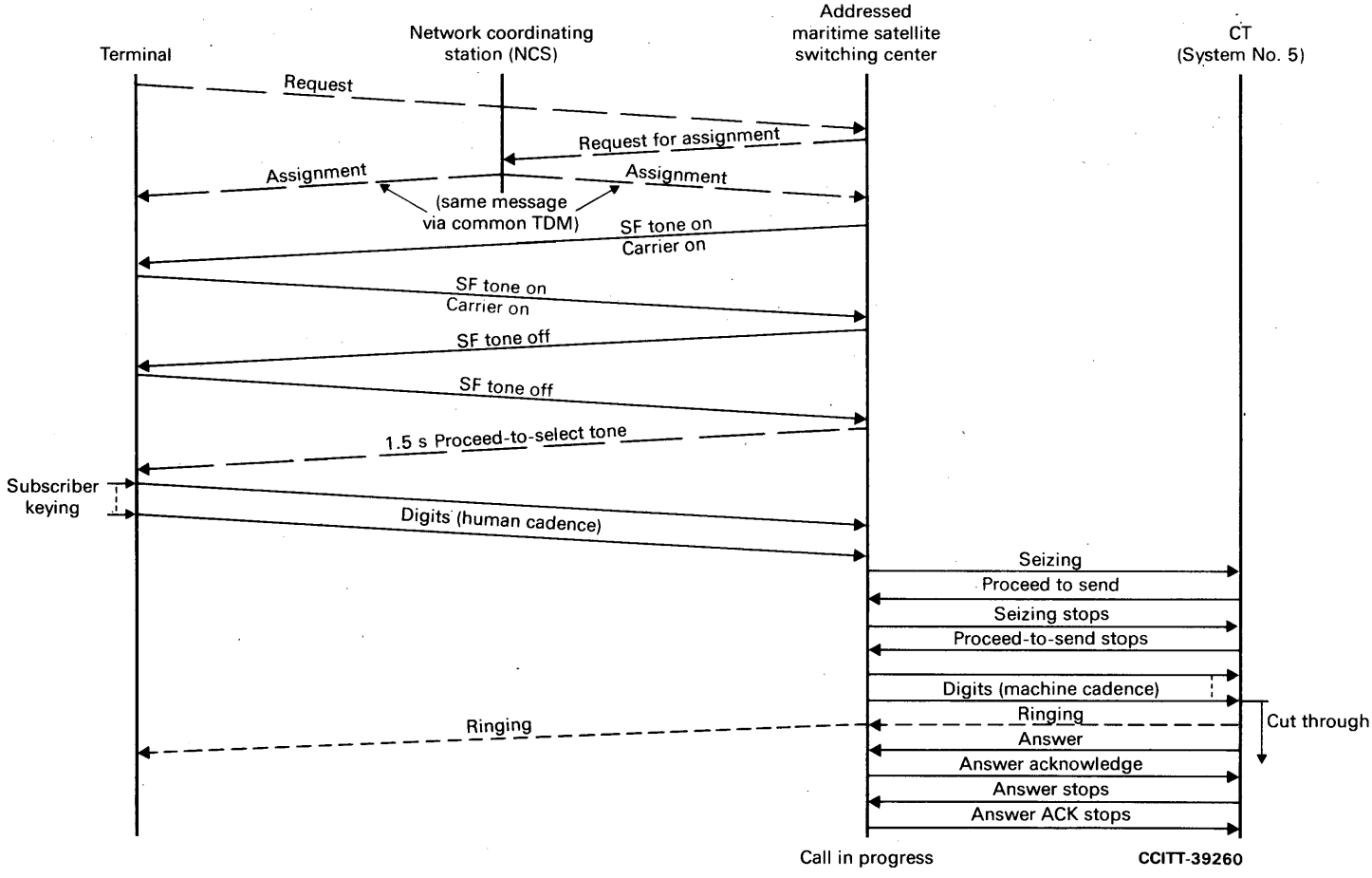

FIGURE A-1/Q.62

Mobile terminal originated calls

A.3 *Terrestrial originated calls*

The normal call setup procedure for automatic call processing from the terrestrial network to a mobile terminal is shown in Figure A-2/Q.62. The CT selects a circuit and sends the Seizing signal to the MSSC which responds with the proceed-to-send signal. Following termination of the seizing and proceed-to-send signals, the CT sends the mobile terminal identification digits to the MSSC. The MSSC, upon receiving the ST signal, sends a *request-for-assignment* message to the NCS containing the mobile terminal identity. The NCS responds by sending an *assignment* message to both the MSSC and the mobile terminal. The MSSC and the mobile terminal activate their carrier and send a 2600 Hz tone. Upon receipt of the 2600 Hz tone from the mobile terminal, the MSSC sends the ringing tone to the terrestrial network and stops sending 2600 Hz to the mobile terminal. When the mobile terminal operator answers, the terminal discontinues sending its 2600 Hz tone.

The MSSC recognizes the cutting of the 2600 Hz tone as an answer signal from the mobile terminal and begins the answer sequence toward the CT as shown in Figure A-2/Q.62. When the answer acknowledge signal stops, the international connection is established.

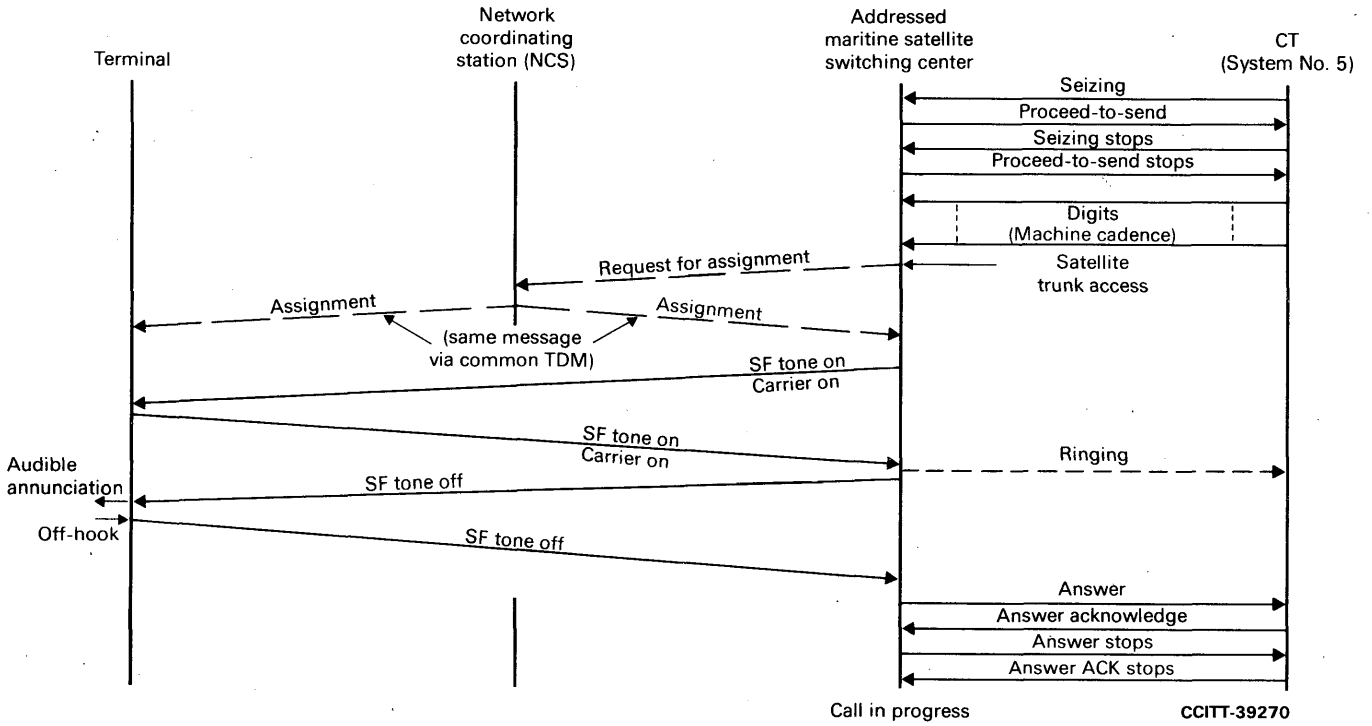

FIGURE A-2/Q.62

Terrestrial originated automatic call

A.4 *Automatic clearing of calls*

Whether a telephone call originated from a mobile terminal 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 mobile terminal, will initiate clearing toward the terrestrial network in accordance with normal System No. 5 signalling procedures. This applies to both clear-forward and clear-back from the mobile terminal. 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 appropriate clear-back or clear-forward signal. For clear-forward, the MSSC would continue clearing with normal System No. 5 signals 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-3/Q.62 illustrates the clearing of a mobile terminal originated call and Figure A-4/Q.62 illustrates the clearing of a call originated in the terrestrial network. For a terrestrial originated call which has clearing initiated by the mobile terminal, the satellite circuit is cleared after the MSSC recognizes the stopping of the mobile terminal carrier. The terrestrial circuit is held until the release guard tone stops as shown in Figure A-4/Q.62.

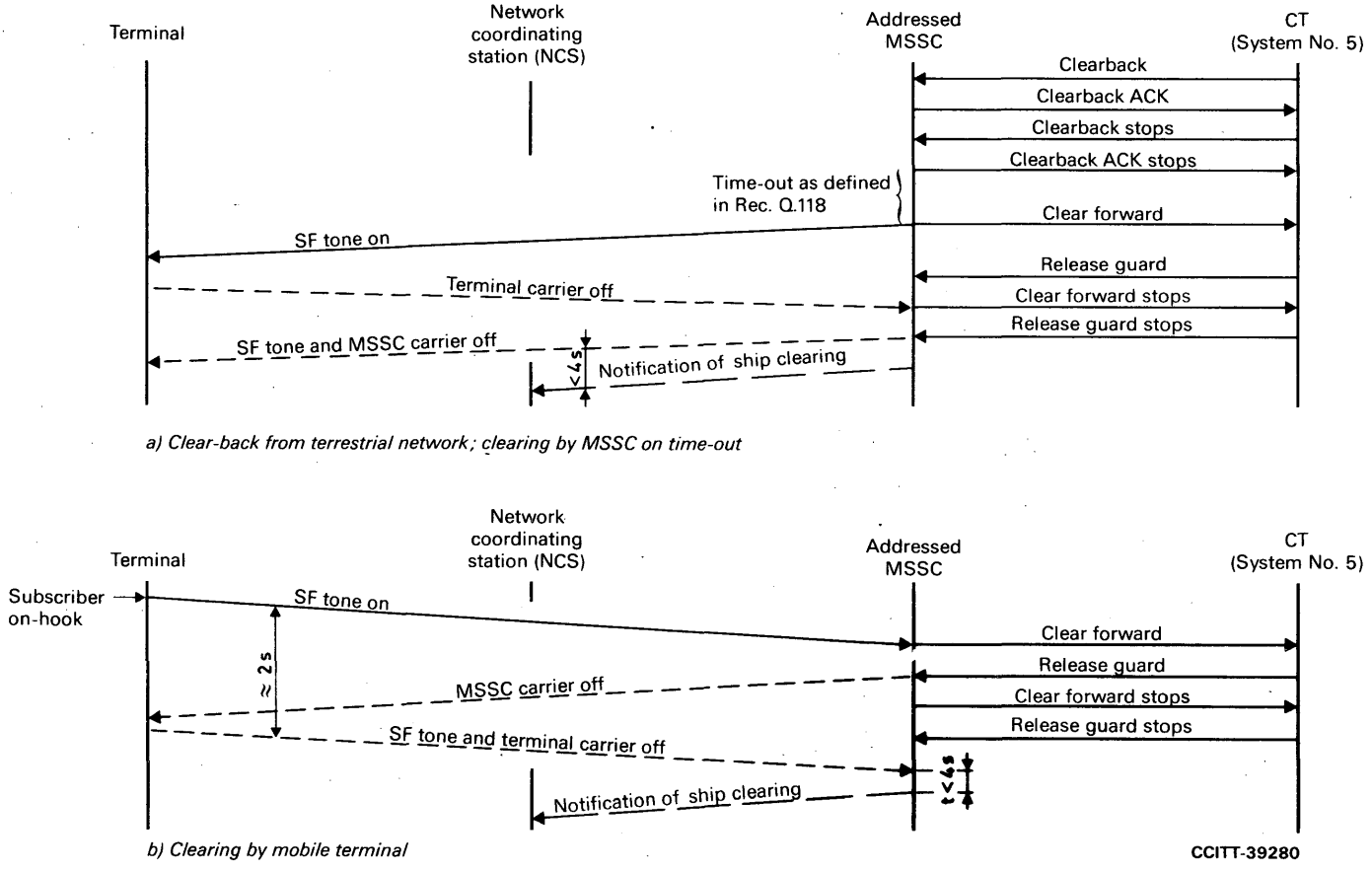

FIGURE A-3/Q.62

Clearing sequences for terminal originated calls

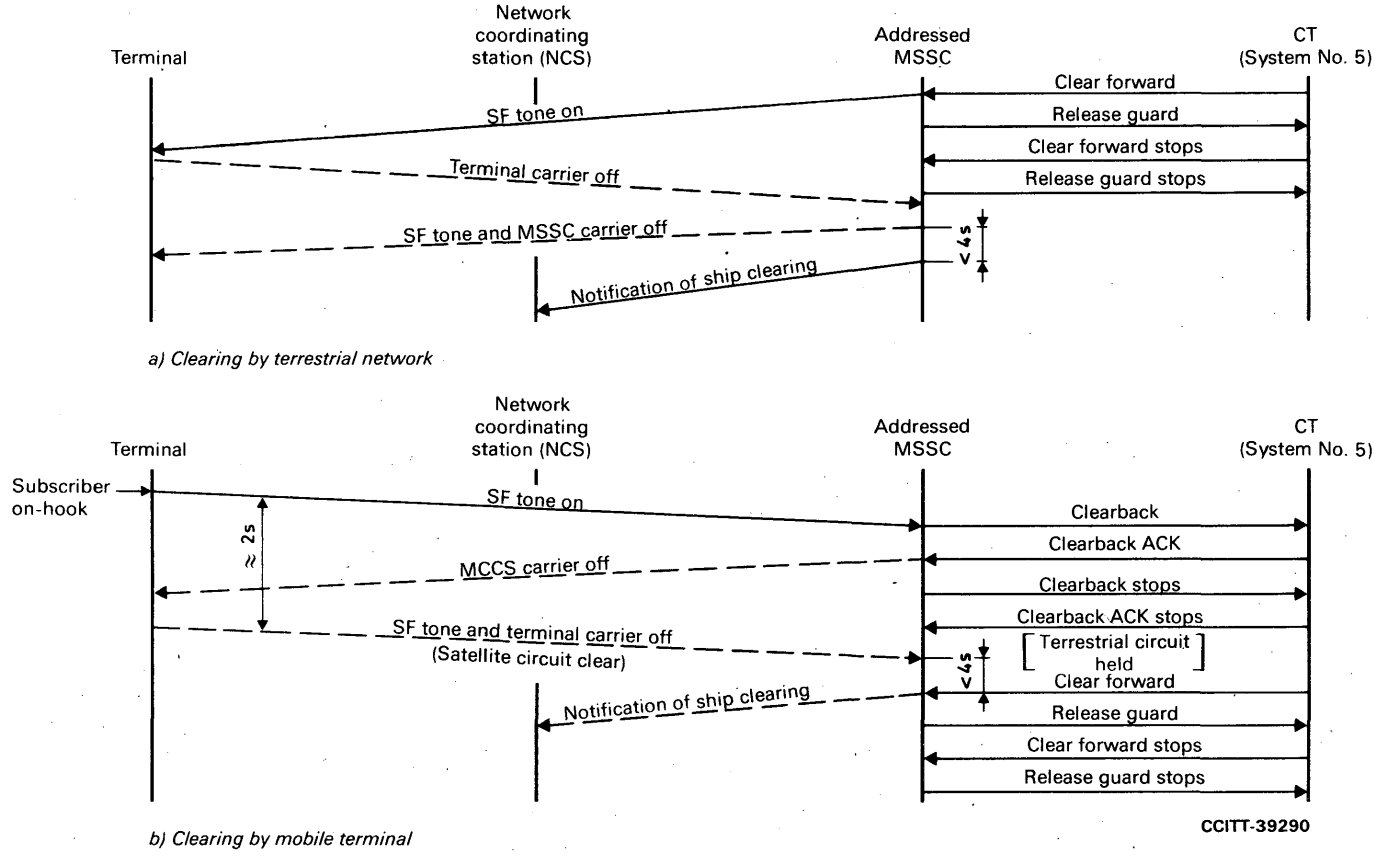

FIGURE A-4/Q.62

Clearing sequences for terrestrial originated calls

References

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

[2] CCITT Recommendtion *Analysis of digital information for routing*, Vol. VI, Fascicle VI.2, Rec. Q.155, § 3.5.4.

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

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

PART IV

Recommendations Q.101 to Q.118 *bis*

CLAUSES APPLICABLE TO CCITT STANDARD SYSTEMS

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SECTION 1

GENERAL CLAUSES

Recommendation Q.101

1.1 FACILITIES PROVIDED IN INTERNATIONAL SEMI-AUTOMATIC WORKING

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

a) *outgoing* operators;

b) *incoming* operators;

c) *delay* operators;

d) *assistance* operators;

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

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

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

a) subscribers;

b) incoming operators at the incoming international exchange;

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

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

e) information or special service operators.

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

1.1.3 The *incoming operator*[1] at the incoming international exchange is obtained by using a special code 11 signal or a special number. The code 11 signal is a particular combination provided by the signal code. This operator performs the functions of an incoming operator in ordinary manual service for those calls which cannot be routed automatically at the incoming international exchange.

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[1] Called alternatively in French "opératrice translatrice", see *Instructions for the International Telephone Service* (art. 125).

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

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

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

1.1.5 *Notes on incoming and delay operators*

a) Incoming and delay operators must be able to speak the *service language* used for the route concerned, and hence may have to belong to a particular language group. A *language (or information) digit*, from 1 to 8, sent on all semi-automatic calls, is used to obtain operators of a particular language group (see Recommendation Q.104) [2].

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

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

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

The assistance operator is called by a forward-transfer signal, sent by the outgoing operator when, for example, she operates a key on the outgoing position. An assistance operator in a required language group is obtained in conjunction with the forward-transfer signal by the language digit (or information) sent previously during the setting up of the call. Hence the incoming relay set must store the language digit (or information).

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

The assistance operator must be able:

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

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

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

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

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

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

Recommendation Q.102

1.2 FACILITIES PROVIDED IN INTERNATIONAL AUTOMATIC WORKING

In international automatic working, the calling subscriber can obtain only such subscriber numbers as are made up of the numerical digits appearing on his dial or push-button set. Hence, he cannot obtain operators reached by code 11 or code 12 signal, or an assistance operator reached by a forward-transfer signal. In principle, he should not obtain access to incoming, delay or information operators [3] reached by special numbers.

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

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

- enables the equipment in the outgoing international exchange to make a distinction between semi-automatic and automatic calls as is required when drawing up international accounts, as described in § 2 of Recommendation E.260;
- enables, therefore, incoming equipment to serve both automatic and semi-automatic service;
- in Systems No. 4, 6, 7 and R2 informs the equipment in the international incoming exchange that it has not to rely on an end-of-pulsing signal (see Recommendation Q.106);
- enables the equipment in the incoming international exchange to prevent automatic calls from having access to certain destinations (special services, for example).

Recommendation Q.103

1.3 NUMBERING USED

1.3.1 *International prefix*

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

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

1.3.2 *Country code* [4]

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

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

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

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

- in the case of transit calls;
- in terminal and transit calls to a demand assignment system.

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[3] For information operators, see Recommendation E.115.

[4] The country code may not be used on some intraregional calls.

1.4 LANGUAGE DIGIT OR DISCRIMINATING DIGIT

1.4.1 *Language digit (or language information)*

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

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

1 = French
2 = English
3 = German
4 = Russian
5 = Spanish

6 | available to Administrations for selecting a particular language
7 | provided by mutual agreement (in System No. 5,
8 | however, digit 7 is used on calls requiring access to test equipment)

9 = reserve (see § 1.4.2.2 below)

1.4.1.3 The language digit (or information) is either:

- sent by the operator to the outgoing equipment; in this case the operator must send it immediately before the national (significant) number [5] of the called subscriber; or
- sent automatically by the outgoing equipment.

1.4.2 *Discriminating digit (or discriminating information)*

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

1.4.2.2 The digit 9 (or its equivalent) in the list of language digits (or calling party's categories) has been kept in reserve for use as extra discriminating information if required. Such use should be for a call with special characteristics, but the digit 9 (or the equivalent information) must not be used merely to take the place of the digit 0 (or its equivalent) in an automatic call [6].

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

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5) See definition in Recommendation Q.10.

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

a) automatic calls, and

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

Such a distinction might be necessary because:

- in international accounts, calls mentioned in b) are dealt with as semi-automatic calls and are not to be metered by the international equipment.
- for signalling, calls mentioned in b) are not accompanied by an end-of-pulsing signal.

1.4.2.4 Combination 11 and combination 12 in the signal code of System No. 5 *bis* or its equivalent in System No. 6 may be used as a discriminating digit (or calling party's category indicator) on calls originated by a subscriber with priority (combination 11) or on data calls (combination 12).

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

Recommendation Q.105

1.5 NATIONAL (SIGNIFICANT) NUMBER

1.5.1 In automatic working, the subscriber sends the called subscriber's national (significant) number [5] by means of a dial, push-button set, or automatic dialling device.

1.5.2 In semi-automatic working, the operator sends the national (significant) number [5] of the called subscriber by means of a keyset for example.

1.5.3 The outgoing equipment must be designed to cater for a sufficient number of digits in the national (significant) number [5] as specified in Recommendation Q.11, §§ 2.2 and 3.

Recommendation Q.106

1.6 THE SENDING-FINISHED SIGNAL

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

Note – In semi-automatic working, local sending of the sending-finished signal will cause an *end-of-pulsing* signal to be sent on the international circuit [7] or signalling channel. This has the same function and shows the incoming equipment that there are no more digits to be received. In some cases also in automatic working, when the outgoing equipment decides that there are no more digits to follow, an end-of-pulsing signal is sent on the international circuit or signalling channel, for example in the ST condition of System No. 5 (see Recommendation Q.152).

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5) See definition in Recommendation Q.10.

7) In System R2 the sending of end-of-pulsing signal (code 15) may not occur if a *number-received* indication has already been received.

STANDARD SENDING SEQUENCE OF FORWARD ADDRESS INFORMATION

(Geneva, 1980)

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

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

1 Information to be sent by the telephone user

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

TABLE 1/Q.107

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

Type	Call to:	Address information sent by the user
a)	a subscriber (automatic)	1. International prefix [a] 2. Country code [b] 3. National (significant) number [c]
b)	a subscriber (semi-automatic)	1. Country code [b] [d] 2. National (significant) number [c] 3. Sending-finished
c)	any incoming or delay operator's position (semi-automatic)	1. Country code [b] [d] 2. Extra digit designating the incoming international exchange [e] 3. Code 11 or code 12 [f] 4. Sending-finished
d)	a particular delay operator, or one of those operating a particular group of delay operator's positions (semi-automatic)	1. Country code [b] [d] 2. Extra digit designating the incoming international exchange [e] 3. Code 12 [f] 4. Number of a particular position or a group of positions. 5. Sending-finished
e)	an information operator or a special service operator	1. Special numbers

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

[b] The country code consists of one of these digit combinations: I_1, I_1 I_2, I_1 I_2 I_3.

[c] The national (significant) number consists of the subscriber number and the trunk code: N_1, N_2, N_3 ... It does not contain the national (trunk) prefix (the preferred national prefix is 0 — see Recommendation Q.11 *bis*, § 4.5.2). The subscriber using the international automatic telephone network should be informed in an appropriate manner that the national prefix after the country code must not be sent.

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

[e] The extra digit (N_1) designating the incoming international exchange is used in cases where more than one incoming international exchange can be reached in the country of destination. (It is recognized that the existing design of some equipment does not permit the insertion of the extra digit.)

[f] See Recommendation Q.101.

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

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

2.1 *Common channel signalling systems*

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

a) nature-of-address indicator indicating that the

- international number,
- national (significant) number or
- subscriber number is included;

b) nature-of-circuit indicator indicating that

- a satellite circuit is included
- no satellite circuit is included;

c) echo-suppressor indicator indicating that

- an outgoing half-echo suppressor is included
- no outgoing half-echo suppressor is included;

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

- a language digit, L
- the discriminating digit D;

e) address signals

- country code
- national (significant) numbers
- code 11
- code 12
- end-of-pulsing (ST) signal or code 15.

As the initial address message of Signalling Systems No. 6 and No. 7 carries at least the information mentioned above, it is not necessary to describe here in detail the sequence of the forward address information to be sent by the outgoing international signalling equipment; reference is made to Recommendations Q.258 [3] and Q.722 [2], instead.

Nevertheless, the following additional comments are made:

a) In cases where the international call is routed

- from an originating international exchange (CT) to an international transit CT, or
- from one international transit CT to another international transit CT

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

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

- from an originating CT direct to a destination CT, or
- from a transit CT to a destination CT

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

In both cases a) and b) described above, further routing information will be included in the initial address message. For further details, see Recommendations Q.258 [3] and Q.722 [2].

2.2 *Channel associated signalling systems*

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

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

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

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

TABLE 2/Q.107

First signal to be sent on international links

Type	International link		First signal sent on the international link
	from	to	
a)	Originating country	Destination country	Terminal-call indicator or discriminating or language digit
b)	Originating country	Transit country	Transit-call indicator
c)	Transit country	Transit country	Transit-call indicator
d)	Transit country	Destination country	Terminal-call indicator or discriminating or language digit

The terminal-call indicator is a type of signal indicating that an international terminal link *a)* or *d)* is involved and that no country code has to be sent to the incoming CT. In the case of Signalling System No. 4, the terminal-call indicator is represented by the terminal seizing signal – a forward line signal. For the other channel associated signalling systems, interregister signals are used. The discriminating digit D and the language digit L (both are also called the characteristic digit Z) must be in accordance with Recommendation Q.104.

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

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

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

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

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

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

TABLE 3/Q.107

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

Sending sequence ↓

	Channel associated CCITT signalling system	No. 4	No. 5	R2	R1 [a]
International transit call	Transit-call indicator	Transit seizing [b]	KP 2	I-12 or I-14 or I-11 [c]	—
	Echo-suppressor indicator	— [d]	—		—
	Nature-of-circuit indicator	—	—	I-13 or I-14 [e]	—
	Country code	I_1, I_1 I_2, I_1 I_2 I_3 [f]			—
	Calling-party's-category indicator	D = 0 or L = 1, 2, 3, ...			—
	National (significant) number	N_1 N_2 N_3 ...			—
	Sending-finished	Code 15	ST	Code 15	—
International terminal call	Terminal-call indicator	Terminal seizing [b]	KP 1		KP [h]
	Calling party's category indicator	D = 0 or L = 1, 2, 3, ... [g]			—
	Echo-suppressor indicator	— [d]	—	I-14 [e]	—
	Nature-of-circuit indicator	—	—	I-13 or I-14 [e]	—
	National (significant) number	N_1 N_2 N_3 ...			
	Sending-finished	Code 15	ST	Code 15	ST

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

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

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

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

e) These signals are sent on request.

f) See Recommendation Q.101.

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

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

TABLE 4/Q.107

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

Sending sequence ↓

	Channel associated CCITT signalling system	No. 4	No. 5	R2	R1 [a]
International transit call	Transit-call indicator	Transit seizing [b]	KP 2	I-12 or I-14 or I-11 [c]	—
	Echo-suppressor indicator	— [d]	—		—
	Nature-of-circuit indicator	—	—	I-13 or I-14 [e]	—
	Country code	I_1, I_1 I_2, I_1 I_2 I_3			—
	Language digit	L = 1, 2, 3, ...			
	Extra digit designating the incoming exchange	N_1			—
	Access to operator's position	Code 11 or code 12 [f]			—
	Sending-finished	Code 15	ST	Code 15	—
International terminal call	Terminal-call indicator	Terminal seizing [b]	KP 1		KP [h]
	Language digit	L = 1, 2, 3, ... [g]			—
	Echo-suppressor indicator	— [d]	—	I-14 [e]	—
	Nature-of-circuit indicator	—	—	I-13 or I-14 [e]	—
	Extra digit designating the incoming exchange	N_1			—
	Access to operator's position	Code 11 or code 12 [f]			e.g. 121 or 1150
	Sending-finished	Code 15	ST	Code 15	ST

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

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

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

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

[e] These signals are sent on request.

[f] See Recommendation Q. 101.

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

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

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

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

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

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

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

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

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

In the case of the common channel Signalling Systems No. 6 and No.7, all information will be carried by means of an initial address message in which the message indicators will be set to their appropriate values as specified in Recommendations Q.258 [3] and Q.722 [2].

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

TABLE 5/Q.107

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

Sending sequence ↓

	Channel associated CCITT signalling system	No. 4	No. 5	R2	R1 [a]
International transit call	Transit-call indicator	Transit seizing [b]	KP 2	I-12 or I-14 or I-11 [c]	—
	Echo-suppressor indicator	— [d]	—		—
	Nature-of-circuit indicator	—	—	I-13 or I-14 [e]	—
	Country code	$I_1, I_1 I_2, I_1 I_2 I_3$			—
	Language digit	L = 1, 2, 3, ...			—
	Extra digit designating the incoming CT	N_1			—
	Access to operator's position	Code 12			—
	Number of a particular position	$x_1 (x_2 x_3 ...)$			—
	Sending-finished	Code 15	ST	Code 15	—
International terminal call	Terminal-call indicator	Terminal seizing [b]	KP 1		KP [h]
	Language digit	L = 1, 2, 3, ... [g]			—
	Echo-suppressor indicator	— [d]	—	I-14 [e]	—
	Nature-of-circuit indicator	—	—	I-13 or I-14 [e]	—
	Extra digit designating the incoming CT	N_1			—
	Access to operator's position	Code 12			e.g. 1150
	Number of a particular position	$x_1 (x_2 x_3 ...)$			e.g. $11x_1 x_2$
	Sending-finished	Code 15	ST	Code 15	ST

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

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

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

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

e) These signals are sent on request.

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

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

TABLE 6/Q.107

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

Sending sequence ↓

CCITT signalling system	No. 4	No. 5	No. 6	No. 7	R2	R1
Terminal-call indicator	Terminal seizing	KP 1	Together with other message indicators			KP
Calling party's category indicator	D = code 13	D = 7	Test call	Test call	D = code 13[a]	—
Test-call indicator	Code 12	Code 12	—	—	Code 13	—
Access code for a particular testing or measuring device	Digit 0 plus 2 digits x, y	Digit 0 plus 2 digits x, y	16 combi-nations	16 combi-nations	2 digits x, y	Digits to be agreed upon (minimum three)
Sending-finished	Code 15	ST	ST	ST	Code 15	ST

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

TABLE 7/Q.107

Access codes for a particular testing or measuring device

CCITT signalling system	Access codes				
	No. 4	No. 5	R2	No. 6	No. 7[a]
Multiple address capability for transmission access test line	21-29	21-29	21-29	6 7 8	—
ATME 2 Type a ATME 2 Type b ATME 2 Type c	61 62 63	61 62 63	61 62 —	1 2 —	—
Quiet termination Echo-suppressor test Loop around	64 65 66	64 65 66	64 65 66	3 4 5	—
Simplified test Good/not good transmission test	— 00	— —	90 00	—	—
Continuity check	—	—	—	0	—

[a] For further study.

References

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

[2] CCITT Recommendation *General function of telephone messages and signals*, Vol. VI, Fascicle VI.6, Rec. Q.722.

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

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

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

Recommendation Q.107 *bis*

ANALYSIS OF FORWARD ADDRESS INFORMATION FOR ROUTING

Geneva, 1980

1 General

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

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

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

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

2 Digit analysis at the outgoing international exchange

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

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

$$I_1\ Z\ N_1\ N_2\ N_3\ ^{1)}$$

$$\text{or } I_1\ I_2\ Z\ N_1\ N_2\ ^{1)}$$

$$\text{or } I_1\ I_2\ I_3\ Z\ N_1\ N_2\ ^{1)}$$

where

I_1, I_2, I_3 = digits of the country code

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

$N_1, \ldots N_n$ = digits of the national (significant) number.

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

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

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

In the case of countries with more than one incoming international exchange where semi-automatic calls to code 11 or code 12 operators require a digit analysis beyond the country code for routing in the outgoing international exchange, N_1 may be used as the extra digit designating the incoming international exchange. For direct relations between the outgoing exchange and the incoming exchanges, sending of the digit N_1 to the incoming international exchanges is not required [2].

3 Digit analysis at the international transit exchange

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

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

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

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

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

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

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

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

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

4 Examples of the digit analysis in an international transit exchange

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

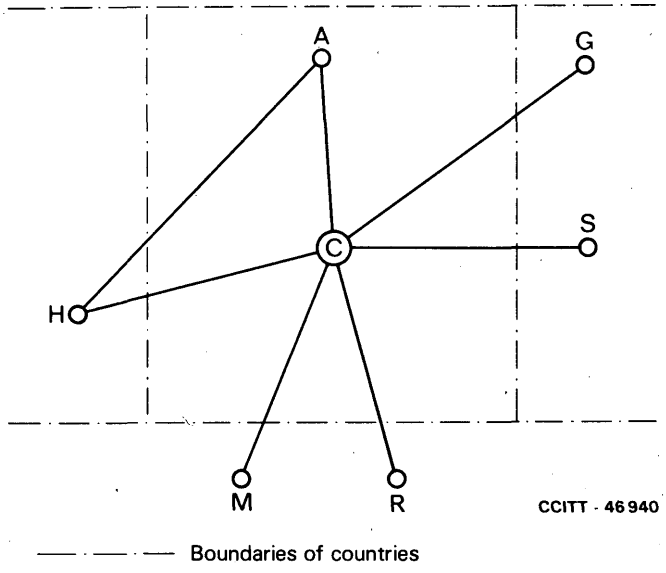

FIGURE 1/Q.107 *bis*
Examples of the digit analysis in an international transit exchange C

4.1 *Example 1*

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

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

Example: $I_1\ I_2\ Z\ N_1\ N_2$ [3]

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

Examples: $I_1\ I_2\ L\ C_{11}$ or $I_1\ I_2\ L\ C_{12}$ [3]

In the case of countries with more than one incoming international exchange where code 11 or code 12 traffic requires for routing in the transit exchange a digit analysis beyond the country code, N_1 may be used as the extra digit designating the incoming international exchange [2].

Examples: $\underbrace{I_1\ I_2\ L\ N_1}_{\text{analysed}}\ C_{11}$ or $\underbrace{I_1\ I_2\ L\ N_1}_{\text{analysed}}\ C_{12}$ [3]

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

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

4.2 *Example 2*

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

Examples: $\underbrace{I_1\ I_2\ D}_{\text{analysed}}$ or $\underbrace{I_1\ I_2\ L}_{\text{analysed}}$ [3].

5 Example of digit analysis for incoming terminal traffic

Terminal traffic incoming to an international exchange C in a country and which is to be routed to code 11 or code 12 operators in another international exchange A in the same country according to the extra digit N_1 [2].

Examples: $\underbrace{L\ N_1}_{\text{analysed}}\ C_{11}\ C_{15}$ or $\underbrace{L\ N_1}_{\text{analysed}}\ C_{12}\ X\ X\ C_{15}$ [4]

6 Cross-border traffic between adjacent countries

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

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

References

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

Recommendation Q.108

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

1.8.1 *One-way operation*

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

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

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

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

1.8.2 *Both-way operation*

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

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

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

1.8.2.2 All circuits in System No. 5 and the speech circuits in Systems No. 6 and 7 should be equipped to work in both-way operation. Nevertheless, the both-way method of operation would be applied only if it offered a considerable economic advantage. Hence in the case of large groups (for example, more than 40 circuits in each direction), the possibility of maintaining one-way operation might be considered, because of the extra reliability of this type of operation. If, in circumstances necessitating the use of large groups, there are great differences between the busy hours at each end, it would be advisable, if it were desired to maintain one-way operation, to arrange that the circuits be used successively in one or the other direction according to the time of day. This availability of the circuits for routing traffic from country A to country B or vice versa would be arranged by a convenient method.

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

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

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

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

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

Recommendation Q.109

1.9 TRANSMISSION OF THE ANSWER SIGNAL IN INTERNATIONAL EXCHANGES

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

- the conversion of the national answer signal into the international answer signal and vice versa; and
- the transmission of the international answer signal over the international part of the connection,

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

SECTION 2

TRANSMISSION CLAUSES FOR SIGNALLING

A. Signalling on PCM links

Recommendation Q.110

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

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

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

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

These signalling systems are not recommended for use between time division digital exchanges.

2.0.2 *Signalling System No. 6*

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

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

2.0.3 *Signalling System No. 7*

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

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

2.0.4 *Signalling System R1*

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

An alternative method of transmitting the line signals via a PCM system as specified in Recommendation G.733 has been developed as the digital version of System R1. Details are given in Recommendations Q.310 to Q.332. The multifrequency interregister signals are applied in-band via the analogue input of the speech circuit.

This signalling system is not recommended for use between time division digital exchanges but the digital version may be used between a time division exchange and a space division exchange.

2.0.5 *Signalling System R2*

The line signals of System R2 cannot be transmitted via an analogue input of a PCM transmission system since these signals are sent out-band using a 3825 Hz signalling channel. A digital version of the R2 line signalling system has been developed for use with a PCM system as specified in Recommendation G.732. Details are given in Recommendations Q.421 to Q.424. The multifrequency interregister signals are applied in-band via the analogue input of the speech circuit.

This signalling system is not recommended for use between time division digital exchanges, but the digital version may be used between a time division and a space division exchange.

B. Clauses common to signal receivers (and senders) for Signalling Systems No. 4, No. 5, R1 and R2 [1]

Recommendation Q.112

2.1 SIGNAL LEVELS AND SIGNAL RECEIVER SENSITIVITY

2.1.1 *Standardized transmitted power*

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

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

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

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

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

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

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

The operate level range of the signal receivers about a nominal value should take account of these three factors. In System No. 4, the operate range (± 9 dB) is appropriate for end-to-end signalling. The maximum number of circuits in the end-to-end signalling situation is normally three but more may be possible depending upon the actual conditions. In System No. 5 the operate range, (± 7 dB) for line signals and for register signals is appropriate for each circuit in link-by-link signalling. For the other CCITT systems see the relevant parts of their specifications.

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

2.1.3 *Maximum sensitivity of the signal receiver*

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

Recommendation Q.113

2.2 CONNECTION OF SIGNAL RECEIVERS IN THE CIRCUIT

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

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

- operate the line signal receiver;
- interfere with the reception of signals by operating the guard circuit of the line signal receiver.

The additional attenuation introduced should in consequence take account of:

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

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

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

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

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

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

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

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

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

2.3 TYPICAL TRANSMISSION REQUIREMENTS FOR SIGNAL SENDERS AND RECEIVERS

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

2.3.2 *Input and output impedance*

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

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

$$\left|\frac{Z_E - 600}{Z_E + 600}\right| \leqslant 0.35 \text{ and } \left|\frac{Z_S - 600}{Z_S + 600}\right| \leqslant 0.35.$$

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

2.3.3 *Attenuation*

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

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

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

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

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

$$1.55 \cdot 10^{\frac{n}{20}} \text{ volts, if } n \text{ is expressed in decibels.}$$

2.3.4 *Attenuation distortion*

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

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

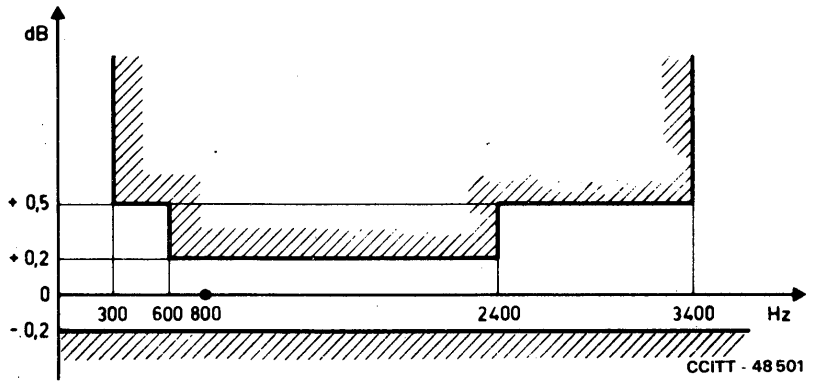

FIGURE 1/Q.114

Attenuation distortion of the signal receiver

2.3.5 *Nonlinear distortion*

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

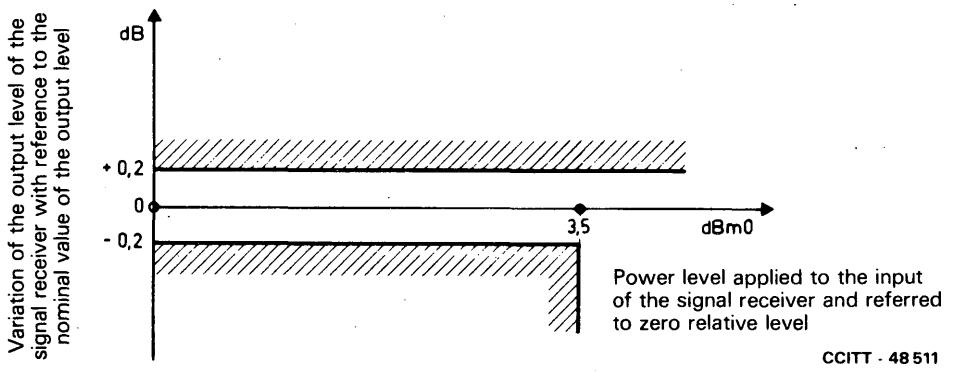

FIGURE 2/Q.114

Limits for nonlinear distortion due to the insertion of the signal receiver

2.3.6 *Balance*

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

The same clause should apply to the signal sender.

2.3.7 *Crosstalk between adjacent signal receivers*

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

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

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SECTION 3

CONTROL OF ECHO SUPPRESSORS

Recommendation Q.115

3. CONTROL OF ECHO SUPPRESSORS

3.1 *General*

In order to achieve transmission objectives on long automatic and semi-automatic telephone connections, it is necessary to take into account the effects of echo. A general discussion of echo considerations is given in Recommendation Q.42 which is an extract of Recommendation G.131. Included there are rules governing the use of echo suppressors. Both ideal rules and practical rules are listed. The characteristics of terminal half-echo suppressors are given in Recommendation G.161 of the *Orange Book*.

The various rules mentioned above can be carried out at switching centres only if sufficient information is available to coordinate an overall control action. Logical means to obtain pertinent information and the switching considerations governing its practicable use are detailed below. Control based on the transfer of signals between switching centres is given particular attention. Self-contained control action such as tone disablement of echo suppressors for data transmission is not within the scope of this Section.

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

3.2 *Compatibility of echo suppressors and signalling equipment*

a) Arrangements should be incorporated in the switching equipment to prevent echo suppressor action from disturbing simultaneous forward and backward signalling via the speech paths. For this case typical arrangements are:

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

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

Note – The standard half-echo suppressor (Recommendation G.161 of the *Orange Book*) if located on the line side of line signalling equipment may adversely affect signalling. This difficulty is possible because with the new standard half-echo suppressor normal operation will at times cause 6 dB additional loss to appear in the path to a line signalling receiver. Operating margins are correspondingly reduced. For example, with signalling receivers for System No. 5 as specified in Recommendation Q.112, signalling reliability could be impaired. Accordingly, adequate operating margins should be assured or the echo suppressor should not be located on the line side of line signalling receivers. With regard to interregister signalling which requires simultaneous transmission in both directions, similar considerations call for disabling the echo suppressors while interregister signalling is in progress in order to prevent the 6 dB loss.

b) Arrangements should be incorporated in the Systems No. 6 and No. 7 equipment to prevent echo suppressor action from disturbing the procedure for making the continuity check of the speech path.

3.3 *Terminology*

a) Subsequent discussion of control measures will refer only to the standard terminal half-echo suppressor specified in Recommendation G.161 of the *Orange Book*. The term *echo suppressor* will be used to denote this device.

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

c) With respect to d.c. control of permanently associated echo suppressors, control actions are said to *enable* or *disable*.

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

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

Systems No. 4 and R2: incoming half-echo suppressor required,

Systems No. 6 and No. 7: outgoing half-echo suppressor included.

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

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

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

3.4 *Operation without signals*

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

3.5 *Analysis of information at an outgoing international exchange*

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

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

ii) information about the actual routing of the call;

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

iv) nature of incoming national circuit at A;

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

With respect to iii) and iv), the characteristic of primary interest is propagation time. Two general categories, *long* and *short*, are the basis of control action. See §§ 3.3 g) and h) above, for definition of terminology.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

3.9 *Other considerations*

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

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

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SECTION 4

ABNORMAL CONDITIONS

Recommendation Q.116

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

In general, when an abnormal condition occurs in the setting up of a call, the outgoing operator in semi-automatic operation and the calling subscriber in automatic operation should receive an indication to show that it is necessary to make a new attempt to set up the call or to take other appropriate action.

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

Recommendation Q.117

4.2 ALARMS FOR TECHNICAL STAFF AND ARRANGEMENTS IN CASE OF FAULTS

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

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

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

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

4.3 SPECIAL RELEASE ARRANGEMENTS

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

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

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

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

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

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

During the establishment of the connection to the requested extension, PBXs should not return clear-back condition, because this would unintentionally clear the connection especially on calls from networks with shorter time-outs.

4.3.3 *Clear-forward signal not received by the incoming exchange after sending a clear-back signal* [2]

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

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

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1) In the North American network the corresponding time-out is 10 to 32 seconds.

2) These release arrangements may not be used within some regional networks.

4.4 INDICATION OF CONGESTION CONDITIONS AT TRANSIT EXCHANGES

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

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

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

4.4.2 In addition, in a transit exchange, when reached by a circuit with System No. 4, connection should be made to a recorded announcement to advise the outgoing operator of the place where the congestion occurred.

In this case the busy-flash signal and the recorded announcement will be used at the outgoing exchange in the manner judged most suitable by the Administration of the country concerned.

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PART V

SUPPLEMENTS TO THE SERIES Q RECOMMENDATIONS

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Supplement No. 1

REPORT ON THE ENERGY TRANSMITTED BY CONTROL SIGNALS AND TONES

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

Supplement No. 2

CHARACTERISTICS OF SPEECH INTERPOLATION SYSTEMS AFFECTING SIGNALLING

1 Celtic system

1.1 *General*

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

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

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

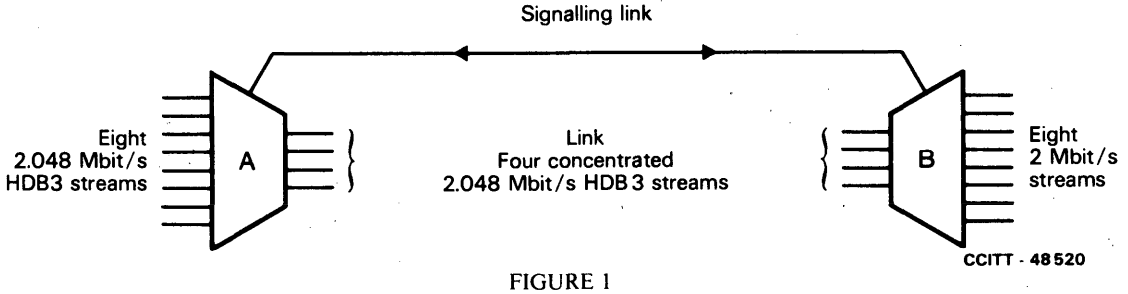

FIGURE 1

1.2 *Summary description of CELTIC*

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

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

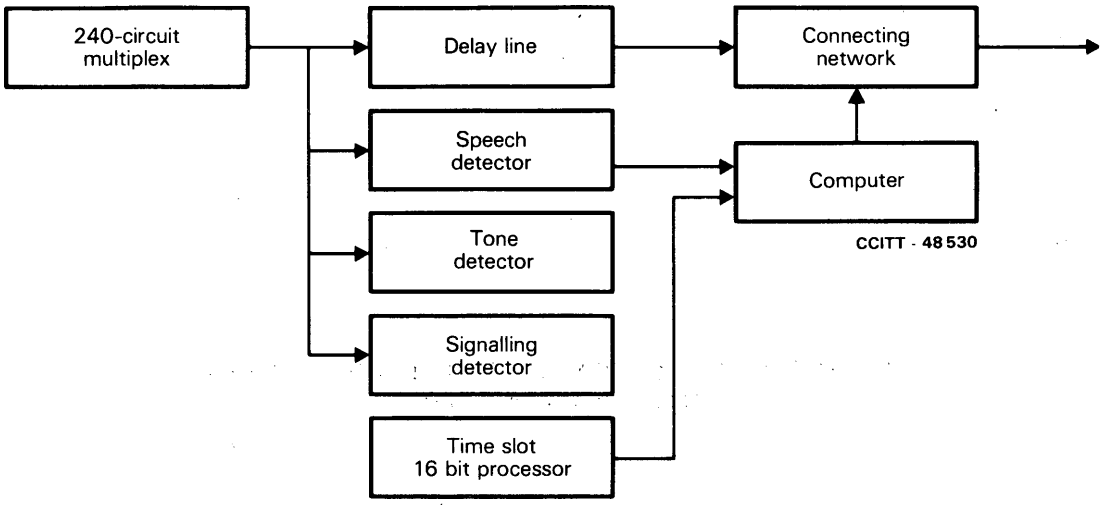

FIGURE 2

1.2.1 *Delay line*

The delay line is used to offset delay due to the decision time of the speech detector, the answering time of the computer (search for an available channel and its assignment to an active circuit) and the processing time taken by the CELTIC signalling unit to set up the connecting message. The delay line is the same for all circuits (adjustable from 0 to 32 ms). Its nominal value is *32 ms.*

This delay line may be cancelled circuit by circuit.

1.2.2 *Speech detector*

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

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

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

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

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

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

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

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

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

1.2.3 *Processing of TS-16 bits*

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

This device has two functions:

- transmitting direction: it detects changes in the state of the significant bits of the TS 16 and informs the computer.
- receiving direction: it can modify one or more bits of the TS 16 according to information provided by the computer (command to block junctor or to disable echo suppressor).

1.2.4 *Echo suppressor*

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

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

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

1.3 *Links between CELTIC and the transit centre*

There are four types of link:

- speech links,
- signalling links,
- links for circuit blocking command,
- links for echo protection disabling command, where necessary.

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

- nature of transit centre,
- signalling system (CCITT Nos. 4, 5 and 6, R1 or R2),
- position of CELTIC in relation to the transit centre,
- position of echo suppressors in relation to signalling sets.

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

1.4 *Operation of CELTIC with different types of signalling*

1.4.1 *Signalling System No. 4*

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

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

1.4.2 *Signalling System No. 5*

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

1.4.3 *Signalling System No. 6*

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

1.4.4 *Signalling System R2*

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

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

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

1.4.5 *Conclusion*

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

2 DSI characteristics

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

The DSI system increases the capacity of the TDMA system by interleaving speech bursts from different terrestrial channels on the same satellite channel. Inputs to the DSI module are digitally encoded in accordance with Recommendation G.711 [2] using encoding referred to as "A-law" with alternate digit inversion.

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

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

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

3 TASI characteristics affecting signalling

3.1 During a normal telephone conversation each party usually speaks for only about 40% of the time (speech activity), 60% of his channel time being idle. TASI (Time Assignment Speech Interpolation) is an equipment which rapidly siwtches channels to talkers on a time-shared basis to make use of the otherwise idle channel time and thus permits a greater number of simultaneous calls than would otherwise be possible with the available channels in the cable.

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

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

To reduce the number of times clipping occurs, the TASI speech detector is given a hangover, maintaining circuit/channel association, to bridge the shorter gaps in speech, and thus reduce the interpolation. This feature permits the transmission of a sequence of short-pulse short-gap signals without signal clipping.

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

3.2 There are three TASI systems in service. TASI-A and TASI-B make use of analogue – space division switching matrices while TASI-E uses a digital, time division matrix. Circuits can be connected directly from a digital switch to the TASI-E in digital format (Recommendation G.735 [4]). A primary multiplex per Recommendation G.733 [5] must be placed between an analogue switch and the TASI-E to provide the conversion to PCM digital format. If the outgoing transmission channels are analogue, a primary multiplex per Recommendation G.733 must be placed between the TASI-E equipment and the analogue channels. TASI-E is designed to work with Signalling System No. 5 using the standard inband line signalling, and of course with System Nos. 6 and 7 circuits. The continuous energy Signalling System R1 line signalling on each circuit is detected by the TASI-E terminal and then sent to the distant TASI-E terminal over the internal data links.

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

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

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

TASI-B speech detector sensitivity: usually −36 dBm0 although it does change to −28 dBm0 if input level remains higher than −20 dBm0 in excess of 200 milliseconds. The TASI-E speech detector is made up of the basic speech detector, which adapts to the average speech level and background noise, and signalling-by-pass circuits which detect the presence of moderate level MF frequencies and provide extended hangover time to bridge the gaps between pulses.

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

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

TASI-A

a) 50 ms for input signals of 50 ms or less;
b) 240 ms for input signals greater than 50 ms;

TASI-B

c) 10 ms plus burst length for burst lengths up to 40 ms;
d) 180 ms for burst lengths greater than 40 ms.

TASI-E

e) 128 ms for input signals greater than −19 dBm0;
f) 88 ms for input signals between −19 and −25 dBm0;
g) 16 ms for input signals less than −25 dBm0.

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

a) initial clip: 18 ms;
b) total clip when TASI-A or TASI-B is heavily loaded and a free channel is not immediately available, expressed as a probability that a signal will be clipped for a certain time or longer: (see Table 1).

TABLE 1

Total clip	Number of TASI-A or TASI-B systems in series on one circuit		
	1	2	3
125 ms	1/100	1/20	1/10
250 ms	1/700	1/140	1/60
500 ms	1/15 000	1/5000	1/1500

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

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

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

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

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

References

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

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

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

[4] CCITT Recommendation *Characteristics required to terminate 1544-kbit/s digital paths on a digital exchange*, Vol. III, Fascicle III.3, Rec. G.735.

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

INFORMATION RECEIVED ON NATIONAL VOICE-FREQUENCY SIGNALLING SYSTEMS

SUPPLEMENT No. 3

Information received on national voice-frequency signalling systems

Country	Frequency (Hz)	Tolerance at the generator terminal (Hz)	Frequency variation possible at the entry to the international circuit (Hz)	Splitting time (milliseconds)	Absolute level of the power of signals at the point of zero relative level (decibels)
Algeria	2000	± 6	± 12	15 then 35 with attenuated 18 dB	- 5
Argentina	3825	± 3	± 10	–	- 9
Australia	600-750 separate	± 5	± 15	160-210	0
Austria	2280	± 6	± 15	30	- 6
Bahamas	2600	± 5	± 10	35 maximum	-8 and after attenuation -20
Bangladesh	3825	± 5	–	28-55	–
Brazil	3825	± 4	± 4	30 maximum	- 5
Burundi	3825	± 6	± 15	–	- 6
Cameroon	3825	± 4	± 15	–	-5 and after attenuation -20
Canada	2600	± 5	± 10	30 maximum	-8 and after attenuation -20
Chile	3825	± 4	± 10	–	- 18 or - 20
Cyprus	3825	± 3	± 8	35 maximum	- 18
Korea (Rep. of)	3825	± 10	± 10	–	- 15
Cuba	2100 3825	± 3 ± 6	± 10 ± 15	60 25	- 6 - 6
Denmark	3000 3825	± 6 ± 4	± 10 ± 6	30-50 –	- 8 - 20
Dominican Rep.	2600	–	–	–	–
Spain	2500	± 3	± 15	10	- 6
United States of America	2600	± 5	± 10	30 maximum	-8 and after attenuation -20

Country	Frequency (Hz)	Tolerance at the generator terminal (Hz)	Frequency variation possible at the entry to the international circuit (Hz)	Splitting time (milliseconds)	Absolute level of the power of signals at the point of zero relative level (decibels)
Fiji	3825	± 3	–	–	– 20
France	2280	± 3	± 6	35	– 6
Ghana	3825	± 3	–	–	– 5
Hungary	2280 3825	± 6 ± 6	± 15 ± 15	25 25	– 6 – 6 – 20
India	2400	± 2	± 10	25 filter loss at 2400 Hz →50 dBm	– 10
Iraq	3825	± 5	–	–	– 18
Ireland	2040-2400 compound 2280	± 6 ± 6	– –	60 35	– 9 – 6
Israel	3850	± 3	–	–	– 5
Italy	2040-2400 separate and compound	± 6	± 15	35	– 9
Jamaica	2600	± 5	± 15	35 maximum	–8 and after attenuation –20
Jordan	3825	± 3	–	10	– 18 – 20
Kenya	2040-2400	± 6	–	40-60	– 9
Liberia	3825	± 5	–	–	– 6
Luxembourg	3825	± 3	± 5	35-40	– 5
Madagascar	2280	± 3	± 6	35	– 6
Morocco	2280	± 3	± 10	25-35	– 6
Mexico	2400	± 5	± 15	35 maximum	–8 and after attenuation –20
Mozambique	2400 500/20 1625 3350 3825	± 6 ± 6	± 15 ± 15	35-40 40-60	– 5 – 5

Country	Frequency (Hz)	Tolerance at the generator terminal (Hz)	Frequency variation possible at the entry to the international circuit (Hz)	Splitting time (milliseconds)	Absolute level of the power of signals at the point of zero relative level (decibels)
Norway	2400	± 2	–	35	– 6
New Zealand	600-750 2280	± 3 ± 6	± 3 ± 6	140 maximum 35 maximum	– 3 – 10
Oman	3825	± 5	–	10	–6 and after attenuation – 18
Uganda	2040-2400	± 6	–	30-40	– 9
Peru	3825 1380-1500 1620-1740 1860 1140-1020 900-780 660	± 4 ± 4 ± 4	± 6 ± 6 ± 10	– – –	In agreement with Recommendations Q. 414 [1] Q. 415 [2] Q. 452 [3] Q. 454 [4]
Philippines	2600(*) 3825 (*) This frequency will not be used in the future	± 5 ± 3	± 10 ± 15	40 ± 10 20	– 8, – 20 – 14 and after attenuation + 9
Poland	2280 3825 500/20 2100	± 6 ± 3 ± 10 ± 3	± 8 ± 4 ± 20 ± 10	– – – –	– 6 – 5 – 3 – 6
Portugal	3825	± 5	± 15	30-50	– 9
Syria	3825	± 3	–	50	– 18
Romania	3825 or 2280	± 4	–	–	– 6
United Kingdom	600-750 separate 2280	± 3 ± 6	– –	140 maximum 35 maximum	– 3 (600) – 3 (750) – 6
South Africa (Rep. of)	600-750 separate 2280	± 2.5 ± 5	– –	160-210 35 maximum	– 7 – 6
Sweden	2400	± 6	± 11	35-40	– 6
Switzerland	3000	± 6	± 2	40	– 3.5
Surinam	3825	± 0.8	± 10	–	– 18 after attenuation

Country	Frequency (Hz)	Tolerance at the generator terminal (Hz)	Frequency variation possible at the entry to the international circuit (Hz)	Splitting time (milliseconds)	Absolute level of the power of signals at the point of zero relative level (decibels)
Tanzania	3825	± 6	–	–	–6 and after attenuation –20
Czechoslovakia	2280	± 6	± 15	150 then 130 with filter	– 6
Thailand	3825	± 3	± 6	30-50	– 20
Tunisia	2400	± 6	± 15	40 maximum.	– 6
U.S.S.R.	1200-1600 separate and compound 2600	± 5 ± 6	± 15 ± 15	40 maximum before reply, 150 ± 50 after reply –	–4 changing to –9 after 0.1 sec – 7
Yugoslavia	2280	± 6	–	–	– 6
Zambia	3825	± 3	± 3	30-50	– 20

References

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

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

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

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

Supplement No. 4

VARIOUS TONES USED IN NATIONAL NETWORKS

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

Supplement No. 5

NORTH AMERICAN PRECISE AUDIBLE TONE PLAN

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

Supplement No. 6

TREATMENT OF CALLS CONSIDERED AS "TERMINATING ABNORMALLY"

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

Supplement No. 7

MEASUREMENTS OF IMPULSIVE NOISE IN A 4-WIRE TELEPHONE EXCHANGE

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

Supplement No. 8

SIGNALLING FOR DEMAND ASSIGNMENT SATELLITE SYSTEMS

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

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