Consultancy Services for the Establishment
of a
FUNDAMENTAL PLANNING UNIT
in the

Pakistan Telegraph & Telephone Department

Final Report

SIGNALLING PLAN

Prepared by:

Teleconsult In

Washington D.C,

June 1990

SIGNALLING PLAN

EXECUTIVE SUMMARY

This Signalling Plan specifies the Interoffice and
Subscriber Signalling and Tones necessary for the long-term future
National Telecommunications Network of Pakistan.

In Preliminary Notes to each Fascicle on Signalling of
the Blue Book, CCITT state in unambiguous terms: "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".

Although in theory T&T is free to do as it wishes in the
National Network, in practice the use of future non-CCITT systems
would be unnecessarily difficult and costly.Therefore CCITT
signalling standards should be applied to the network as far as
possible.

Present T&T planning documents cover existing interoffice
signalling systems, both CCITT recommended systems (R-2, No. 5)
and non-CCITT signalling systems and cater for the introduction of
CCITT No. 7 Signalling. Also subscriber loop signalling and tones
are specified therein. Generally these documents define adequately
the signalling requirements for the next fe years.

However, for the long-term future, with the continuous
expansion, improvement, modernization and digitalization of the
telecommunications network and the introduction of ISDN, the
emphasis will change progressively towards No. 7 Signalling, which
is optimized for such digital networks and is essential for ISDN.
Eventually No. 7 Signalling will be totally predominant. In view
of the great importance in future networks and ISDN 's of No. 7
Signalling and Digital Subscribers Signalling Systems (DSS), a
vast amount of new Signalling material has become available in
the recently published Blue Book and has been incorporated in this
Signalling Plan.

The probable widespread utilization of domestic satellite
systems also involves special signalling problems which have to be
addressed. The CCITT specified non-compelled modified version of
R-2 is recommended for the short term with No. 7 later when the
satellite circuits are digitalized.

Tones convey important and useful messages to the users, so
they must be clear, consistent and informative. It would appear
that there are some cases where non-standard tones currently are

used while other potentially useful tones (especially comfort tone, which lets the caller know that his call is progressing) are not employed, Such anomalies should be rectified.

The recommended extensive use of No. 7 Signalling will result in greatly improved accuracy and speed in setting up subscriber connections, call control, billing and a much wider range of subscriber facilities at reasonable cost. It is an essential component of T&T 's Digitalization Strategy which should lead to greater customer satisfaction and enhanced revenues for the Department.

SIGNALLING PLAN

1. GENERAL CONSIDERATIONS.

1.1   This Signalling Plan has as its overall objective the definition of signalling standards throughout the Pakistan T&T network and between the Pakistan national network and other national networks.

1.2   Signalling is subject to many technical, economic and legal constraints and the Signalling Plan must and does take these constraints into account.

1.3   There are a great variety of signalling systems available each tailor made for specific applications, but unsuitable for other applications. Also within Signalling systems, especially with CCITT Signalling System No. 7 (the interoffice signalling system of the future for digital networks), there are many options available, where a careful selection has to be made by T&T.

1.4   Unless the signalling systems utilized can interwork, exchanges cannot "talk" to other exchanges or to subscribers. There would be either no communication or, just as bad, misunderstandings. Therefore it is absolutely essential to ensure proper signalling both between subscribers and their local exchanges and also between different exchanges.

1.5   Signalling can be categorized into three main component parts, each of which must be included in the signalling plan:

   a)   Tones, giving audible signals to the subscriber keeping him informed of the progress of an outgoing call or to ring him to tell him that there is an incoming call. Tones should be standardized to avoid confusing the user.

   b)   Subscriber Line Signalling, where the subscriber apparatus and the exchange convey the necessary information (off-hook, dialled digits, etc) to set up or disconnect a call.

   c)   Inter-Exchange signalling, where exchanges convey information to one another on the setting up, disconnection and many other aspects of a call.

1.6   Regarding tones , CCITT state the important principle

ANNEX 4

NON-CCITT STANDARD SIGNALLING SYSTEMS IN USE
IN THE PAKISTAN NATIONAL NETWORK.

PAKISTAN NATIONAL SIGNALLING NETWORK CCS7

Legend:
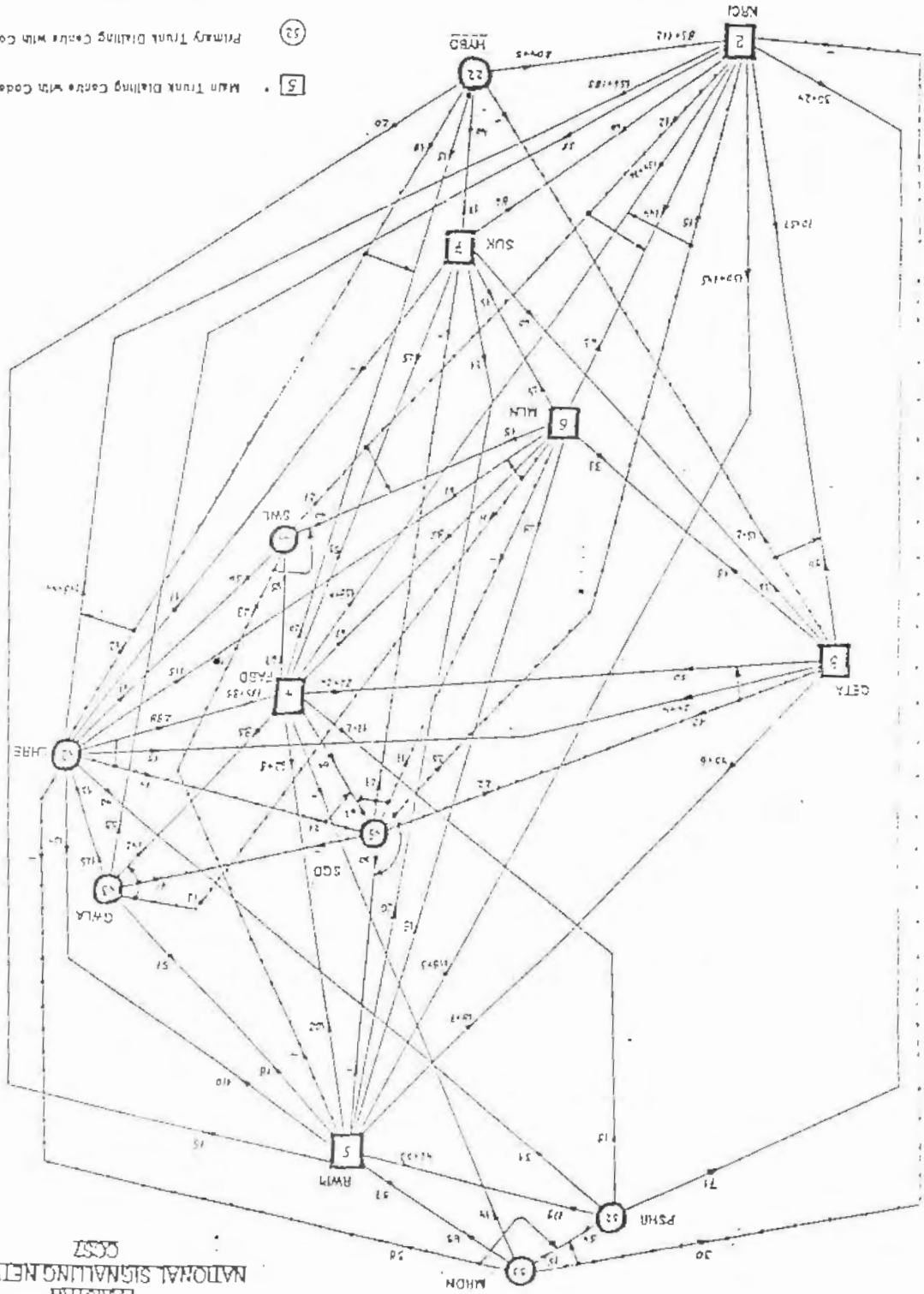
- $\overset{20}{\longleftrightarrow}$ — Direction and Numbers of Speech Channels
- $\longrightarrow$ — Only Speech Channels
- $\longrightarrow$ — Speech and 2 Signalling Channels
- (52) — Primary Trunk Dialling Centre with Code
- [5] — Main Trunk Dialling Centre with Code
- Associated Signalling Channel

Nodes: KRCI, HYBD, SUK, MLN, SWL, FASD, LHRE, GFLA, SGD, RWIP, PSHU, MHDN, QETA

ANNEX 3

PAKISTAN NATIONAL SIGNALLING NETWORK CCS7

(Siemens Document)

2   Indications in an all-ISDN communication path

2.1   It is recommended that no new tone (i.e., tones not in use in the PSTN) be generated by an ISDN terminal.

2.2   Tones are recommended where an auditory method other than "speech" or announcements is chosen as the method for a terminal to translate received D-channel ISDN information for a user. Such tones should be those used in the PSTN in the country where the terminal is situated (Recommendation E.180).

2.3   It is recommended that where a terminal translates ISDN signalling to tones, such tones should be used with meanings analogous to their meanings in the PSTN.

2.4   It is recommended that the use of tones should be restricted to indicating the functions equivalent to the tones used in the PSTN and listed in Recommendation E.182, § A.2. In some cases, notably dial tone, ringing tone, and busy tone, these tones may be the best indicators even when other methods can be provided by terminal.

3   Indications when ISDN is interworking with another network

Given that no tone recognition is likely to be provided by any network element for translating a tone into an ISDN signal for relaying to a terminal, it is recommended that any audible indication arising from a non-ISDN network be passed through an auditory channel to the ISDN terminal.

Recommendation E.184

INDICATIONS TO USERS OF ISDN TERMINALS

1   Introduction

1.1   Recommendations E.180 to E.184 deal with tones and other indications to users of the telephone service. This Recommendation covers the related but perhaps different requirements of the ISDN.

1.2   A person's ability to learn, distinguish between, and remember different tones representing abstract conditions is limited (to about four to six tones). Users are frequently confused by unfamiliar tones encountered through travel or international communication. Section 2 of this Recommendation advises against the use of new tones in order to avoid introducing user difficulties.

1.3   Where indications originate from a network (as proposed to a distant terminal), two situations may exist between the origin of the indications and the user of an ISDN terminal:

a)   ISDN signalling is used throughout

b)   In-band signalling is used in some parts of the connection.

1.4   Considering that information is sent to an ISDN terminal on a D-channel, and that the terminal may transform it into perceptible form, choices exist as to "the most appropriate way of passing indications on to the user (e.g., by means of a display or by tones).

The desirability of translating various ISDN indications, the situations governing such choices, and the relationships of these to terminal capability (particularly display capability), are subjects for further study.

---

4   Tunes and announcements for use in telephone services

The problems associated with "concatenated-word" systems outlined above are avoided by the use of truly synthetic speech generated by rule. These rules translate a specification of what utterance is to be generated into acoustic output. If appropriate rules are found, this method can potentially generate high quality speech, and such features as speed of delivery, duration of pauses, and stress and pitch changes can be readily specified. (One approach to the development of such systems starts with the use of natural speech analysis as the source for generating rule parameters, and leads on to the derivation of general rules to convert any message into speech output.

Rule-generated synthetic speech is currently on the threshold of full functional equivalence with that produced by waveform storage methods, such as word concatenation. However, even highly intelligible synthetic speech sounds unnatural and it may not be as acceptable to users as "concatenated-words" announcements, at least in the immediate future.

5   Preferred listening levels for announcements

The preferred listening level is − 10 dBPa ± 5 dB measured at the customer's ear.

4.3   Update problems

Problems may arise when an announcement has to be changed such that a word or words have to be either recorded or re-recorded for the first time. There may be difficulty in obtaining the original speaker, and even if the original speaker is available the voice may differ from the original recording, either temporarily (e.g., by a head cold) or permanently (e.g., through ageing). This can mean that the entire vocabulary has to be recorded again, or alternatively an announcement of degraded quality may be accepted as an expedient solution. Wherever possible, problems of this sort should be anticipated and recordings made of a larger vocabulary than is to be used immediately.

3.5   The use of pauses within telephone numbers or items of information that have to be remembered written down is recommended (for instance 500 to 1000 msec within a digit sequence).

Telephone numbers should be grouped with groups of two to four digits according to the custom.

4   Speech quality

4.1   Announcements should not sound as if they have finished when they have not, nor should they sound as they continue when they have finished.

4.2   The speech quality of announcements should be assessed by listeners' subjective judgements from the use end. The quality should refer to the whole system, including effects of transmission. A measuring method that can be used is the listening opinion test described in Volume V, Supplement 2.

5   Tones after announcements

5.1   After guidance announcements which ask for input from the user an indication to proceed should be give (in some cases dial tone will be appropriate).

5.2   When the user is required to replace the receiver following an announcement, congestion tone may be used.

6   Concatenated-word announcements

Problems which are peculiar to concatenated-word speech are described in the following paragraphs:

6.1   *Fluency problems*

The fluency of an announcement is influenced by the duration of the stored speech segment (for instance 1/16 second), and by the location of words within a segment or segments. Fluency may also be influenced by the insertion of additional silent segments between segments of speech. An iterative procedure of vocabulary editing and listening to the results until it is judged acceptable is recommended. Human factor tests need to be include in the iterative procedure. Experiments should be held with the typical users.

6.2   *Intonation problems*

Problems arise because speech is required to sound natural. Ideally only one version of each word would be assembled from segments held in store, as this would be the easiest and cheapest method of providing a rang of announcements. However, the intonation pattern of a word may need to vary depending on the position of the word within a sentence.

For example:

a)   "All calls to XXXX are being *diverted*".

-    The stress on the word "diverted" falls towards the end of the word.

b)   "Your call to Dr. Smith is being "diverted" to Dr. Jones".

The pitch of the word "diverted" is neutral.

6.3   *Presentation of numerical information*

Numerical information, and in particular telephone numbers, can be more easily remembered if spoken in a familiar manner. This may necessitate different rules for different countries, and may be influenced by such things as numbering plan and custom. (For example, a 3 or 4 digit area code separated by a pause from a 5 or digit local number. The number 7230 could be spoken as "seven, two, three, oh" or "seventy-two, thirty" or "seven, two, three, zero").

In many languages, three intonation patterns are required for telephone numbers, a neutral pattern for the body of the number, a continuant pattern for the end of an intermediate block (rising pitch), and a terminator for the end of the number (falling pitch). Number strings are more easily remembered if spoken with a rhythm based on the perceptual centres of utterances (e.g. digits), rather than with one based on the start of the utterance period.

The final determinant of what is required in a particular case depends upon the iterative procedure o

GUIDING PRINCIPLES FOR TELEPHONE ANNOUNCEMENTS

Introduction

Recorded announcements are of great value in the setting up of a call or supplementary service.

Administrations will need to use an announcement system which makes the announcements in real time and which permits the inclusion of specific information relating to a particular call or situation. This can be done storing words or parts of words which can be appropriately assembled to make up the required announcements. These are called "concatenated-word" announcements.

Another approach is to use truly synthetic speech (synthesis-by-rule), generated in real time, to produce nouncements as required. This avoids the need to store representations of utterances by a natural speaker, and s the advantage of total flexibility in the announcement that can be produced.

Content of announcements

Announcements should not commence with a significant word.

Ideally only one piece of information should be conveyed in an instructional announcement, but for actical purposes a maximum of three is recommended.

Repetition of important items of information is advisable. Announcements such as acknowledgement ssages and error messages should be produced twice. However, guidance announcements which ask for input m the user should normally be produced only once.

Announcements should be phrased in a polite manner.

Announcements should be concise. This requirement is especially important for guidance announcements.

In many languages, simple affirmative sentences are most easily understood and should be used where isible, rather than negative and passive sentences. The use of negatives can sometimes be helpful, however, en emphasizing a point (e.g., as in "Do not ...").

If applicable, the order in which procedural guidance is presented should correspond to the order in which ons are required to be executed (e.g., "Please press the # button and then replace the receiver", rather than fore replacing the receiver, please press the # button).

If an action and its consequence are described, the consequence should be stated first, then the action , "To receive this message, please press the # button", rather than "Please press the # button to receive the sage").

Where necessary, announcements should be given in more than one language.

) Jargon should be avoided

When several words or phrases could be used to convey the same idea (e.g., handset/receiver, hang-up/ r-down, etc.), one should be selected and used throughout.

Timing of announcements

Announcements should start at the beginning for each customer receiving them.

The speech rate should not exceed normal conversation speed. For example, normal speech rate for the lish language is 150 to 200 words or 300 to 500 syllables per minute.

Attention should be given to the distribution of pauses within announcements, in order to allow listeners igest items of information.

If an announcement is repeated once, the pause between the original announcement and its repetition ild be about 2 seconds. Where announcements are required to be repeated more than once the pause between ouncements may be extended (for instance 5 to 10 seconds).

A.3.2 **general positive recorded announcement**

> F: *annonce enregistrée générale positive*

> S: *anuncio grabado general positivo*

A recorded announcement given to the user of a supplementary service to advise that the request has been accepted.

Example

"Your order has been executed."

A.3.3 **general negative recorded announcement**

> F: *annonce enregistrée générale negative*

> S: *anuncio grabado general negativo*

A recorded announcement given to the user of a supplementary service to advise that the request cannot be executed or that the call cannot be completed.

Examples

"Your order cannot be executed."
"Your call cannot be completed at this time."
"Please try again."

A.3.4 **specific recorded announcement**

> F: *annonce enregistrée spécifique*

> S: *anuncia grabado especifico*

A recorded announcement giving specific information about a call attempt or control order.

A.3.5 **specific positive recorded announcement without supplementary information**

> F: *annonce enregistrée spécifique positive sans information supplémentaire*

> S: *anuncio grabado especifio positivo sin información suplementaria*

A recorded announcement indicating to the user that the request for a particular supplementary service has been accepted.

Example

"The call barring service is now in operation."

A.3.6 **specific negative recorded announcement without supplementary information**

> F: *annonce enregistrée spécifique négative sans information supplémentaire*

> S: *anuncio grabado especifico negativo sin información suplementaria*

A recorded announcement indicating to the user that the request for a particular supplementary service cannot be executed or that the call cannot be completed.

Examples

"Your order for call transfer cannot be executed."

"The called number is not obtainable because of a network fault."

A.3.7 **specific positive recorded announcement with supplementary information**

> F: *annonce enregistrée spécifique positive avec information supplémentaire*

> S: *anuncio grabada especifico positivo con información suplementaria*

A recorded announcement complete with the supplementary information received indicating to the user that a certain condition is being established.

Example

"An alarm call is booked for 06.30."

A.2.14 comfort tone

    F: *tonalité de file d'attente*

    S: *tono de paciencia*

A tone advising that the call is being processed and that the caller should wait.

A.2.15 tone on hold

    F: *tonalité de garde*

    S: *tono de retención*

A tone used to reassure a calling subscriber who has been placed on "hold" by a subscriber with PBX or other facilities.

A.2.16 record tone

    F: *tonalité d'enregistrement*

    S: *tono de grabación*

A tone generated by automatic answering equipment to inform the calling subscriber when to begin a message which will be recorded.

A.2.17 caller waiting tone

    F: *tonalité de demandeur en attente*

    S: *tono de indicación de llamada en espera para el llamande*

A tone advising a caller that a called station, though busy, has a call waiting service active.

A.2.18 positive indication tone

    F: *tonalité d'indication positive*

    S: *tono de indicación positiva*

A tone telling a subscriber controlling a supplementary service that the control procedure has been successfully completed and accepted.

A.2.19 negative indication tone

    F: *tonalité d'indication negative*

    S: *tono de indicación negativo*

A tone advising a subscriber that the request for service cannot be accepted.

A.3 *Recorded announcements*

A.3.1 general recorded announcement

    F: *annonce enregistrée générale*

    S: *anuncio grabado general*

A recorded announcement giving general information about a call attempt or control order.

A.2.6 busy tone

F: tonalité d'occupation

S: tono de ocupado

A tone advising the caller that the telephone number is busy.

A.2.7 congestion tone

F: tonalité d'encombrement

S: tono de congestión

A tone advising the caller that the groups of lines or switching equipment necessary for the setting-up of the required call or for the use of a specific service are temporarily engaged.

A.2.8 special information tone

F: tonalité spéciale d'information

S: tono especial de información

A tone advising the caller that the called number cannot be reached for reasons other than "subscriber busy" or "congestion".

The tone may also be used in conjunction with recorded announcements to signify that what the caller is about to hear is a recording. It should always be used to precede all call failure announcements.

A.2.9 warning tone

F: tonalité d'avertissement

S: tono de aviso

A tone warning participants in a call that privacy of a conversation cannot be ensured where a recording machine is being used.

A.2.10 intrusion tone

F: tonalité d'intrusion

S: tono de intervención

A tone advising participants during a call that the privacy of the conversation has been breached, e.g. by the intervention of an operator.

A.2.11 call waiting tone

F: tonalité d'appel en attente

S: tono de indicación de llamada en espera

A tone advising the user of the call waiting supplementary service who is engaged on a call that someone is attempting to call his number.

A.2.12 pay tone

F: tonalité de paiement

S: tono de pago

A tone advising users of a payphone that a payment is required.

A.2.13 payphone recognition tone

F: tonalité d'identification de publiphone

F: *tonalité*

S: *tono*

A tone is an audible indication comprising a small number of discrete frequencies, but excluding speech.

A.1.3 recorded announcement

F: *annonce enregistrée*

S: *anuncio grabado*

An audible indication in the form of speech

A.1.4 call information

F: *information d'appel*

S: *información de llamada*

Call information includes normal address information, control codes for supplementary services, and other information dialled or keyed by the subscriber.

A.2 *Tones*

A.2.1 dial tone

F: *tonalité de numérotation*

S: *tono de invitación a marcar*

A tone advising that the exchange is ready to receive call information and inviting the user to start sending call information.

A.2.2 PABX internal dial tone

F: *tonalité interne de numérotation des commutateurs privés*

S: *tono de invitación a marcar interno de centralitas privadas automáticas conectadas a la red pública* (tono de marcar interno de centralita privada automática, CPA)

A tone advising that the PABX is ready to receive call information and inviting the user to start sending call information.

A.2.3 special dial tone

F: *tonalité spéciale de numérotation*

S: *tono especial de invitación a marcar*

A tone advising that the exchange is ready to receive call information and inviting the user to start sending call information, at the same time reminding the user that special conditions apply to the termination from which the call is being made.

A.2.4 second dial tone

F: *seconde tonalité de numérotation*

S: *segundo tono de invitación a marcar*

A tone advising the caller that the network has accepted the call information already sent and asking the caller to provide more information.

A.2.5 ringing tone

F: *tonalité de retour d'appel*

S: *tono de llamada*

A tone advising the caller that a connection has been made and that a calling signal is being applied to a telephone number or service point.

(6) that, except for PABXs and supplementary services, a second dial tone should not be used and a second application of dial tone should also be avoided;

(7) that when a subscriber should wait until the called party answers and no special condition applies to the line, a *ringing tone* should be given;

(8) that when the called number is busy and no special condition applies to the called line, a *busy tone* should be given to the calling subscriber;

(9) that when a special condition of either "call waiting" or "call diversion" applies to a called line, the calling subscriber may be informed about the special condition. The responses should therefore be either a *specific recorded announcement* or *caller waiting tone* or *ringing tone*. In PABXs a *special ringing tone* may be used for the "call waiting" service.

In the case of "call diversion", if an announcement is given, it is necessary to give the announcement before the call is diverted. This especially applies if additional call charges have to be paid by the calling party.

(10) that a subscriber should be informed when the network has accepted a control order for a supplementary service, e.g., activation, deactivation, registration, erasure. The responses to be given should be either a *specific recorded announcement*, e.g., "alarm call booked for 7.18", a *general positive recorded announcement*, e.g. "order executed" or a *positive indication tone*;

(11) that a subscriber — after having applied a valid *interrogation order* for a supplementary service — should be informed by the network whether the service is activated or not (status check) or, if the information dialled is identical to the stored information (data check) or, specifically what information is stored (data request).

If a status check or data check applies, the responses to be given should be:

- either a *positive* or *negative general recorded announcement* e.g., "service (not) active" or "information dialled (not) identical to information stored",
- or an appropriate *positive indication tone*,
- or an appropriate *negative indication tone*.

If a data request applies, the response should be a *specific recorded announcement* e.g. "alarm call booked for 7.18, 9.30 and 12.35" or "no alarm call booked".

(12) that a busy subscriber, having the service "call waiting" activated, should be informed that an incoming call is waiting. The response is *call waiting tone*.

(13) that when the called number cannot be reached or a control order for activation, registration, deactivation, interrogation, or erasure for a supplementary service cannot be executed by the network in one attempt, due to "short-term system nonavailability" but a repeated attempt within a short time may be successful, a *congestion tone* should be given. This condition applies, for example, if short-term congestion of switching equipment, circuits or memory storage capacity occurs;

(14) that when the called number cannot be reached or a control order for a supplementary service cannot be executed in one attempt due to "recognized long-term nonavailability" and a repeated attempt would have no overall probability of success for a longer period of time (e.g., a few hours), the preferred response is a *specific recorded announcement*, e.g., "the called number is not obtainable because of a network fault, please call again after (1) hour". Alternatively, a *general recorded announcement* or *special information tone* may be used.

This condition applies when:

- a number is out of order for technical reasons;
- where switching equipment or circuits or memory storage capacity will not be available for at least a few hours.

(15) that when the called number cannot be reached in one attempt because of an unresolved condition of the called number due to administrative reasons, the preferred response is a *specific recorded announcement* e.g. "the number has been changed, the new number is 12345". Alternatively, a *general recorded announcement* or *special information tone* may be used.

This condition applies when:

(16) that when the information dialled by the subscriber, for set-up of an ordinary telephone call or order a supplementary service, is not valid or cannot be accepted by the network from that particular line the subscriber should check his information and/or his instructions before making a new attempt;

- the preferred response is a *specific recorded announcement*, e.g., "In international dialling to country the trunk prefix 0 should be deleted";

- the accepted response is a *general negative announcement*, e.g., "You have dialled incorrect information, please consult your instructions". For PABXs a *negative indication tone* may be used;

- the exceptional response is a *special information tone*.

This condition applies when the number dialled:

- is non-existing,

- is barred for calls from a particular line,

- contains an incorrect prefix,

- is a control order for a service which is not provided to the particular line.

(17) that when it is desirable to inform the subscriber to continue dialling during the ordering supplementary service in the conversational mode, the response to be given should be either a *specific recorded announcement* followed by the appropriate dial tone, or a *second dial tone*;

(18) that an indication should be given when a payphone user is required to make a payment during a call. The response to be given should be either a *specific recorded announcement* or a *pay tone*;

(19) that an indication should be given to a public network operator when handling a call from or to a payphone, and that where a tone is used:

- the preferred response is *payphone recognition tone*.

(20) that when a subscriber is asked to speak so as to be recorded by a recording machine, a tone should be given to inform him when to begin to speak; the response to be used is the *record tone*;

(21) that when the privacy of a conversation on a call cannot be ensured, e.g., because of the intrusion of an operator, the preferred response is the *intrusion tone* given to both subscribers;

(22) that when the privacy of a conversation on a call cannot be ensured, e.g., because of the presence of a recording machine, the preferred response is the *warning tone*;

(23) that all the above-mentioned tones should be different.

ANNEX A

(to Recommendation E.182)

List of tones and announcements used as indications to telephone subscribers

Note — This annex is provided to explain the terms in Recommendation E.182 and some related terms. It is not a definitive list and additional refinement will be undertaken as part of future studies.

A.1 *Basic terms*

A.1.1 **audible Indication**

   F: *indication audible*

   S: *indicación audible*

An audible indication is understood to be a sound composed of frequencies within the range 300-3400 which is used to inform the user about the state of a telephone call or supplementary service.

3   In this Recommendation, where no preference is stated between alternative responses, individual Administrations should evaluate the situation in their own networks taking the above factors into account. Additional CCITT studies will be undertaken to better evaluate the relative merits of tones and recorded announcements.

4   A list of tones and announcements used as indications to telephone subscribers is given in Annex A.

The CCITT,

considering

(a) that subscribers set up telephone calls and control supplementary telephone services by means of an interchange of information between the subscriber and the telephone system;

(b) that information sent by the subscriber to the exchange is standardized in several CCITT Recommendations, e.g., Recommendation E.163 for country codes;

(c) that information from the telephone system to the subscriber can be sent in the form of tones or recorded announcements;

(d) that the technical characteristics of the dial tone, the ringing tone, the busy tone, the congestion tone, the special information tone and the warning tone are specified in Recommendation E.180 and that the specification of other tones is studied by the CCITT;

(e) that a certain tone or recorded announcement should unambiguously indicate the desired subscriber action without requiring subscriber knowledge of the operation of the telephone system;

(f) that a standardized application of tones and recorded announcements will improve subscriber performance and will lead to a more efficient use of the telephone network;

(g) that for normal telephone calls and supplementary telephone services an identical application of tones and recorded announcements is desirable;

(h) that it is easy to implement standardization of the application of tones and recorded announcements for new supplementary telephone services, but this is more difficult for existing telephone systems and should be regarded as a long-term objective;

(i) that to avoid abuse of the transfer charge service it is desirable that an operator should be advised when connecting calls to a payphone;

(j) that only tones and announcements are covered in this Recommendation although it can be seen that in some cases a visual indication may be an alternative;

recommends

(1) that this Recommendation shall apply to all telephone services and telephone networks. PABXs should, with certain indicated exceptions, use the same tones as the network in the country in which it is located;

(2) that all tones and recorded announcements should be given as soon as the information received by the telephone network is sufficient to decide which tone or recorded announcement applies, unless there is an established subscriber need for the indication to be given later;

(3) that when a subscriber should wait for a network reaction, no tones or announcement should be given. This condition applies during, e.g., dial-tone delay and post-dialling delay. Exceptionally when a post-dialling delay on an outgoing international automatic call occurs that is likely to cause a subscriber to abandon the call, an appropriate announcement or a *comfort tone* may be used if it has been shown to reduce premature abandonment;

(4) that when a subscriber should start dialling, a *dial tone* should be given. At PABXs this tone may be different from that at the public exchange and in this case the tone is named *PABX internal dial tone*;

(5) that when a subscriber should start dialling and a special condition applies to his line, a *special dial*

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.

Note — This Recommendation is complementary to Recommendation E.180 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.

Recommendation E.182

APPLICATION OF TONES AND RECORDED ANNOUNCEMENTS IN TELEPHONE SERVICES

Introduction

This Recommendation gives the responses that telephone networks should provide to subscribers in the operation of both basic and supplementary telephone services. Three levels of response may be given:

- preferred responses based solely upon subscriber requirements;
- accepted responses to be used where technical or economic reasons inhibit the use of preferred responses;
- exceptional responses to be used where severe technical or economic constraints prevent the use of preferred or accepted responses.

It has not been possible in some cases to state a universally applicable preference between recorded announcements and tones. The factors influencing such a choice vary widely between Administrations in their relative importance. Some features which make recorded announcements attractive are:

- They can reduce the level of calls to operators thus saving considerable expense.
- From a human factors point of view the use of an excessive number of different tones can be confusing to the user. Recorded announcements give an opportunity to present a far greater spectrum of information.
- They can impart more detailed and specific information than tones.
- They can have less chance of being misunderstood than tones in situations encountered infrequently.

Nevertheless recorded announcements have certain drawbacks also:

- They require more time to convey simple information than a tone indication would.
- They are meaningless to people who do not understand the language used. This fact may make their application in multilingual countries impractical.
- Technical and economic constraints might inhibit their use in some networks.
- Subscribers might not always listen long enough to distinguish between different announcements.

...tone advises a caller that a called station, though busy, has a call waiting service active.

...intended that, if this tone is not correctly interpreted by subscribers, it be misinterpreted as the ringing

...dissuade a caller from waiting indefinitely, the tone may cease 30 seconds[*] after it starts and may be
...busy tone, or an Administration may decide to disconnect the calling station.

...caller waiting tone consists of a ringing tone followed, after a silent interval of 0 to 200 ms, by one of
...ing:

   the tone defined in § 10.3 a)

   the pair of tones defined in § 10.3 b)

   another call waiting tone in use by an Administration, provided that it can be appended to each
   sounded part of the ringing tone.

...he caller waiting tone, as defined in § 11.4, should be distinguishably different from the ringing tone
...ctly compared with it.

Machine recognition of tones

The CCITT appreciates the value of machine recognition of tones for the purpose of service observations,
...ance, testing or for the collection of statistics where equivalent electrical signals do not exist. However, the
...considered, at Mar del Plata in 1968, that such machine recognition should not be a substitute for
...l signals. Where machine recognition of audible tones is to be introduced, the tone frequencies and
...s must be within close limits of precision.

For dial tone, ringing tone, busy and congestion tones a working frequency tolerance of $\pm$ 1% should be

Note — The figure of 1% is taken as a compromise out of several national specifications which vary
...n $\pm$ 0.5% and $\pm$ 1.5%. (See also Supplement No. 3.)

ANNEX A

(to Recommendation E.180)

Digital generation of tones

The practice of several Administrations and equipment designers for digital generation of tones is known
...viate largely:

- in the frequency chosen within the recommended range;

- in the power level which varies with the national application;

- in the mechanism of generation of tones and signal frequencies where, in part, the same equipment is
  used.

Therefore, it was found difficult to standardize on a fixed number of samples with a coded bit-stream,
...ch represents one frequency with one distinct power level.

The specification of this time needs further study.

On the other hand there is no necessity for standardizing digital generated tones in a more stringent than analogue generated tones for the following reasons:

— It is to the interest of Administrations that subscribers should not be confused by hearing different tones for the same purpose within their national networks. Consequently the practice already for analogue generated tones should be maintained for reasons associated with the human factor.

— The advantages that can be achieved by standardizing the code words for the tones in order to automatic recognition of tones by monitoring the bit stream seem to be so small that they justify a stringent restriction on all possible methods for digital generation of any frequency allocated with any level.

— For a long period of time a mixture of analogue and digital networks will exist. Thus, recognition of tones will have to be performed also with analogue receivers.

However, when Administrations have full freedom to make new decisions about tones in future networks especially with respect to an all-digital network, they may consider a preferred solution for the digital generation of dial tone, busy tone, congestion tone and ringing tone having a uniform frequency of 425 Hz, as recommended by CCITT.

ANNEX B

(to Recommendation E.180)

Examples for limitation of spurious components of the dial tone with respect to interference with the frequencies recommended for pushbutton telephone sets in Recommendation Q.23

B.1   *Method A* (used by ATT)

The total distortion power should be at least 33 dB less than the dial tone power, and the distortion power in any 100 Hz band above 500 Hz should be at least 40 dB less than the dial tone power.

B.2   *Method B* (used by the Federal Republic of Germany)

In the frequency range from 500 to 2000 Hz [i.e., the range of multifrequency pushbutton (MFPB) frequencies] the distortion power in any 100 Hz band should be at least 40 dB below the dial tone power. In addition, in the frequency range above 2000 Hz up to 4000 Hz the total distortion power should be at least 25 dB below the dial tone power.

Recommendation E.181[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 should:

1) emphasize that a slow repetition rate of the tone means "ringing" whereas a rapid repetition rate means "busy";

2) 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.

[1] This Recommendation is also included in the Series Q Recommendations under the number Q.36.

Where digital tone generation is applied, the frequency for busy and congestion tones should be the same that recommended for analogue generated tones (see Annex A).

Special information tone

The special information tone is provided for all cases in which neither the busy nor the congestion tone give the required information to the calling subscriber in the case of call failure. There are three ways in ch 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 gnized that customers may refer to an operator if they fail to understand the meaning of the recorded uncement and/or the special information tone.

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 milli-ds. Between these tone signals there may be a gap of up to 30 milliseconds.

Silent period — This lasts for 1000 ± 250 milliseconds.

The frequencies used for the three tone signals are: 950 ± 50 Hz; 1400 ± 50 Hz; 1800 ± 50 Hz, sent in der.

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 Administra-uire the use of a warning tone to indicate that the conversation is being recorded. When such a tone is it is recommended that:

i) it consists of a 350-500 ms pulse every 15 ± 3 seconds of recording time, and

i) the frequency of the tone should be 1400 Hz $\pm$ 1.5%.

Payphone recognition tone

here Administrations see the necessity of application of a payphone recognition tone in order to allow to recognise that a call originates at a payphone station or that the called number belongs to a station it is recommended to use a payphone recognition tone.

ie application of the tone will depend on the operational requirements of individual Administrations. me cases the tone will only be required on an incoming call to the payphone, whilst in others there may rement for the tone to be present on originating calls and throughout the period of the call.

Figure 3/E.180 shows the recommended and the accepted areas for the busy tone and the congestion periods.
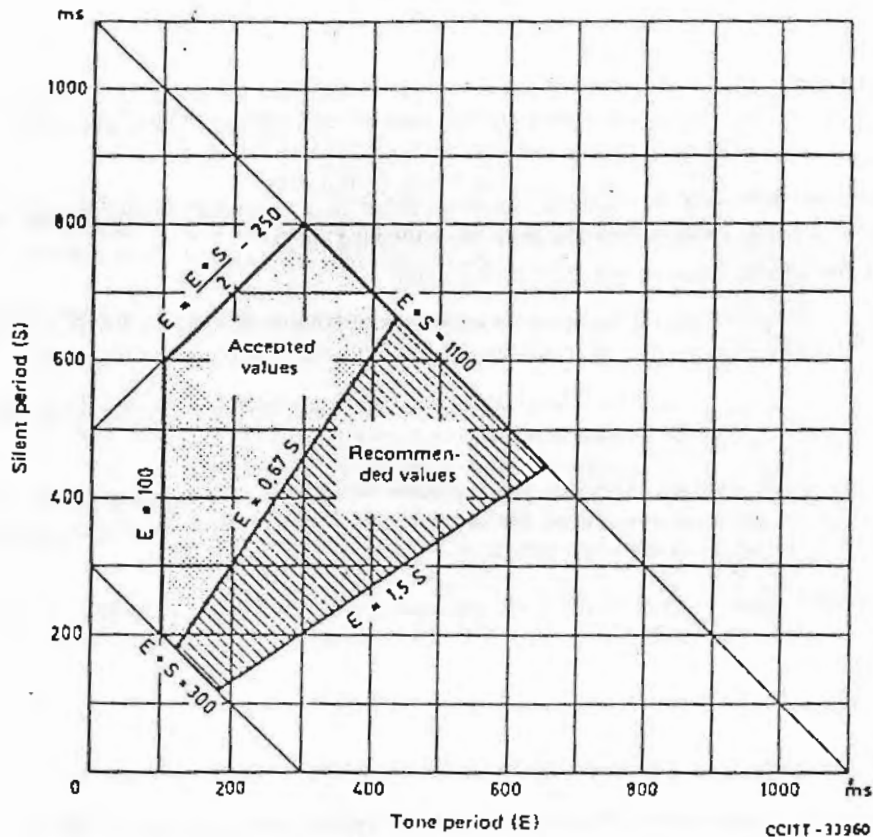
Frequency:

– recommended interval: 400-450 Hz
– accepted interval: 340-500 Hz

FIGURE 3/E.180

(Subscriber) busy tone and (equipment or circuit group) congestion tone

6.2   The busy tone (of the called subscriber) and the congestion tone (of switching equipment or circuit group) 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.

6.3   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.

6.4   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. Administrations adopting a new frequency for busy and congestion tones are recommended to use 425 Hz.

It is emphasized that there is no one-to-one relationship between electrical and acoustical power. What acoustic level will result from a given electrical level is dependent on various parameters such as characteristics of the user's equipment.

It should be noted that the recommended sound pressure levels apply only to the most common subscriber of a user listening via a telephone handset, held reasonably close to the ear so that normal "ear coupling" values apply.

When using a loudspeaking telephone or a headset, the preferred sound pressure level is generally exchange than the recommended levels.

4 Dial tone

4.1 It is recommended that dial tone should be a continuous tone.

4.2 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 ranges 340-425 Hz and 400-450 Hz. The difference between any two frequencies should be at 25 Hz.

4.3 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 to including non-continuous tones as in Supplement No. 2 at the end of this fascicle, are considered accepta However, when adopting a new single frequency dial tone, Administrations are recommended to use 425 Hz.

4.4 Where digital tone generation is applied, the frequencies for dial tone should be the same as the recommended for analogue generated tones (see Annex A).

4.5 In order to prevent interference of harmonics or spurious components of the dial tone with the frequen recommended for pushbutton telephone sets in Recommendation Q.23 and the MFPB signal reception specified Recommendation Q.24, the maximum permissible power level of harmonics or quantizing noise of the dial t has to be limited in a suitable way, depending on the specific characteristics of the implementations of the tone generator and the MFPB receivers within the same exchange. Examples of such limitations for the dial t generator are given in Annex B.

Note — In cases of digital generation of the dial tone, the quantizing noise is composed of a number spectral lines which depend on the number of samples in the generating pattern. In order to reduce the amplitu of the quantizing components, the number of samples should be chosen sufficiently high, thus spreading t quantizing distortion power more evenly over the whole spectrum.

5 Ringing tone

5.1 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 2/E.180 shows the recommended and accepted limits for the ringing tone periods.
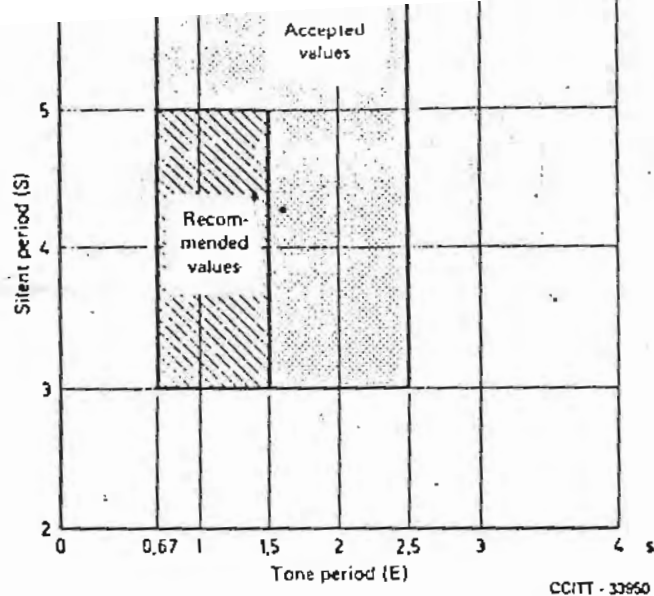
Frequency:

— recommended interval: 400-450 Hz
— accepted interval: 340-500 Hz

FIGURE 2/E.180

Ringing tone

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.

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. Administrations adopting a new single frequency ringing tone are recommended to use 425 Hz.

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 the same as that recommended for analogue generated tones (see Annex A).

Busy tone and congestion tone

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.

The ratio E/S of the tone period to the silent period should be between 0.67 and 1.5 (*recommended*).

For existing exchanges, or for tones to be used in a special way, it is *accepted* that the tone period may be 500 milliseconds shorter than the silent period ($E \geqslant S - 500$ milliseconds). In no circumstances should the tone period be shorter than 100 milliseconds.

Fascicle II.2 — Rec. E.180

SECTION 7

TONES FOR USE IN NATIONAL SIGNALLING SYSTEMS

Recommendation E.180 [1]

TECHNICAL CHARACTERISTICS OF TONES [2]
FOR THE TELEPHONE SERVICE

1   General

Administrations are reminded of the advantages of standardizing audible tones as far as possible so th 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 Recommendation E.182.

In considering the degree of standardization, the CCITT took account of the nature of the various ton already in use. It was also considered that Administrations introducing new tones would find it helpful to kno the preferred limits of cadence frequency and level.

Limits for tone cadences and frequencies are set forth below, all working tolerances being included in t limits.

Besides the limits applying to specifications, limits have been laid down for application to existi exchanges.

These latter limits are herein called *accepted* limits, while those for new equipment are called *recommend* limits.

The present Recommendation covers the case where audible tones are applied within the networ However, the same frequencies and cadences are to be applied if, in the ISDN, the audible tones are generated the terminal equipment.

2   Electrical levels for tones

For international purposes, the levels of the ringing tone, the busy tone, the congestion tone, the spec information tone and the warning tone have to be defined at a zero relative level point at the incoming (in t traffic direction) end of the international circuit.

The level of tones so defined must have a nominal value of -10 dBm0. The recommended limits shou be not more than -5 dBm0 nor less than -15 dBm0 measured with continuous tone.

---

[1] This Recommendation is also included in the Series Q Recommendations under the number Q.35 (Fascicle VI.1)

[2] See Supplement No. 2 at the end of this fascicle for particular values of tone cadences and frequencies in actual use.

connected. In the existing networks the absolute power at the 2-wire access in the direction towards the subscriber station is normally in the range of −10 dBm ± 5 dB. However, with respect to interference with multifrequency pushbutton (MFPB) receivers dial tone levels higher than −10 dBm should be avoided.

Note — The relative level of local exchanges in an analogue network is not fixed. For digital local exchanges the relative levels are given in Recommendation Q.517. A preferred level range of digital tone generators is −8 dBm0 to −3 dBm0 corresponding with the above level range at the output of local exchanges.

Acoustical levels for tones

When tones are generated by a source within a network, e.g., by a telephone exchange, the power level as received by the user will be influenced by the characteristics of the subscriber's line and the equipment between the source and the user's ear.

Furthermore, tones can be generated within the user's equipment, triggered by signals from the exchange. In these circumstances it is necessary to define the tone level in terms of the preferred range of sound pressure levels as heard by the listener.

Research has shown that the preferred listening level for information tones is substantially independent of room noise, circuit noise and tone cadence, but does vary over a range of tone frequencies. Figure 1/E.180 shows the recommended sound pressure levels, with upper and lower limits of the recommended range, over a range of tone frequencies, based on these experiments.
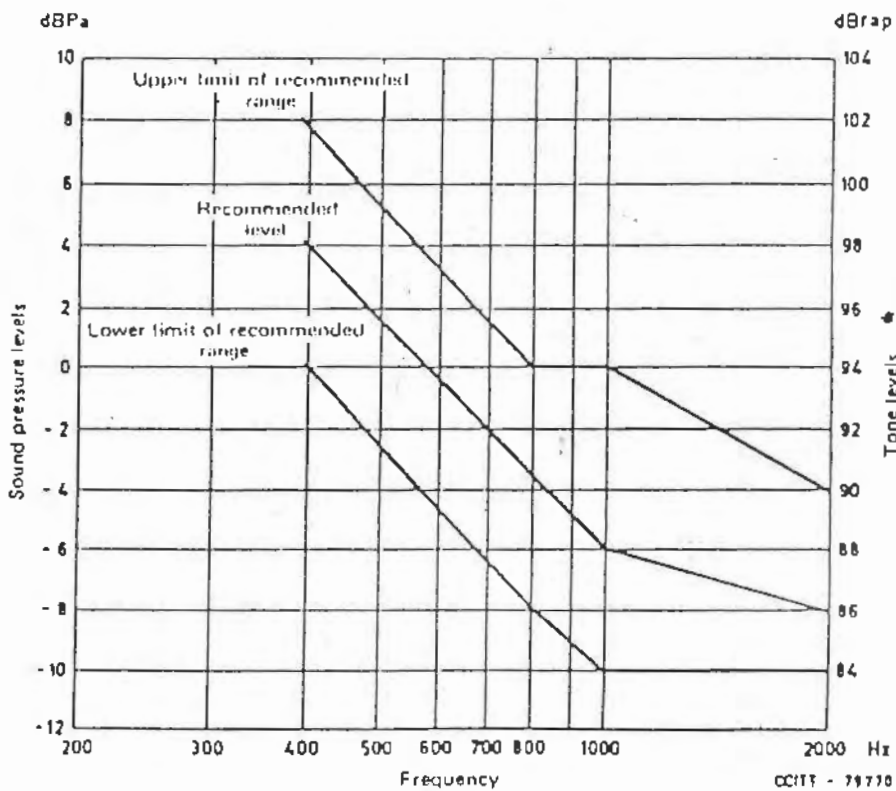
FIGURE 1/E.180

Recommended listening level limits for tones

The Signalling systems specified in this Annex are non-CCITT Signalling systems which are frequently connected to digital exchanges. Therefore all digital exchanges should be able to interwork with these systems.

F6 SIGNALLING

Switching Signals	Signal Duration (mS)	PCM Signalling Time Slot 16 Forward a b c d	Backward a b c d	Direction
Idle	Continuous	1 0 0 1	1 0 0 1	—
Seizure	Continuous	0 0 0 1	1 0 0 1	>>>
Seizure Acknowledgement	Continuous	0 0 0 1	0 0 1 1	<<<
Dial Pulsing	60 / 40	0 1 0 1	0 0 1 1	>>>
End of Selection	120	0 0 0 1	1 1 0·0	<<<
Answer	150	0 0 0 1	0 1 0 1	<<<
Clear Back	Continuous	0 0 0 1	1 1 0 1	<<<

Switching Signals	Signal Duration (mS)	PCM Signalling Time Slot 16 Forward a b c d	Backward a b c d	Direction
Idle	Continuous	1 0 0 1	1 0 0 1	−
Seizure	Continuous	0 0 0 1	1 0 0 1	>>>
Seizure Acknowledgement	Continuous	0 0 0 1	0 0 1 1	<<<
Dial Pulsing	60 / 40	0 1 0 1	0 0 1 1	>>>
End of Selection	120	0 0 0 1	1 1 0 0	<<<
Answer	150	0 0 0 1	0 1 0 1	<<<
Clear Back	Continuous	0 0 0 1	1 1 0 1	<<<
Meter Pulse	150	0 1 0 1	0 1 0 1	<<<
Clear Forward (after 200mS)	−	1 0 0 0 1 0 0 1	x x x 1	>>>
Backward Blocking		1 1 0 1	1 1 0 1	<<<
Meter Pulse	Continuous	0 1 0 1	0 1 1 1	<<<

F6 SIGNALLING (Siemens)

Switching Signals	Signal Duration (mS)	PCM Signalling Time Slot 16 Forward a b c d	Backward a b c d	Direction
Idle	Continuous	1 1 1 1	0 1 1 1	–
Seizure	Continuous	0 1 1 1	0 1 1 1	>>>
Seizure Acknowledgement	Continuous	0 1 1 1	1 1 1 1	<<<
Dial Pulsing	60 / 40	0 0 1 1	1 1 1 1	>>>
End of Selection	120	0 1 1 1	1 0 1 1	<<<
No. Request (ANI)	150	0 1 1 1	1 1 0 1	<<<
Answer (Static) w/o metering over trunk	Continuous	0 1 1 1	1 0 0 1	<<<
Answer (Dynamic) with metering over trunk	150	0 1 1 1	1 0 0 1	<<<
Clear Back	Continuous	0 1 1 1	1 1 0 1	<<<

F6 SIGNALLING (Siemens)   ctd.

Switching Signals	Signal Duration (mS)	PCM Signalling Time Slot 16 Forward a b c d	Backward a b c d	Direction
Meter Pulse	150	0 1 1 1	1 1 0 1	<<<
Meter Pulse Pause	−	0 1 1 1	1 1 1 1	<<<
Trunk Offering	Continuous	0 1 0 1	1 1 1 1	>>>
Clear Forward	−	1 1 1 1	1 x x 1	>>>
On Hook Pulse	200	0 0 1 1	1 x x 1	>>>
On Hook Status	100	0 1 0 0	1 x x 1	>>>
Malicious Call Hold	Continuous	0 1 0 0	1 0 1 1	<<<
Backward Blocking	Continuous	1 1 1 1	1 1 1 1	<<<

2W LOOP SIGNALLING (DID PABX)

Switching Signals	Signal Duration (mS)	PCM Signalling Time Slot 16 Forward a b c d	Backward a b c d	Direction
Idle	Continuous	1 0 0 1	1 0 0 1	−
Seizure	Continuous	0 0 0 1	1 0 0 1	>>>
Seizure Acknowledgement	Continuous	0 0 0 1	1 1 0 1	<<<
Dial Pulsing	60 / 40	1 0 0 1	1 1 0 1	>>>
Answer	Continuous	0 0 0 1	0 1 0 1	<<<
Clear Back	Continuous	0 0 0 1	1 1 0 1	<<<
Clear Forward	Continuous	1 0 0 1	x 1 0 1	>>>
Backward Blocking	Continuous	1 0 0 1	1 1 0 1	<<<

108

SIGNALLING SYSTEM, TIMING AND SYNCHRONIZATION

EXTRACT FROM T&T SWITCHING SPECIFICATION

CHAPTER-5

SIGNALLING SYSTEM, TIMING AND SYNCHRONIZATION

5.1 GENERAL

The exchange shall inter-work with all the existing analogue and digital exchanges like Siemens electro-mechanical type F-1, F-6(a), F-36, NWD, digital EWSD, NEC exchange ND-10 B, International Gateway exchange NXE-20 B and NEAX-61, Ericsson AXE- 10 and CIT Alcatel E-10 B etc. etc.

The exchanges shall be suitably equipped with channel associated and common channel signalling system as explained hereunder for general information. However, the bidder shall himself ascertain the actual signalling conditions for working with the existing networks. All the signalling system shall co- exist and interwork perfectly.

5.2 SIGNALLING.

5.2.1 CALLING SUBSCRIBER WITH PULSE TRAIN DIALLING.

5.2.1.1   The address number for the called subscriber shall be received in the local exchange as decadic DC loop Pulses. The following conditions apply:

Nominal 10 p.p.s. with 40:60 ratio with interdigit pauses of 800 ms.

5.2.1.2   Arrangements may also be available to receive 20 p.p.s. with interdigit pause of 250 ms.

5.2.2 CALLING SUBSCRIBER WITH PUSH BUTTON SIGNALLING.

The address number to the called subscriber and sometimes the number of the calling subscriber will be received as push button voice frequency signals. The push button sets shall conform to CCITT Rec. Q.23 Red Book. The code receivers must be compatible with the push button telephone sets.

5.2.3   PABX - LOCAL EXCHANGE (OPERATOR ASSISTED CALLS)

The same signalling conditions apply as in Clause 5.2.1
and 5.2.2.

5.2.4   PABX- LOCAL EXCHANGE   (AUTOMATIC CALL)

When decadic pulsing is used between PABX and the local
exchange the pulse receiving condition shall be the same as
given in Clause 5.2.1.

When push button signalling is used between PABX and the
local exchange, the code receiver shall conform to CCITT Rec.
Q.23 Red book.

5.2.5   SPECIAL EQUIPMENT - LOCAL EXCHANGE

Signalling at connection of coin boxes and private meters
shall be as specified in documents "SUBSCRIBER LINE
EQUIPMENT".

?

5.2.6   LOCAL EXCHANGE -LALL SUBSCRIBER OR
         PABX WITHOUT IN-DIALLING.

Loop disconnect pulsing or DTMF signalling shall be
used.

5.2.7   LOCAL EXCHANGE -PABX WITH DIRECT IN-DIALLING

The same signalling conditions apply as for signalling
between two local exchanges as well as in Clause 5.2.6
above.

5.2.8   MAXIMUM LOOP RESISTANCE AND LINE CHARACTERISTICS.

5.2.8.1 The permissible loop resistance with the telephone set
         included is 2,000 ohms, except during pulse train
         dialling from dial set, when the maximum loop resistance
         shall be 1800 ohms.

5.2.8.2 The exchange shall work with insulation resistance
         between the two subscriber wires or between a

110

subscriber wire and earth of at least 20 k ohms.

5.2.9   CURRENT FEED RESISTANCE.

5.2.9.1   The current feed of the subscriber line and terminating equipment shall correspond to the exchange voltage applied to the a and b branches over a 2x400 ohms resistance.

5.2.9.2   A short-circuit or high voltage surge at the subscriber line shall not cause any damage to the exchange. A connection to earth and a connection to 250V (continuous) over a low-ohmic resistance (100-200 ohms) shall not cause any damage to the equipment.

5.2.10   SIGNALLING TO/ FROM RSU.

To be indicated by the bidder.

5.2.11   SIGNALLING TO/ FROM ANOTHER DIGITAL EXCHANGE.

The trunks between two digital exchanges if any shall work on common channel CCITT signalling No. 7 .For this purpose digital links shall be supplied by the T&T department, either as a 64 k bits/ sec slot of a PCM link or in some other form.

5.2.12   RING DOWN SIGNALLING.

The exchange shall be connected with manual trunk board (F-36) with ring down signalling system.

The ring down signalling system shall be 4 wire connection with simplified E&M signalling provision.

5.2.13   E&M SIGNALLING.

The system shall have provision for E&M signalling.

5.2.14   D.C. 2/3 WIRE SIGNALLING.

The 2/3 D.C. Signalling connection shall be provided for interworking with the local exchange working with F-1 and F-6(a) switching equipment mainly.

5.3   COMMON CHANNEL SIGNALLING.

Common channel signalling shall be applied between all SPC Transit, local exchanges and remote switching units of national network.

5.3.1   CCITT No. 7 SIGNALLING SYSTEM.

5.3.1.1   The CCITT No. 7 signalling system as per recommendation of CCITT Red Book series Q.700 shall be used wherever the common channel signalling system is specified in this document.

5.3.1.2   The transport system shall be equipped to use analogue as well as digital channels.

5.3.1.3   The signalling system shall be complete in all respects and shall consist of following parts/ applications:-

   i)   The Message Transfer Part (MTP) as specified in the CCITT Recommendation Q.701 to Q.709 Red Book.

   ii)   The telephone user part (TUP) as per CCITT Recommendation Q.721 to Q725 Red Book.

   iii) The data user part (DUP) is per CCITT Recommendation X.61 (Q.741).

   iv)   ISDN user part (ISDN UP) as per CCITT Rec. Q761 to Q.766 Red Book.

   v)   Operation and Maintenance Application part (OMAP) as per CCITT Rec.Q.795 Red Book.

   vi)   Signalling connection control part (SCCP) as per CCITT Rec.Q.711 to Q.714 Red Book.

   vii) Monitoring and Measuring for MTP as per Rec.Q.791.

   viii) PABX application part as per Rec.Q.710 Red Book.

5.4   CONNECTIONS THROUGH AN EXCHANGE.

The system shall provide the following four types of connections with CCITT No. 7 signalling at bit rates defined under para 3 of CCITT Rec. Q.513 Red Book:-

         i) Type   I
         ii) Type II

112

iii) Type   III (a and b)
iv) Type   IV (a and b)

5.5.   SIGNALLING AND D&E CHANNEL HANDLING.
_____

This shall confirm to para 4 of CCITT Rec. Q.513 Red Book.

5.5.1   Signalling associated with exchange connection Type I-IV
          as per Q.513 page 4.2.

5.5.2   Digital subscriber access - D&E channel protocol
          handling layers 1, 2 & 3 as per Q.513 para 4.4.

5.5.3   User to user signalling as per Q.513 para 4.4.

5.6   CONTROL FUNCTIONS ASSOCIATED WITH CALL HANDLING.
_____

The following control functions shall be in accordance with
CCITT Rec.Para 5 of 513 red Book.

5.6.1   Basic control functions.

5.6.2   Control functions associated with calls over a digital
          subscriber access via interfaces U and IV.

5.6.2.1   Control of circuit switched calls type 1, 11 & 111.

5.6.2.2   Control of message/ packet calls over the D-channel,
          Type-IV.

10.4   TYPES OF TONES AND ANNOUNCEMENTS.
_____

10.4.1   The dial tone, ringing tone, busy tone and number un-
          obtainable tone shall be as they already exist in
          Pakistan Telephone System and listed with parameters in
          this chapter and shown in tone table in clause 10.4.7.
          The other tones are as follows.

10.4.2   CONGESTION TONES.
          _____

When a called number cannot be reached or a control order for
activation/ deactivation of a supplementary service is not
successful in first attempt due to short term system un-
availability, but a repeated attempt within a short period is
successful, a congestion tone shall be given.

113

10.4.3 SPECIAL INFORMATION TONE.

When the called number cannot be reached or a control order for a supplementary service cannot be executed in one attempt due to recognized long term non-availability and repeated attempt would have no or small probability of success for a longer period of time or when the called number cannot be reached in one attempt because of an unresolved condition of the called number due to administrative reasons, the respond shall be the special information tone. This special condition shall also hold good when a number is out of order or has not been opened or has been changed.

10.4.4 PAY TONE.

A pay tone shall be extended when a pay phone user is required to make the payment during the call.

10.4.5 RECORDER TONE.

When a subscriber is asked to speak so as to be recorded by a recording machine in the exchange a recorder tone shall be given to inform him when to begin to speak.

10.4.6 INTRUSION-TONE.

To ensure privacy against intrusion by an operator or otherwise, an intrusion tone shall be extended to both subscribers.

10.5 ANNOUNCEMENTS

10.5.1 Announcements shall be fed from a continuous play back machine to an analogue/ digital codec similar to that used in the line circuits. There shall be provision for at least ten types of announcements.

Announcements may also be provided as digitalized information in the firmware of the system.

10.5.1.1 ANNOUNCEMENT FOR CONGESTION.

The system shall have a provision for an announcement for congestion in local telephone system to a subscriber from national network approaching the local telephone network.

10.5.1.2 ANNOUNCEMENT OF SPARE CODE.

A provision shall be make for an announcement of spare code to the subscriber approaching national network.

10.5.1.3 ANNOUNCEMENT OF SPARE LEVEL.

·The system shall provide for an announcement of spare level to subscriber approaching the local network.

10.5.2 LENGTH OF MESSAGES.

It shall be possible to have a variable length of the message in the range 5-15 seconds.

10.5.3 REPETITIONS.

It shall be possible to select any frequency of repetitions of a recorded message through programming. The connection to the announcement machine shall be time supervised.

10.5.4 It shall be possible to synchronize the start of messages (without waiting) to individual lines. If this condition cannot be met, then the maximum waiting time shall be equal to the length of the message. the start/stop to a message shall be indicated from the announcing machine to the exchange.

10.5.5   TRANSMISSION REQUIREMENTS.

The recorded announcing machine shall have an adjustable output level at the amplifier output with a nominal level of o dBu (775 mv) at a frequency of 800 Hz. The output level must not vary by more than 0.8 dB (10% when the load is varied between 20' and 1000 Ohms). The output level of the announcing machine as measured at subscriber terminals in MDF shall be -3.8 dBu (500mv) at 800 Hz with a level variation of 2.5 d ?   chapter. It will be preferable to use solid state devices (PROMs, etc) with parts (words) of the announcement selectable by the software of the system and applied to the circuit requiring it.   ·   *

10.6.1   NUMBER OF LANGUAGES.

Every text shall be announced in two languages alternately.

10.6.2   LENGTH OF MESSAGES.

Expected range of length of messages is 2 to 10 seconds for each language.

10.6.3   RECORDING.

Acoustic equipment required to record the various components of the message off-line shall also be supplied under this arrangement.

10.6.4   TAPE/ DISC RECORDERS ETC.

In case where rotating/ moving machines are used, these machines shall work with the exchange D.C voltage and shall conform to the environmental conditions specified for the exchange equipment.

10.6.5   TIME ANNOUNCEMENT (OPTIONAL).

Equipment shall also be quoted separately for self contained time announcing machines in one language. If the text of such tones is to be derived form another exchange, the matching, amplifying and distribution equipments shall be quoted.

SUBSCRIBER LOOP SIGNALLING IN USE IN
THE PAKISTAN NATIONAL NETWORK

SIGNALLING FOR LOCAL EXCHANGE

LOOP SIGNALLING

BETWEEN 2 - WIRE SUBS   (LOOP)   & EX

1   Calling Subs with pulse train dialling   L = EX

      Decadic loop pulses

      a)   Normal   10 p.p.s   40 : 60 msec ratio
                                  with interdigital pause of 800 msec

      b)   Special Arrangement Special 20 p.p.s with interdigital
                                              pause of 800 msec

2   Calling subs with push button signalling
      L E X will use v-f signals
      MFC dialling

PLG 2643   Issue A

118

TONES IN USE IN THE PAKISTAN NATIONAL NETWORK

(NEW EXCHANGES)

TABLE FOR TONES

S No	Name of Tone	Freq in Hz 450 - 680	Power/Freq at ex. where tone is applied	Cadence
1	Dial Tone	450 Hz	- 10 dBmO	Continuous
2	Ringing Control Tone (Ringing back Tone)	450 Hz	- 10 dBmO	1 sec on 4 sec off
3	Ringing Current	25 Hz		1 sec on 4 sec off
4	Busy Tone	450 Hz	- 10 dBmO	0.25 sec on 0.35 sec off
5	Time Information Tone	450 Hz	- 15 dBmO	0.5 sec on 0.5 sec off
6	Ringing Current for Booth Current	450 Hz	- 15 dBmO	1 sec on 2 sec off
7	Intrusion Tone	450 Hz	- 13 dBmO	Burst 0.5 sec silence 0.2 sec
8	Recorder Tone	450 Hz	- 15 dBmO	Burst 0.5 sec silence 0.5 sec
9	Call Waiting Tone	450 Hz	- 13 dBmO	0.3 sec every 10 sec
10	Congestion Tone	450 Hz	- 13 dBmO	Burst 0.3 sec silence 0.8 sec
11	Specific Information	450 Hz	- 5 dBmO	1 sec burst after every 2 sec with alternative tone
12	Pay Tone	450 Hz	- 15 dBmO	1 sec burst after every 0.5sec with alternative tone

Annex 7:

Divergencies between existing T&T CCITT Signalling System
(Red Book)No. 7 and CCITT Blue Book Recommendations.

Divergencies between existing T&T CCITT Signalling System (Red Book) No. 7 and CCITT Blue Book Recommendations.

1. The T&T CCITT Signalling System No. 7 complies fully with the CCITT Red Book, but not with the Blue Book. The following differences have been noted between the existing T&T CCITT No. 7 Signalling System (Red Book) and the corresponding CCITT Blue Book Recommendations.

    a) Several messages are missing in the Message Transfer Part (MTP)
        See Section 2 for details

    b) Several TUP messages have heading codes which are not regarded as spare or reserved for national use.

2. Message Transfer Part.

2.1 The following Blue Book messages are missing in the MTP of the T&T CCITT No. 7 Signalling System (Red Book)

    -   LLT (Link Local Inhibit Test signal)
        H0 = 0110 : H1 = 0111
        Required for Management -inhibiting test procedure, to keep a signalling link unavailable for signalling other than test traffic while it under test by local command.

    -   LRT (Link Remote Inhibit Test signal)
        H0 = 0110 : H1 = 1000
        Required for Management -inhibiting test procedure, to keep a signalling link unavailable for signalling other than test traffic while it under test by remote command.

        Red Book SP/STP's should ignore this message.

    -   TRA (Traffic restart Allowed signal)
        H0 = 0111 : H1 = 0001

        Required for Signalling point restart procedure. This procedure allows a graceful increase in message traffic at a restarting signalling (as opposed to a sudden increase, which may cause problems).

        Red Book SP/STP's should ignore this message.

    -   UPU (User Part Unavailable Signal)
        H0 = 1010 : H1 = 0001
        Required for ISDN.

122

Red Book SP/STP's should ignore this message.

2.2   Future implementations the CCITT No. 7 Signalling System in the T&T network should include these messages.

2.3   Existing implementations of the CCITT No. 7 Signalling System should ignore these messages (This point should be confirmed with the supplier).

2.4   Existing implementations of the CCITT No. 7 Signalling System should be upgraded as soon as possible to include these useful and important messages.

3   Telephone User Part

3.1   The NNM (node-to node) message group, CFM, CPM, CPA, CSV, CVM, CRM, CLI, with H0 = 1001, used in the T&T CCITT No. 7 Signalling System (Red Book) has been eliminated from the Blue Book.

3.2   A new message group CNM circuit network management message has been added. So far only one message in this group, ACC (automatic congestion control), has been defined. Obviously ACC is a very useful message and should be included.

3.3   The following national option messages are outside the range reserved by CCITT Blue Book for national use.

a)   EHA (End of Hold) Message

Existing Heading Codes   H0 = 1100 : H1 = 1100

Preferred Heading Codes   H0 = 1100 : H1 = 0100
(Not in conflict
with the Blue Book)

b)   TOS (Trunk Offering Start) Message

Existing Heading Codes   H0 = 1100 : H1 = 1101

Preferred Heading Codes   H0 = 1100 : H1 = 0101
(Not in conflict
with the Blue Book)

c)   TOR (Trunk Offering Reset) Message

123

Existing Heading Codes   H0 = 1100 : H1 = 1110

Preferred Heading Codes   H0 = 1100 : H1 = 0110
(Not in conflict
with the Blue Book)

d) SNC (Subscriber Number Change) Message

Existing Heading Codes   H0 = 1100 : H1 = 1111

Preferred Heading Codes   H0 = 1100 : H1 = 0111
(Not in conflict
with the Blue Book)

e) MPM (Meter Pulse Message)

Existing Heading Codes   H0 = 1101 : H1 = 0010

Preferred Heading Codes   H0 = 1101 : H1 = 0110
(Not in conflict
with the Blue Book)

Although they do not conflict with messages of the Blue Book, they are in conflict with areas which are not defined as being reserved for national use in the Blue Book. There is therefore no guarantee that future CCITT Books will not conflict with them and thus cause interworking problems in the future. In fact they may well be as CCITT would not have reduced the area reserved for national use unless there was some prospect of using them for other purposes in the future. Even if they do not cause problems in the immediate future, the value and relevance of these messages in the Pakistan network should be kept under review from time to time.

4   It is recommended that all T&T specifications for Signalling System No. 7 require compliance with the latest version of the CCITT Book, the Blue Book.

5   The possibility of changing the existing Red Book compliant T&T Signalling System No. 7 to make it comply with the Blue Book, especially by the addition of the extra useful MTP messages, should be explored with all of the digital switch suppliers.

6   If the extra costs involved are justifiable, then the sooner these changes are carried out, the better.

124

that "it is to the interest of Administrations that subscribers should not be confused by hearing different tones for the same purpose within their national networks". This principle should be strictly applied in the Pakistan, which is not the case at present.

1.7   Cost of course is a major consideration. Too great a variety of signalling systems requires unproductive but complex and costly equipment to translate from one signalling "language" to another. There are legal constraints particularly those imposed by international telecommunications agreements.

1.8   There are several signalling systems in existence at present, and this situation will continue for at least one decade more. Therefore the Signalling Plan must ensure a smooth transition from the existing situation to the long term goal.

1.8   This Signalling Plan should be read as one with the other fundamental technical plans, with which it is closely related.

2.   OBJECTIVE

2.1   The overall objective of this Signalling Plan is to
determine the optimal mix of signalling systems which will
best serve the long-requirements for the Pakistan national
telecommunications network at economic cost.

2.2   The achievement of this end involves the determination
of the following:

            a.   Inter-office Signalling Systems for the long term

            b.   User Signalling Systems for the long-term

            c.   Call Progress Signals/ Tones

            d.   PABX Signalling for the long-term

            e.   A strategy for the orderly evolution of the
                  signalling network from the present situation toward
                  the long-term objective.

2.3   The problem of ensuring compatible operation of the
various elements in a national telecommunications network is
complex.   This is particularly the case with interoffice
signalling. Two exchanges connected by a Signalling link must
employ the same signalling language, and the overall mode of
operation must be the same.

2.4   Communication in the same universal language is just as
much an ideal for telephone exchanges as it is for human
beings. There are several signalling languages, fortunately
relatively few, in use in any one country and conversion from
one to another is a difficult,unproductive, but necessary
task. There is therefore a conflict between the attractiveness
of the ideal of minimizing the number of signaling systems and
the practical economic and technical constraints which must
be resolved.

2.5   The network signalling systems between exchanges and also
between the equipment and the subscriber must provide the
necessary and correct information confidently and quickly,
Unnecessary information leads to needless complexity and cost;
incorrect information causes   confusion delay or errors as
does the untrustworthy transmission of information; slow
signalling will cause the subscriber to lose patience or to
assume his call is getting nowhere. Moreover the signalling
system must be sufficiently comprehensive and flexible to be
able to cope with all the necessary existing and future

3

services at a reasonable cost.

2.6   The general long-term trend in the Pakistan National
Network is towards digitalization. The only signalling system
which is optimized for providing fast, accurate, error-free,
secure, flexible signalling between digital exchanges at
reasonable cost and with all the necessary features is CCITT
signalling system No. 7. Therefore the long-term future
signalling network of Pakistan must be based on CCITT No. 7
signalling. The emphasis in this Signalling Plan is therefore
very much on CCITT No. 7 Signalling.

3. EXISTING SIGNALLING SYSTEMS IN USE.

3.1 The following interexchange signalling systems are in use in Pakistan T&T's network at present (1989) or in the very near future:

a) National

Non-CCITT systems (see Annex-4)

R2 (Analogue)   .

R2 (Digital)

CCITT No. 7 (Red Book Version)

b) International

R2 (Analogue)

CCITT No. 5

3.2 The following subscriber line signalling is used at present (mid 1990):

a) Rotary Dials (see Annex-5)

Pulse Rate: 10 ± 2 i.p.s

Make/ Break Ratio: 40/60

Interdigital Pulse: 800 ms min.

b) Multi Frequency Telephones

In accordance with CCITT Rec.

3.3 In general, CCITT Tones Standards are employed throughout Pakistan for new exchanges.(see Annex-6).

3.4   In addition, according to CCITT Blue Book the following
Tones are in .use in the T&T Network at the time of its
compilation (end 1988) and have not been greatly changed since
that date:

Tone	Frequency	Cadence
Dial Tone	450 Hz (approx.)	Continuous
Busy	400z	0.75 sec.on; 0.75 sec. off
	450 Hz.	0.4 sec.on; 0.675 sec. off; 0.13 sec. on; 0.17 sec. off
Ringing	450 Hz.	1 sec. on ; 4 sec. off
	400 + 16 $\frac{2}{3}$ Hz.	0.4 sec. on; 0.2 sec. off; 0.4 sec. on;
		.2 sec. off.

According to CCITT, the 450 Hz busy tone (Cadence
0.4/0.675/0.13/0.17) is unique to Pakistan. No other country
has this standard.

Having two Dial Tones and two Ringing Tones violates the
principle that there should be only one tone for each purpose
(which may cover several different functions)

3.5   At present (mid 1990) the No. 7 signalling system is used
between certain EWSD Exchanges. This signalling scheme
complies with CCITT Red Book Recommendations but only
partially with the CCITT Recommendations Blue Book
Recommendations (see Section 5 for details).

The CCITT Signalling System No. 7 operates at present
over analogue circuits using 4.8 kbit/s data links. Later with
the digitalization of the main transmission systems in the
next few years, it will then utilize 64 kbit/s signalling
links over digital circuits which will optimize the use of
CCITT Signalling System No. 7. The proposed CCITT No. 7
signalling network connecting the various future EWSD
exchanges is shown in Annex-3.

4.   INTEROFFICE SIGNALLING SYSTEMS FOR FUTURE USE IN PAKISTAN.

4.1   General.

4.1.1   In the very long-term, with the transformation of the T&T network into an IDN/ISDN, the signalling system used throughout national network will be CCITT No. 7 Signalling. However since it is anticipated that the transition to IDN will be of considerable duration, the total conversion of the signalling network will also be long.

4.1.2   In the medium to long-term there will still be extensive use of CCITT R-2 signalling, and for the quite a long time to come several non-CCITT signalling systems will continue to be employed. This will mean that many combinations of signalling conversion will have to be carried out at various exchanges. This signalling conversion function will gradually be phased out as the network advances towards complete digitalization.

4.1.3   Being the standard signalling of the future in the Pakistan network, it is essential to have a standard specification for CCITT Signalling System No. 7. As the latest CCITT Recommendations for Signalling System No. 7 are contained in the CCITT Blue Book, the T&T specification should be based on these Blue Book Recommendations. With each issue of future CCITT Books, this Specification will have to be reviewed by T&T.

4.2   **Specification of Signalling System No. 7.**

4.2.1   General.

      The CCITT Signalling System No. 7 used in the Pakistan national and International networks shall conform to the Recommendations of the latest CCITT Book (currently the Blue Book), especially the Q.700 Series. Table 4.2.1 lists the various Functional Parts of CCITT Signalling System No. 7, showing their relevance or otherwise both now and in the future to the Pakistan national network.

      The remainder of this Section specifies the requirements for each of these Functional Parts.

Functional	CCITT Recs.	Relevance to T&T Network
Message Transfer Part (MTP)	Q.701-Q.710	Essential. Various Options to be Chosen (See Section 4.2.2.)
Signalling Connection Control Part (SCCP)	Q.711-Q.716	Not required for TUP, but will be needed in future, especially for ISDN-up.
Telephone User Part (TUP)	Q.721-Q.725	Essential. Various Options to be Chosen (See Section 4.2.4)
Data User Part (DUP)	X.16	Not Required, as a Data Network Supported by CCITT No. 7 Signalling is not envisaged
ISDN User Part (ISUP)	Q,761-Q.766	Required for future ISDN. (See Section 4.2.5)
Transactions Capabilities Application Part (TCAP)	Q.771-Q.775	Required for future ISDN (See Section 4.2.6)
Operations, Administration & Maintenance Part (OAMP)	Q.795	Required for future sophisticated IDN/ ISDN (See Section 4.2.7)

Table 4.2.1: FUNCTIONAL PARTS OF CCITT No. 7 SIGNALLING SYSTEM
RELEVANT TO T&T TELECOMMUNICATIONS NETWORK

(MEDIUM TO LONG TERM)

Note; MTP and TUP are of immediate relevance to the T&T Network.

4.2.2   **Specification of Message Transfer Part (MTP).**

4.2.2.1   The Message Transfer Part of the CCITT Signalling System No. 7 used in the Pakistan national and International networks shall conform to CCITT Recs. Q.701 to Q. 705 of the Blue Book. **The changes from the Red Book (1984) to the Blue Book (1988) should be incorporated.** These especially include the following :

a)   Increased capacity of Signalling Information Field to 272 Octets.

b)   Inclusion of Signalling Point Restart Procedure (Rec. Q704).

c)   Deletion of Management Blocking Procedure.

d)   Enhanced Signalling link Test (Rec. Q.707)

e)   Incorporation of compatibility mechanism for compatibility with future issues of CCITT No. 7 Recommendations.

f)   Timer values as per Recs. Q.703 and 704.

g)   Processor Outage procedures as per Recs.Q.703 and Q.704.

h)   User Flow Control Procedures as per Recs. Q.701 and Q.704.

i)   Inclusion of Management Inhibiting and Management Inhibiting Test procedures.

j)   Signalling Point/ Signalling Transfer Point Connection, Detection and Handling procedures as per Recs. Q.701 and 701.

4.2.2.2   In the medium-term (approx. 5 years) the MTP will support only the Telephone User Part (TUP). However in the longer term the MTP must support ISDN-UP, SCCP, TCAP and OMAP as detailed in later sections. Therefore the MTP must be capable of being upgraded in the future to accommodate these future requirements.

4.2.2.3   The Signalling Data Link (Level 1 functions of MTP) should conform to CCITT Rec. Q.702 (Blue Book). In particular, the Signalling Bit Rate will be 64 kbit/s

derived from a 2048 kbit/s digital path. Other options such as analogue signalling (except for the short-term) or bit rates lower than 64 kbit/s will not used in the future for telephone call control applications. The data link must be exclusively dedicated to CCITT No. 7 Signalling, be capable of full duplex operation with bit integrity and when entering a digital exchange via a multiplex structure, must be switchable as a semi-permanent 64 kbit/s channel in the exchange.

4.2.2.4   The Signalling Link (Level 2 functions of MTP) should conform to CCITT Rec. Q.703 (Blue Book). Except for satellite circuits, error correction shall be by the basic method for both national and international links. For both domestic and international satellite circuits using CCITT No. 7 signalling, error correction shall by the preventive cyclic retransmission method. The various signalling link functions (signal unit delimitation , signal unit alignment , error detection, error correction, initial alignment, signalling link error monitoring, flow control) shall be as specified in Rec. Q.703. The signalling link error monitoring parameters shall be as defined for 64 kbits/s.

Timers shall be adjustable over the full range specified in Rec. Q.703, but should be set initially to the following values:

T1	45 s.
T2	50 s.
T2 low	30 s.
T2 high	100s.
T3	1.2 s.
T4n	8.2 s.
T4e	110 s.
T5	100 s.
T6	4 s.
T7	1 s.
Pe	0.5 s.
Pn	8.2 s.

11

4.2.2.5   The Signalling Network Functions and Messages (Level
3 functions of MTP) should conform to CCITT Rec. Q.704
(Blue Book). Initially the only Level 4 entity with which
Level 3 will communicate is TUP, but it must be
extendible to include SCCP, ISUP, TCAP and OMAP in the
medium term (approx. 5 years). Of various options of Rec.
Q.704, the following are selected:

a)   The national options of signalling route restricted,
      signalling transfer restricted, multiple congestion
      thresholds, multiple congestion priorities are not
      to be used initially. However to cater for future
      possibilities (especially ISDN), it should be
      possible to include these facilities later.

b)   Options for Level 3 messages are as follows:

          Service Information Octet.

          Service Indicator

          (Ref. Para 14.2.1. of Rec. Q.704)

          Bit D C B A .
          ----
              0 0 0 0   used as per para 14.2.1
              0 0 0 0   used as per para 14.2.1
              0 0 0 0   Not used initially, but later
                            used for SCCP, when ISDN is
                            introduced.

              0 1 0 0   TUP : used.
              0 1 0 1   Not used initially, but later
                            used for ISUP of ISDN.
              0 1 1 0   Not used.
              0 1 1 1   Not used.
              1 0 0 0   Reserved as per para 14.2.1.

          Subservice Field

              (Ref. Para 14.2.2 of Rec. Q.704)

          Bits A, B spare.

```
Bits   D   C
-----------
       0   0    International Network.
       1   0    National Network.
                Other codes spare.
```

Heading codes are as per Table 1/Q.704 (Blue Book) except that TFR and RSR code are not used. As per CCITT Recommendation, Yellow Book codes for TFP and TFA acknowledgement are not to be used.

c) Timers shall be adjustable over the full range specified in Rec. Q.704 but should be set initially to the following values:-

Time	Timers
500 ms	T24
1 sec.	T1, T3, T4, T5, T6, T8, T12, T13, T17,
1.5 sec	T2, T7, T16
2.5 sec.	T14, T15
4 sec.	T19, T20
20 sec.	T18
30 sec.	T21
40 sec.	T10
50 sec.	T11
5 min.	T22, T23
	T9 not used.

4.2.2.6   The Signalling Network Structure shall conform to CCITT Rec. Q.705. To comply with these requirements and to ensure the adequate capacity, availability and security of the signalling network, which is extremely important as the consequences of signalling failure can be very grave, the following engineering rules apply:

a)   Each Signalling Point (SP) in the network when practicable shall be connected to a minimum of two Signalling Transfer Points (STP). This is especially the case in large multi-exchange areas. These signalling links shall be wherever possible, be via

different Transmission Links. Where two links are used, each should be capable of carrying the total signalling traffic in the event of failure of the other link.

b) Except for very large routes (500 + trunks) associated signalling links between local exchanges cannot be justified economically. Most local-local exchange links will operate in the quasi-associated mode.

c) The International Signalling Points (ISP) are the digital gateway exchanges at Islamabad and Karachi. Pakistan has been assigned the Signalling Area/ Network Code (SANC) of 4-020 (See Rec. Q.708) or as coded in binary 100 - 10100. The 14 bit binary International Signalling Point Codes (ISPC) for Islamabad and Karachi are as follows:

Digit	N	M	L	K	J	I	H	G	F	E	D	C	B	A
Islamabad	1	0	0	0	0	0	1	0	1	0	0	0	0	1
Karachi	1	0	0	0	0	0	1	0	1	0	0	0	1	0

Zone Identification = 4(100)

Area/ Network Identification = 020 (10100)

Islamabad ISP identification = 001

Karachi ISP identification = 010

d) For international terrestrial or submarine circuits (e.g. UAE cable) Satellite circuits should not be used for the supporting signalling connection.Equally for national terrestrial circuits, satellite circuits should not be used as signalling connections.

e) All outgoing international calls using CCITT No. 7 Signalling shall use the Signalling Area/ Network Codes (SANC) defined in Annex A of Rec. Q.708.

f) One or more 14-digit Destination Point codes must be allotted to each exchange with NO. 7 signalling. This gives a capacity of over 32,000 signalling points. For ease of administration, the signalling destination code numbering can be closely related to the N.W.D code and allocating one digit to each

14

exchange (up to a max. of 16 exchanges).

For Example: Nok Kundi (0-881-21xxxx)
                    1101110001 - 0001.
Note: Binary 1101110001 = Decimal 881

   The only metropolitan Area of over 16 exchanges where numbering scheme will not work are Karachi and Lahore. In the case of Karachi a spare code (11111111xxxxxxx) can be used. For example, PECHS exchange (Exchange NO. 10) would have a code 11111111001010. Similarly with Lahore (11111110xxxxxx).

g)   For the purpose of rec. Q.709, Pakistan is considered a "large" country (Max.distance between subscriber and gateway exchange of over 1,000 km.) The specification of parameters for a hypothetical signalling reference connection for both link-by-link and end-to-end signalling shall be as laid down in Rec. Q.709 (See Table 4.2.2.6.o). Within the national network only End-to-End Signalling is employed.

h)   Signalling messages should pass through a minimum number of intermediate signalling transfer points. In the international signalling network, the number of signalling transfer points (STP's) between an originating and a destination signalling points should not exceed 2 in a normal situation. Within the national signalling network, for a national call number of national signalling points and STP's should not exceed the limits set down in Rec. Q.709 for a Large country (max. distance of subscriber to gateway is over 1,000 km); that is 3STP's mean, 4 STP's 95% of time.

i)   Routing at each STP will not be affected by the message routes used up to the concerned STP.

j)   Where more than one message route is available, signalling traffic should be load-shared.

k)   Messages relating to a given user transaction in a given direction will be routed over the same message route. Messages in different directions may take different message routes.

15

l) The performance parameters specified in Rec.Q.706 shall be met for national as well as for international CCITT No. 7 signalling:

   i) Unavailability of signalling route set: 10 min per year

   ii) Undetected Errors: 1 in 10^{10}

   iii) Loss of Messages : 1 in 10^{7}

   iv) Messages out of sequence: 1 in 10^{10}

m) The national as well as the international CCITT No. 7 signalling network should be dimensioned and configured in accordance with the traffic calculating methodology and the security and availability requirements specified in Rec. Q.706.

   Under normal operating conditions, the No. 7 signalling network should be used to the maximum extent, with entry and exit as near to the origination and destination as possible and without reentering the No. 7 signalling network once on exit has been made.

n) The simplified MTP specified in Rec.Q.710 can be used for small systems (PABX's, remote concentrators, etc.), since the full MTP would be unnecessarily expensive for small systems. Many of the functions of the full MTP are not applicable in this simplified version of MTP (as defined in section 3 of Rec.710).
   However, of course, PABX's are free to use the full MTP, indeed it is preferable that they do so.

o) Hypothetical Signalling Reference Connection HSRC shall comply with Rec. Q.706. See Table 4.2.2.6.o.

HSRC Component/Parameter	National Network End-to-End Signalling		Pakistan - Large Country Link-by-Link Signalling		End-to-End Signalling		Pakistan-Average Sized Country Link-by-Link Signalling		End-to-End Signalling	
	Mean	95%	Mean	95%	Mean	95%	Mean	95%	Mean	95%
A. Number of STP's	4	5	3	4	4	4	4	5	6	6
B. Number of Signalling Points	-	-	3	3	-	-	4	4	-	-
C. Number of SPR's	1	2	-	-	2	3	-	-	2	3
D. Number of SEP's	1	1	-	-	-	-	-	-	-	-
E. Max. Delay (International Component) mS.										
-Processing Simple	-	-	390	410	300	410	520	540	340	450
-Processing Intensive	-	-	600	620	440	620	800	820	480	660
F. Max, Delay (National Component) mS.										
-Processing Simple	300	430	-	-	-	-	-	-	-	-
-Processing Intensive	440	640	-	-	-	-	-	-	-	-
G. Overall Delay mS.(G=E+2F)										
-Processing Simple	-	-	1170	1450	900	1270	1170	1450	900	1180
-Processing Intensive	-	-	1800	2200	1320	1900	1800	2220	1320	1900
H. Unavailability (Minutes/Year)	30	40	20	20	20	20	30	30	30	30

Notes :

- All Values Provisional
- See Rec. Q.709 Tables 1-10
- Propagation Delays not Included
- Unavailability of Particular Signal-
  ling Route Set = 10 Minutes /Year

- STP=Signalling Transfer Point
- SEP=Signalling End Point
- SPR=Signalling Points with SCCP relay functions
- CCITT recommend that number of SPR be kept to minimum
- The international switching centre (Islamabad/
  Karachi) is included in the international component.

-Max. number of signalling nodes from originating node to destination node is 18 (50% of connections) and
23 (95% of connections)   2*STP(N)+1*STP(I)+2*SPR(N)+1*SPR(I)+2*SEP(N)   N=National: I=International

$2 * 4 + 1 * 4 + 2 * 1 + 1 * 2 + 2 * 1 = 18$ (50% of connections)

$2 * 5 + 1 * 4 + 2 * 2 + 1 * 3 + 2 * 1 = 23$ (95% of connections)

-A country with a larger distance than 1,000 km. between an international switching centre and a subscriber
is considered as of large size for the purposes of CCITT Rec. Q.709. Thus Pakistan is a large country

TABLE 4.2.2.6.g: HYPOTHETICAL SIGNALLING REFERENCE CONNECTION (HSRC) ; NUMBER OF COMPONENTS AND VALUE OF PARAMETERS

NATIONAL & INTERNATIONAL COMPONENTS OF HSRC

4.2.3   Specification of Telephone User Part (TUP)

4.2.3.1   The Signalling System No. 7 Telephone User Part shall
          comply with CCITT Recs. Q.721-Q.725 (Blue Book) for the
          national telecommunications network as well as for the
          international network. As the TUP will be used in the
          near future in the Pakistan national network, the
          telephone user message codes shall comply with Rec.
          .Q.723 with the following clarifications:

          a) Destination and Originating Point codes will be as
             defined earlier in Section 4.2.2.6. f

          b) As only 2048 kbit/ s digital paths are used, the
             Circuit Identification Code allocation will be as
             per para 2.2.3. a of Rec. Q.723.

          c) There are no optional National Labels (para
             2.3/Q.723) for Destination/Originating Point Codes
             and Circuit Identification Codes.

          d) TUP Heading Codes shall be in accordance with Table
             3/Q.723 with the following options:

             i)   National Options for Message Group GRM
                     (SGB, SGA, SGV, SVA) are not used.

             ii)   Certain messages with HO=1100 which are
                     reserved for national use are used as
                     described in subsequent paragraph n.

          e) Forward Address Messages (FAM: HO= 0001)

          e.1)   Initial Address Message (IAM :HO=0001:H1= 0001)

                  As per Rec. Q.723 para 3.3.1. with the following
                  national options chosen:

                  -     Calling party category
                        Spare codes (Blue Book) utilized for
                  national use:

Bits	F	E	D	C	B	A	
	0	0	1	0	0	1	national operator
	0	0	1	1	1	0	VIP Subscriber
	1	0	1	1	0	0	Maintenance Line
	1	0	1	1	0	1	Multiparty Line
	1	0	1	1	1	1	Charge Information Request
	1	1	0	0	0	0	IDS Barred Subscribers
	1	1	0	0	0	1	ANI Equipment Trouble

17

- Message Indicators

    Used in accordance with para 3.3.1.f.of Q.723 (Blue Book) including bits D,C,G since there are satellite circuits in the domestic network;

    Bit L spare.

- Address Signals

    Code 11 and Code 12 not used nationally. International usage in accordance with CCITT Recommendations.

e.2) Initial Address Message with Addition Information. (IAI : HO = 0001 : H1 = 0010).

As per Rec. Q. 723 para 3.3.2.

Although not required until ISDN Pilot Project, the capability should be included in No. 7 Signalling System used.

e.3) Subsequent Address Message (SAM:Ho.= 0001 :Hi= 0011)

As per Rec. Q.723 para 3.3.3

Not required until ISDN Pilot Project.

e.4) Subsequent Address Message with one Signal (SAO: HO =0001 : H1 = 0100)

As per Rec. Q.723 para 3.3.4.

Although not required until ISDN Pilot Project, the capability should be included in the No. 7 Signalling System used.

f)   Forward Set Up Messages (FSM : HO = 0010)

f.1) General Forward Set Up Message (GSM : HO = 0010: H1 = 0001)

As per Rec.Q.723 para 3.4.1.

(Including bits C, D, E, F of Response Type Indicator)

f.2)   Continuity Check Message
        (COT :HO = 00010 : H1 = 0011)

        As per Rec. Q.723 para 3.4.2.

f.3)   Continuity Failure Signal.
        (CCF : HO = 0010 :H1 = 0100)

        As per Rec. Q.723 para 3.4.2.

g)   Backward Set-Up Request Message. (BSM : HO = 0011)

g.1)   General Request Message.
        (GRQ : HO = 0011 :H1 :H1 = 0001)

        As per Rec. Q.723 para 3.5.1
          (Including Request Type Indicators D,E,F and the
          capability of using C later for ISDN Pilot Project).

h)   Successful Backward Set-Up Information Messages
        (SBM : HO = 0100)

h.1)   Address Complete Message
        (ACM : HO = 0100 : H1 = 0001)

        As per Rec. Q.723 para, 3.6.1.
        (Including Message Indicator Bit D)

h.2)   Charge Message
        (CHG : HO = 0100 : H1 = 0010)

        As per Rec. Q.723 para. 3.6.2. and annex-A, initially
        only the Charge Band Message (Ref.Q.723 para A4.1.1) is
        required but there should be the capability to expand the
        charging messages at a later date to include Explicit
        Charging Indication (A4.1.2) and other messages, Tariff
        Change (A4,2), Collection Charging (A4.3), Charging
        Confirmation (A4.4), Acknowledgement Message (A4.5) for
        which Header Code HO=0000 is provisionally reserved.

i)   Unsuccessful Backward Set-Up Information Messages.

i.1)   Simple (UBM : HO = 0101) Unsuccessful Backward Set-Up
        Information Message.
        (HO = 0101 : H1 = 1111)

        As per Rec. Q. 723 para, 3.7.2).

j)   Call Supervision Message (CSM :HO = 0110)

        As per Rec. Q.723 para 3.8

k)   Circuit Supervision Message (CCM :HO = 0111)

        As per Rec. Q.723 para 3.9.

l)   Circuit Group Supervision Message (GRM : HO -1000)
        As per Rec. Q. 723 para 3. 10
        National Options SGB, SBA, SGU, SUA not used.
        Message Group HO = 1001 not used.

m)   Circuit Network Management Messages
        (CNM : HO -1001 : H1 -0001)

        Automatic Control Information Message
        (ACC : HO =1001 : H1 -0001)

        As per Rec. Q.723 para 3.11.1)

n)   Subscriber Facility Messages, (National Options Utilized
     (HO = 1100)

        See Annex 1 of this Signalling Plan.
        Selected Messages for Pakistan National Application.

n.1)   Trunk Offering Start Message
           (TOS : HO = 1100 : H1 = 0101)

n.2)   Trunk Offering Reset Message
           (TOR : HO = 1100 : H1 = 0110)

n.3)   Subscriber Numbering Change
           (SNC : HO = 1100 : H1 = 0111)

n.4)   Forced Release
           (FRL : HO = 1100 : H1 = 0100)

n.5)   Meter Pulse Message
           (MPM : HO = 1100 :   H1 : 1010).

     The functions, formats and codes of these messages are
     defined in "Telephone Signalling: An Overview" (See Annex
     1).

Note:-   This represents a change in H1 codes from that shown
           in Annex-1: Heading Code Allocation for the TUP
           within the national network of Pakistan, (Telephone
           Signalling: An Overview) because the Blue Book does
           not allow the previously defined codes as a national
           option.

4.2.3.2. Signalling procedures within the national CCITT No. 7
          Signalling Network shall comply with Rec. Q.724 (Blue
          Book). Interworking with other signalling systems shall
          be in   accordance with Section 5. Timers shall be
          adjustable over the full range wherever a range is
          specified in Rec. Q.724 paras 13.2.2. and 15.3.

Initially these adjustable timers should be set as follows:

2 Sec.	T8
4 Sec.	T9
8 Sec.	T3, T4, T6, T12, T15, T18, T21 T26,T28, T32, T38, T40, TUe 2
12 Sec.	T1
25 Sec.	T2
2 Min	T10

Other timers (T7, T11, T13, T14, T17, T19, T20, T22, T23, T24,
T27, T29, T30, T31, T33, T35, T36, T37, T39, T41) are not
adjustable and shall be set to the values specified in Q. 724
Section 15.3.

21

4.2.4   Specification of Signalling Connection Control Part
                                            (SCCP).

4.2.4.1   Since the SCCP is not used at present in conjunction with
            TUP, there will be no initial requirement in Pakistan.
            However with the introduction of ISDN and the
            possibility in the long term of other User Parts Types
            A and B or other SCCP users, the SCCP will be required.

4.2.4.2   The specification of SCCP in the Blue Book leaves many
            important aspects unresolved (see Appendix to Rec.
            Q.711). Since ISDN will not be introduced before the
            publication of the next CCITT Book (1993), the SCCP will
            not be required before that date. The SCCP should comply
            with Recs. Q.711- Q.716 as updated in 1993. This
            specification must be revised by T&T as soon as the next
            CCITT Book becomes available.

4.2.4.3.   For the ISDN pilot project, a relatively simple set of
            services has been proposed in the Report on
            Digitalization Strategy. The introduction of
            connectionless services (such as packet switching via
            D-Channel) is not envisaged.

            Only the basic connection-oriented class of service
            (class 2) is required. Classes 0,1,3 are not required.
            The SCCP messages for class 2 defined in Rec. Q.712
            should be used. Other messages are irrelevant (Data Form
            2 , Expedited Data, Expedited Data Acknowledgement, Reset
            Confirm, Reset Request, Unitdata, Unitdata service).The
            SCCP Formats and Codes for these messages defined in Rec.
            Q.712 should be used, bearing the following
            simplifications in mind:

            a)   Translation by SCCP not required, so the global
                  title Indicator = 0001 (Para. 3.4.2.3)

            b)   SCCP messages not relevant to class 2 are omitted
                  (see list above).

            c)   Protocol class parameter set to 0010 (Para 3.6)

            The SCCP Procedures and SCCP Performances shall comply
            with those specifications of Rec.Q.716 relevant to
            Protocol class 2.

4.2.4.4   Later with the Commercial Introduction of ISDN, the
            subsequent addition of further classes of service and
            user Parts, it will be necessary to expand the
            specification of the SCCP in line with Recommendations
            of future CCITT Books.

                                   22

4.2.5   Specification of ISDN User Part.

4.2.5.1   General

        While ISDN capabilities are not required for the
immediate future, it is essential that the CCITT No. 7
Signalling System be capable of being expanded in the medium
term to include such capabilities.

4.2.5.2   Signalling Procedures for ISDN.

        Supplementary Services shall comply with Rec. Q.730 for the
ISDN Pilot Project and the subsequent ISDN Commercial
Introduction with the following clarifications:

a)   User-to-User Information (Up to 128 octets).

b)   Closed User Group (CUG) supplementary service, while not
      required for Pilot Project or Initial Commercial
      Introduction, will be required later and CUG Data will
      be administered on a decentralized basis at the local
      exchange.

c)   Calling Line Identification Presentation (CLIP) and
      Calling   Line   Identification Restriction (CLIR)
      Supplementary Services will not be required initially,
      but will be required later.

      The Calling Line Identity (CLI) will be included in the
      Initial Address Message (IAM). The following various
      national options related to CLIR are not required
      initially:

              —   Override Category (Rec. Q.730 para 4.2.2.1)

              —   Restrict CLI to destination network (Rec. Q.
                   730 para 4.2.2.2 and 4.2.2.3).

              —   No presentation of CLI on Forwarded Call
                   (Rec. Q.730 para 4.5.2).

              —   CLIR in connection with a CUG

         d)   DDI procedures are in accordance with Rec. Q.730
              Section 5. The local exchange knows the number of
              DDI digits required nationally. (6 or 7 digits).

         e)   All types of Call Forwarding specified in Rec. Q.730
              are required:

              — Call Forwarding Unconditional

23

- Call Forwarding Busy
    - Network Determined User Busy

    and

    - User Determined User Busy.

- Call Forwarding No Reply.

A maximum of two forwardings are permitted in each case.

4.2.5.3　The ISDN User Part (ISUP) shall comply with CCITT Recs. Q. 761- Q.766 (Blue Book) with the following clarifications. The ISDN shall support the basic bearer service and also those supplementary services which are detailed in the previous Section 4.2.5.2.

The guidelines for specifying new protocols for future enhancements specified in Q.762 should be strictly adhered to for future updates. In order to ensure adequate service continuity, the inclusion of a new protocol version into one part of a network should be transparent to the reminder of the network. Compatible interworking between protocol versions is optimized by adhering to the following guidelines when specifying a new version:

1) Existing protocol elements, i.e. procedures, messages, parameters and codes, should not be changed unless a protocol error needs to be corrected or it becomes necessary to change the operation of the service that is being supported by the protocol.

2) The semantics of a message, a parameter or of a field within a parameter should not be changed.

3) Established rules for the formatting and encoding messages should not be modified.

4) The addition of parameters to the mandatory part of an existing message should not be allowed. If needed, a new message should defined containing the desired set of existing an new mandatory parameters.

5) A parameter may be added to an existing message as long as it is allocated to the optional part of the message.

6) The addition of new octets to an existing mandatory fixed length parameter should be avoided. If needed, a new optional parameter should be defined containing the desired set of existing and new information fields.

24

7) The sequence of fields in an existing variable
    length parameter should remain unchanged. New fields
    may be added at the end of the existing sequence of
    parameter fields. If a change in the sequence of
    parameter fields is required, a new parameter should
    be defined.

8) The all zeros code point should be used exclusively
    to indicate an unallocated (spare) or insignificant
    value of a parameter field. This avoids an all zeros
    code, sent by one protocol version as a spare value,
    to be interpreted as a significant value in another
    version.

.2.5.5   All of the Mandatory Parameters specified in Table
         1/Q.762 shall be provided. The optional parameters
         specified there in shall be provided or not provided as
         shown in Table 4.2.5.5.

         Notes on Table 4.2.5.5.

         –   =   Not Applicable

         M   =   Mandatory (CCITT)

         R   =   Required in T&T National Network

         T   =   Required, if Tariff Structure requires it.

         L   =   Not required initially; required later.

         N   =   Not Required.

PARAMETER	IAM	INR	INF	ACM	CON	CPG	ANM	FOT	REL	DRS	RLC	SUS RES	CFR CFC CPJ	FAA FAR	FAJ	USR
Access Transport	R	-	R	R	-	T	T	-	R	-	-	-	-	-	-	R
Automatic Congestion Level	-	-	-	-	-	-	-	-	R	-	-	-	-	-	-	-
Backward Call Indicators	-	-	-	-	-	T	T	-	-	-	-	-	-	-	-	-
Call Reference	R	R	R	R	R	R	R	R	-	·R	-	R	R	R	R	R
Redirection Number	-	-	-	-	-	R	-	-	R	-	-	-	-	-	-	-
Calling Party Number	L	-	L	-	-	-	-	-	-	-	-	-	R	-	-	-
Calling Party Category	M	-	R	-	-	-	-	-	-	-	-	-	-	-	-	-
Cause Indicators	-	-	-	R	-	R	-	-	M	-	R	-	-	-	M	-
CUG Interlock Code	L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Connected Number	-	-	-	R	R	-	R	-	-	-	-	-	-	-	-	-
Connection Request	R	-	R	-	-	-	-	-	-	-	-	-	-	-	-	-
Optional Backward Call Indicators	-	-	-	R	R	R	R	-	-	-	-	-	-	-	-	-
Optional Forward Call Indicators	L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Original Called Number	R	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Redirecting Number	R	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Redirection Information	R	-	-	-	-	-	-	-	R	-	-	-	-	-	-	-
Signalling Point Code	-	-	-	-	-	-	-	-	R	-	-	-	-	-	-	-
Transit Network Selection	L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
User Service Information	L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
User-to-User Indicators	L	-	-	L	L	L	L	-	-	-	-	-	-	L	L	-
User-to-User Information	N	-	-	N	N	N	N	-	N	-	-	-	N	-	-	-

4.2.5.6   The ISUP Formats and Codes shall comply with Rec. 763 with the following clarifications:

   a)   There are no message type codes or parameter name codes for national use which are not included in Rec. Q. 763.

   b)   The Reserved Message Codes (Red Book Version) are not used: Sec Table 3/Q..763.
        (00001010 ; 00001011; 00001111: 00100010;
        00100011; 0000100101; 00100110)

   c)   National use options for message types:

        Loop Back Acknowledgement, Overload, Unequipped Circuit Identification Code (Table 23/Q.763) are used.

        Delayed Release (Table 21/Q.723) is not used.

   d)   Parameters (Table 4/Q.723) are required as specified in previous section 4.2.5.5.

   e)   User-to-User Information can be up to 128 octets.

   f)   Fields with unrecognized codes shall have default interpretations when interpretable in accordance with Table A - 1/Q.763 Messages with uninterpretable fields (Table A-2/Q.763) shall be discarded.

4.2.5.7   Signalling Procedures shall comply with Rec. Q.764 with the following clarifications:

   a)   Connection Types Required Initially are:

            - Speech

            - 64 kbit/ s unrestricted.

            - 3.1 kHz Audio

            -Alternate speech/64 kbit/s unrestricted/speech

        Other connection types may be required later and the signalling system should be capable of being upgraded appropriately.

   b)   Charging (where applicable) begins on answer, never before answer.

   c)   There is only one public ISDN carrier in Pakistan

(T&T).

d)   The method used to minimize the occurence of dual
      seizure of bothway trunks in the national network
      is an opposite order of selection at each exchange
      of a bothway circuit group (CCITT Method 1).

e)   For ISDN end-to-end signalling, the pass-along
      method (ISDN user part end-to-end signalling
      connection) is used. The Signalling Connection
      Control Part (SCCP) method is not used.

f)   Timers should be adjustable over the full range
      specified in Annex A/ Rec. Q. 764. Initially the
      values should be set as follows:

Time	Timer
500 ms	T29
2 sec.	T24
5 sec.	T10
8 sec.	T1, T4, T12, T14, T16, T18, T20, T22, T30
10 sec.	T28
12 sec.	T8, T33, T34
18 sec.	T11
25 sec.	T7
1 min	T5, T13, T15, T17, T19, T21, T23
2 min	T26
3 min	T2, T3
4 min	T24
6 min	T31

4.2.5.8   The Performance Objectives specified in Rec. Q.766 for
          ISDN Application apply. In the Blue Book, only very
          general performance objectives are specified, but in
          future versions of the CCITT Book it is expected that
          this subject will be specified in much greater detail and
          the signalling plan should be revised and aligned with
          these future CCITT Books when published.

4.2.6   Specification of Transaction Capabilities Application
            Part (TCAP).

4.2.6.1   TCAP will be required in the long term. It is not
            required at present nor for the ISDN Pilot Project
            nor for the initial Commercial Introduction of ISDN.
            When used TCAP shall conform to the Q.77x series of
            Recommendation (Blue Book) and any CCITT No. 7
            Signalling System introduced must be capable of being
            expanded to include TCAP.

4.2.6.2   It is not possible at this time to be very specific
            about the requirements of TCAP. A likely future
            scenario is shown in Table 4.2.6.2. The CCITT NO. 7
            Signalling System must be sufficiently versatile to
            include these and other Requirements and also new
            specifications in future CCITT Books.

```
SERVICES                                          Requirement
-------                                            -----------

- Connectionless Network Service                       I
              (Basic Service)

- Connection- Oriented Network Service                 L


CLASS OF SERVICE
----------------

-Class  1 : both success & failure reported            L
-Class  2 : only Failure reported                      I
-Class  3 : only success reported                      L
-Class  4 : Neither success nor failure                N
            reported

DIALOGUE
--------

-Structured                                            I

-Unstructured                                          L

AG CLASS
--------
Universal                                              I
Application Wide                                       I
Context Specific                                       L
Private Use                                            N

ENGTH OF TCAP INFORMATION ELEMENT CONTENT
-----------------------------------------
Short Form                                             I
Long Form                                              I
Indefinite Form                                        L

ote; I = Required for initial introduction of TCAP ( 1997 +)
     L = Required for later extension of TCAP (2000 +)
     N = Not Required
```

ABLE 4.2.6.2 :   MAIN CHARACTERISTICS OF TCAP AND ITS FUTURE
                 APPLICATION IN PAKISTAN T&T NETWORK

4.2.7   Specification   of   Operations,   Maintenance   and
           Administration Part (OMAP).

4.2.7.1   OMAP will be required in the long term. When used
           OMAP shall conform to Rec. Q. 795 and any CCITT No.
           7 Signalling System introduced must be capable of
           being expanded to include OMAP. Since OMAP uses the
           services of TCAP, it will be introduced either
           simultaneously with or subsequent to TCAP.

4.2.7.2   As with TCAP, it is not possible at this stage to be
           very specific about the requirements of OMAP. A
           likely future scenario is shown in Table 4.2.7.2.
           The CCITT No. 7 Signalling System must be sufficiently
           versatile to include these and other requirements and
           also new specifications in future CCITT Books.

4.2.7.3   The Monitoring and Measurements performed by OMAP shall
           conform to Rec. Q.791 (Blue Book). The monitoring
           measurement   of   performance,availability,
           utilization,accessibility of signalling links, routes
           link and route sets of MTP and also of SCCP shall conform
           to Tables 1-9/Q.791. Prior to introduction of OMAP, other
           methods of monitoring and measuring MTP parameters will
           have to be used. These methods should be determined in
           accordance   with   the   recommendations of the switch
           manufacturer.

TRANSFER CATEGORIES

-Connectionless Service   R

-Connection Oriented Service   PL

MANAGEMENT OF ROUTING DATA

-Single Mode   R

-Multiple Mode   L

FUNCTIONS

-Creation   R

-Modification   R

-Deletion   R

-Interrogation   R

-Activation   R

-Deactivation   R

MTP ROUTING VERIFICATION MESSAGES
These messages are as per Rec.Q. 795 Sections 2 & 8

-MTP Routing Verification Test (MRVT)

-MTP Routing Verification Acknowledgement (MRVA)

-MTP Routing Verification Result (MRVR)

Note: R = Required
      L = Required Later
      PL= Possible required later

TABLE 4.2.7.2 : MAIN CHARACTERISTICS OF OMAP AND ITS FUTURE
               APPLICATION IN PAKISTAN NATIONAL NETWORK

4.2.8   Test Specification.

4.2.8.1   The Test Specification defined in CCITT Recs. Q.78x
             (Blue Book) shall be applied to any CCITT NO. 7
             signalling   system   introduced   into   the Pakistan
             National   Network   for   use   in   the   national and
             international network. Validation tests shall first
             be performed and then, when validated, compatibility
             tests shall be performed. For compatibility testing
             of international No. 7 signalling links, appropriate
             arrangements shall be made with the corresponding
             overseas administration.

4.2.8.2   The Blue Book only covers test specification for MTP
             and TUP. Future CCITT Book Recommendations for Testing
             of ISUP, TCAP, SCCP and OMAP should be applied at the
             appropriate time when test specifications for these
             parts are defined.

5.   INTERWORKING OF SIGNALLING SYSTEMS

5.1   CCITT Signalling System.

Each digital exchange shall be capable of providing the
necessary interworking functions for the CCITT signalling
system to which it will be connected as follows:-

Exchange	CCITT Signalling
Gateway :	R-2 (analogue and digital) No.5, No. 7.
Transit, Tandem, Local :	R-2 (analogue and digital) No.7

The interworking of these CCITT signalling systems shall
comply with CCITT Rec. Series 6xx (Sec. Table 5.1).

5.2   In addition to CCITT Signalling System, there are various
      other signalling systems in use in the Pakistan national
      network (see Section 3 for details) and will be for the
      medium-term future (up to year 2000). Certain specific
      exchanges must be capable of providing the necessary
      interworking functions.

5.3   The CCITT No. 7 Signalling System with ISUP shall be capable
      of interworking wit the Digital Subscriber System No. 1 (see
      CCITT Rec. Q920 - 940).

5.4   The national PSTN will be required and the national ISDN may
      be required to interwork wit mobile systems, especially the
      public land mobile network. Interworking shall be in
      accordance with CCITT Recs. Q.1000 -1032.

5.5   ISDN Interworking.

5.5.1   The national ISDN will be required to interwork with a
            variety of other networks:

            1)   The national Public Switched Telephone
                 Network (PSTN)
            2)   The national Packet Switched Public Data
                 Network (PSPDN)
                      - Initially Minimum Integration Scenario
                                            (Rec. I.462)
                      - Later Maximum Integration Scenario.

Interworking Combinationn	CCITT Recommendation
No. 5 to No. 7 (TUP)	Q. 653
NO. 5 to R-2	Q. 645
No. 7 (TUP) to NO. 5	Q. 662
NO. 7 (TUP) to No. 7 (TUP)	Q. 664
No. 7 (TUP) to R-2	Q. 666
R-2 to NO. 5	Q. 682
R-2 to No. 7 (TUP)	Q. 684

Note; All interworking combinations of CCITT signalling systems shall comply with the relevant CCITT Recommendation related to Interworking as specified as specified herein.

      3)   The national Telex Network.
      4)   Other ISDN's (of other Administrations).
      5)   Specialized Service Provider.

          a)   Within the National Network.
          b)   Outside the National Network.
             - Service providers located in Pakistan
             - Service providers located outside pakistan.

      6)   (Possibly) The public Land Mobile Network.
      7)   Other (Dedicated Network, possibly in long-term B-ISDN, etc.

5.5.2   The interworking functions (IWF) may be witin the ISDN or in the other network or in both. For PSTN, Telex these IWF will be within ISDN.

5.5.3   The interworking functions shall comply with the relevant CCITT Recommendations (Blue Book) especially with the I.500 series (I.500; I.510; I.511; I.515; I.520; I.530; I.540; I.550; I.560); I.310; I.324; I.340; X.31; X.81; X.300; X.301.

6.   EVOLUTION OF THE INTEROFFICE SIGNALLING NETWORK.

6.1   The Pakistan national signalling network will evolve in a series of stages from the present mainly analogue signalling network to the long-term future all digital network with only CCITT No.7 signalling (See Figures PLG-2685 and PLG-2686 A-E). This evolutionary process will be long, in the region of 20 years, with various intermediate steps as described below.

6.2   The first step is from the present network with loop signalling, R-2 analogue and digital, CCITT No. 5 internationally to CCITT Signalling System No. 7 signalling as the new signalling network for digital switches. This new signalling network has recently started, based on Red Book Recommendations, using 4.8 kbit/s data links via modems over analogue channels operating in either the Associated or Quasi-Associated Mode. However the use of such low-speed links reduces the performance of the No. 7 signalling network, which is optimized for use at 64 kbit/s.

6.3   The second step therefore will be the introduction of 64 kbit/s using the mainly digital transmission systems which will be in place about year 1993. This No. 7 signalling system should also be aligned with the Blue Book, to take advantage of the improvements in the system and also to permit at some stage about 1995 the introduction of an ISDN Pilot Project. Depending on the size of the route, signalling may be either in the quasi-associated mode or alternatively for large routes, in the associated mode.

6.4   The third step will come with the commercial introduction of ISDN (about 1996), which will require CCITT No. 7 signalling fully equipped with the necessary functional parts for ISDN working (ISUP, TCAP, SCCP) in addition to the basic MTP and TUP parts. The Interworking Functions (IWF) necessary to allow the ISDN to interface wit the telephone and other networks would be located with the ISDN. At about the same time OMAP, for superior operations, maintenance and administration performance of the network, should be added.
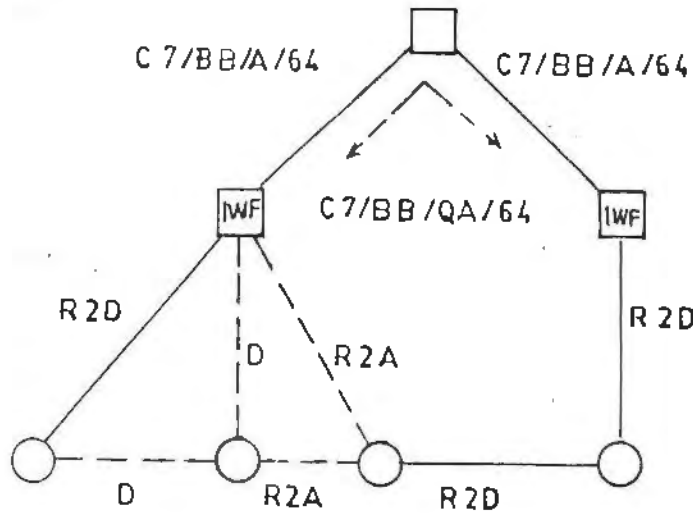
C) MEDIUM TERM SIGNALLING NETWORK (1993)
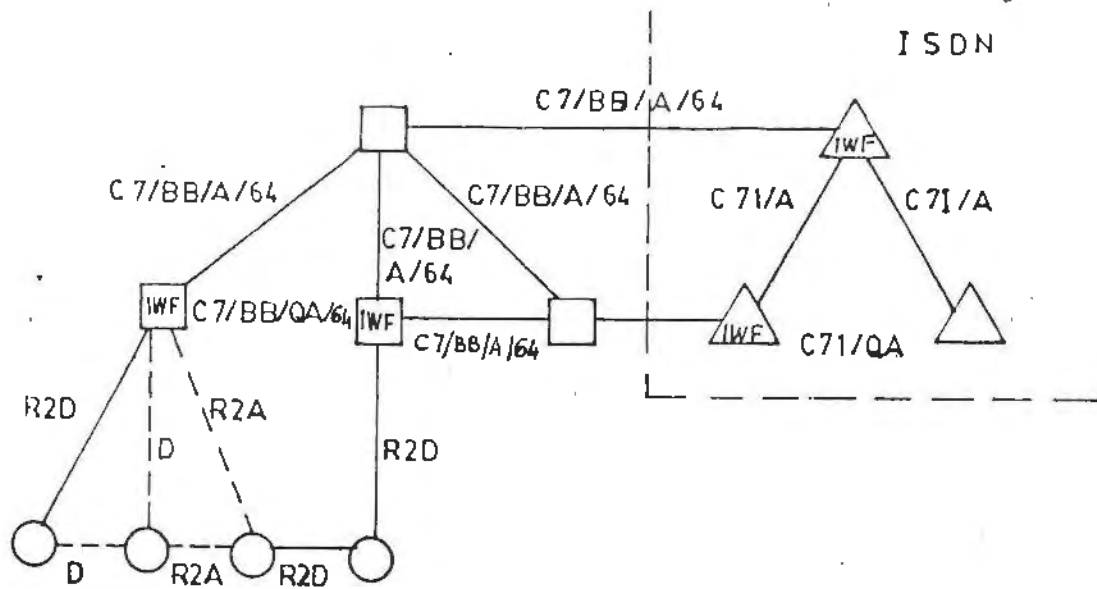
D) LONG TERM SIGNALLING NETWORK (1996)
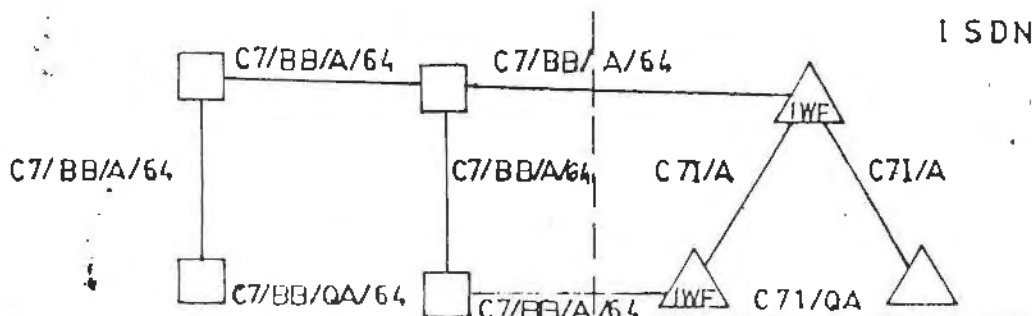
E) VERY LONG TERM SIGNALLING NETWORK (2003)

Issue No.	Initial Date	Drawn	*Jamal DS* 17-1-90	FIGURE 6.1. EVOLUTION OF THE INTEROFFICE

DIGITAL
SWITCHES

C 7 R·B/ 4. 8   C 7 RB/ 4. 8

C 7 · /4.8

IWF   IWF

R2 D   D   R2 A   R2 D
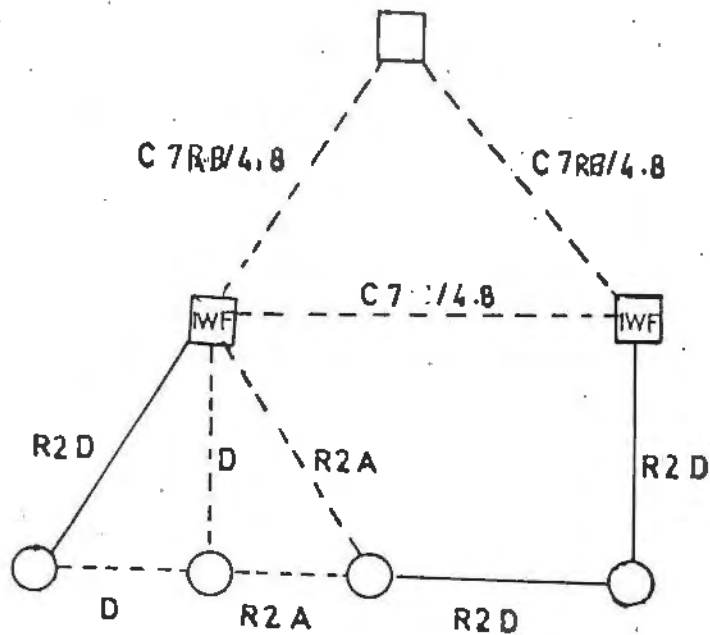
ANALOGUE
SWITCHES

D   R2 A   R2 D

A) PRESENT SIGNALLING NETWORK   (J .N 1990)

C 7/ R B / A/ 64   C7/ R B / A/ 64

IWF   C7/R B/QA/   IWF

R2 D   D   R2 A   R2 D

D   R2 A   R 2 D
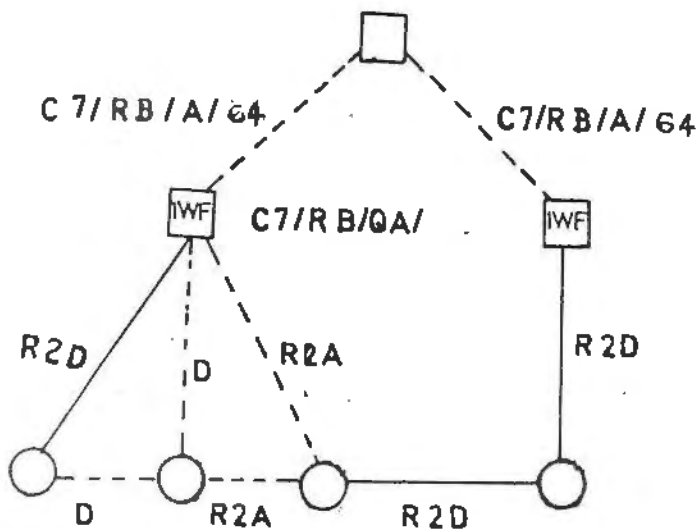
B) IMMEDIATE FUTURE SIGNALLING NETWORK (1990)

NATIONAL

INTERNATIONAL

DOMSAT

INTELSAT

R.2
Non-Compelled

R.2
Non-Compelled

C-5

C-5

Switch

Switch

Gateway

Over-
seas

A) MEDIUM TERM (ANALOGUE LINKS)

NATIONAL

INTERNATIONAL

DOMSAT

INTELSAT

C-7

C-7

C-7

C-7

Switch

Switch

Gateway

Over-
seas

B) LONG TERM (DIGITAL LINKS)

FIGURE 6.8 SIGNALLING LINKS VIA SATELLITE

D = Decadic Signalling

IWF= Interworking Function

R2A= CCITT R-2 Signalling System (Analogue)

R2D= CCITT R-2 Signalling System (Digital)

C7/RB/A/4.8 = CCITT Red Book Signalling System No. 7 Associated
              Mode with 4.8. kbit/s digital signalling link

C7/RB/QA/4.8= CCITT Red Book Signalling System No. 7 Associated
              Quasi-Associated Mode with 4.8 kbit/s digital
              Signalling link

C7 BB/A/64 = CCITT Blue Book Signalling System No. 7 Associated
               Mode with 64 kbit/s digital signalling link

C7 BB/QA/64 = CCITT Blue Book Signalling System No. 7 Quasi-
               Associated Mode with 64 kbit/s digital signalling
               link

C7I = CCITT Blue Book Signalling System No. 7 with MTP, TUP, ISUP
      TCAP, SCCP

                KEY TO FIGURE 6.1 (PLG-2685 & PLG-2686) A -E

6.5 In the very long term the last step foreseeable at present will be that the existing systems other than C7 such as decadic, R-2 etc. will be phased out gradually and eventually only be CCITT No. 7 signalling will remain . Different functional parts of CCITT No. 7 signalling will be utilized depending on the application. There will be TUP at all exchanges and ISUP, TCAP, SCCP at those centres where ISDN is required. Also PABX and concentrator signalling would be the reduced version of CCITT No. 7 signalling specified by CCITT for such small systems. OMAP will also be introduced in this best phase.

6.6 Similarly the existing international signalling systems, CCITT R-2 and CCITT No.5, will gradually be phased out. The digitalization of these international signalling link, using digital techniques such as IDR, will make the use of CCITT No. 7 signalling both economically and technically very attractive. Whenever a digital Route to a foreign administration to be activated, arrangements should be made wherever possible to utilize CCITT No. 7 signalling (either associated mode or quasi-associated mode with only TUP or alternatively TUP, ISUP, ISUP,SCCP). Validation tests and compatibility tests in accordance with CCITT Rec. series 78x will have to be performed in cooperation with the corresponding overseas administration before putting these CCITT No. signalling links into service.

6.7 For DOMSAT Links, in the long-term these will be digital using CCITT No. 7 Signalling.However during the short and medium terms they will be analogue, for which the only CCITT specified signalling system is the "Semi-Compelled and Non-Compelled Multifrequency Interregister Signalling for National Satellite Applications based on System R 2 Interregister Signalling" (see Fascicle V.4 - Suppl. No.7 - Blue Book). Conventional R-2 compelled signalling cannot be used over satellite as the delays with signals being interchanged to and from would be prohibitive.The Semi-compelled method is more closely related to conventional R-2 than with the Non- compelled method, so it is cheaper, but delays are .longer and can be unacceptable with a network which extensively uses satellites. In the Pakistan network, the Non-compelled method is better with the exchanges at both ends of a satellite link capable of sending and receiving non-compelled signals and , where necessary, of interworking with other signalling with other signalling system.

6.8 Figure 6.8 (PLG-6297) shows the evolution of signalling over satellite, both national and international, initially over analogue channels, later over digital channels.

6.9 To implement the long-term No. 7 signalling network which causing minimal disruption to the existing signalling systems and avoiding unnecessary expense in interworking and signalling conversion equipment the following guidelines should be followed:

a) All new digital exchanges should be capable of utilizing No. 7 signalling, Blue Book version, as specified in detail in Section 4.

b) For most digital exchanges, TUP will be the only user part employed for the foreseeable future. Nevertheless to cater for ISDN requirements for the long-term, the design of including ISUP, TCAP, SCCP, OMAP economically.

c) New digital exchanges should be capable of incorporating DSSI functions. (See Section 7) .

d) New digital exchanges should be capable of interworking with all of the existing signalling systems (various combinations of non-CCITT, R-2 (analogue/digital)/non-compelled, No.5 to which it will be connected. Interworking between CCITT standardized signalling systems shall be in accordance with the coding scheme defined (see Section 4.2.2.6.e.)

e) Existing digital exchanges with No. 7 signalling (either reduced version or Red Book version) should be aligned with Blue Book version. As the differences between Red Book and Blue versions of MTP and TUP are not great, there should not be great difficulty provided this process of alignment with Blue Book is carried out soon.

f) For areas where there will be demand for ISDN services (mainly government/ commerical areas of Karachi, Islamabad / Rawalpindi, Lahore) the subscriber loop distance from the exchange should not exceed the maximum distance limitation for ISDN loop signalling (Approx. 5 km).

g) Existing exchanges utilizing No. 7 signalling over analogue facilities using 4.8 kbit/ s modems should be converted to 64 kbit/s operation as soon as digital links become available.

h) The CCITT No. 7 signalling network should be utilized to the maximum extent possible, in view of its superiority over other signalling system. For

systems, the No. 7 signalling network should be entered at a point as close as possible to the originating subscriber and exited at a point as close as possible to the destination subscriber. Within the national network, no call should be allowed to exit and later reenter No. 7 signalling network.

i)   The configuration of the No. 7 signalling network is non-hierarchical.

All digital transit and tandem exchanges should be capable of acting as signalling ~~transit and tandem exchanges should be capable of acting as signalling~~ transfer points (STP).

j)   As international routes become digitalized, No. 7 signalling should be introduced. Procedures defined by CCITT for testing, verifying and activating such No .7 international links with other Administrations should be followed. For the purposes of Rec. Q. 709 and the values/ parameters specified therein, Pakistan is to be considered a "large" country.

7.   SUBSCRIBER LOOP SIGNALLING.

7.1   The decadic and multifrequency subscriber loop signalling
      which exists at present (see Section 3) will continue to exist
      for the foreseeable future. The vast majority of subscribers
      will require only basic telephone service, with or without
      supplementary services. For these subscribers, the existing
      standards will suffice.

7.2   Digital Subscriber Signalling.

7.2.1   The advent digital telephone and of ISDN will require
           completely new subscriber loop signalling.The Interface
           Structures and Access Capabilities of ISDN user-network
           interfaces should comply with Rec. 1.412 and other
           related Recommendations of Blue Book.

7.2.2   The Interfaces and Interface structures permitted by the
           Blue Book are:

      a)   Basic Interface Structure

                   2B   +   D   (B=64 kbit/s ; D=16 kbit/s)

      b)   Primary Rate Interface Structure

            i)   H11 channel structure
                 1,536 kbit/s, based on U.S. digital hierarchy,
                 Not applicable in Pakistan.

            ii) H12 channel structure.
                 Applicable in Pakistan

            iii)   nB   + D Where $n \leq 30$ unless signalling is
                       provided in another interface, when n = 31 may
                       be allowed.
                       B = 64 kbit/s ; D = 64 kbit/s.

            iv)   nHo + D Where $n \leq 5$
                       Ho = 386 kbit/s ; D = 64 kbit/s.

      Also appropriate mixtures of B and Ho channels are
      allowed.

7.2.3   The Basic User Network Interface should conform to the
           appropriate CCITT Recommendations with certain
           qualifications (as listed in the referred Tables):

Basic Access	CCITT Rec.	Remarks.
Layer 1 Spec.	1.430	See table 7.2.A
Data Link Layer Spec.	Q.920, Q.921	See Table 7.2.B
Network Layer Spec.	Q.930 - Q.940	See Table 7.2.C

The Primary User Network Interface should conform to the appropriate CCITT Recommendations with certain qualifications:

Primary Access	CCITT Rec.	Remarks
Layer 1 Spec.	1.431	See Table 7.2.D
Data Link Layer Spec.	Q.920, Q.921	See Table 7.2.B
Network Layer Spec.	Q.930 - Q.940	See Table 7.2.C

NOTES ON TABLES 7.2.A-C

- Table 7.2.A is intended only to select Options available under Rec. I. 430. It does not allow any non-compliance with Rec.I.430

- Table 7.2.B is intended only to select Options available under Recs. Q. 920 and Q.921. It does not allow any non-compliance with Recs. Q920 and Q.921.

- Certain Options permissible under CCITT Red Book are not allowed under Blue Book (Single Frame Acknowledged Operation; Modulo 8 Operation). Therefore they are not to be used.

- Table 7.2.C based on CCITT Red Book; requires revision when Blue Book becomes available. It is understood that there will be several important additions and amendments in the Blue Book and that the DSSI will be fully aligned with CCITT No. 7 Signalling, which is not the case in the red Book.
- In Table 7.2.C.1:

R =Provision required for Circuit-Mode Connections

A=Also used for Temporary User-User Signalling Connections

B=Also used for Permanent User-User Signalling Connections

C=Also used for X.25 via D-Channel (Later Requirement)

D=Also used for X.25 via B-Channel
See Table 1 / Q. 931

- In Table 7.2.C.2 L= required Later

                    M=Mandatory (CCITT)

                    N=Not required

                    O=Option possible required later

                    R=Required

- Table 7.2.C is intended only to select options available under Rec. Q. 931. If does not allow any non-compliance with Rec. Q.931.

- Table 7.2.D is intended only to select Options available under Rec. I.431. It does not allow any non-compliance with Rec. I.4.31.

I. 430 para	Option	Remarks
4.5	Connecting Cord part of Interface Wiring	Not Aplicabe
5.3	TE Polarity	Not across Interface
6.2.2	Wiring Polarity	Reversal of Wiring Polarity allowed. All NT & TE should allow Reversal.
6.3.3	Q-Channel/Q-bits	Not used initially, but required later.
6.6.2	NT Configurations	-Short Passive Bus (Fixed Timing) -Short Passive Bus (Adaptive Timeing) -Extended Passive Bus -Point-to-Point
9	Power Feeding	Power Sources/ Sinks 1 & 2 not provided

TABLE 7.2.A: BASIC USER-NETWORK INTERFACE - LAYER 1 SPECIFICATION
(CCITTT Rec. 1.430)
OPTIONS SELECTED

Paragraph Q.920	Q.921	OPTION	REMARKS
4.3	---	Unacknowledged	Information Transfer which is unacknowledged at L2 (except broadcast) should be acknowledged at a higher level or by Layer Management and appropriate error recovery procedures used
--	2.3	Support of LAPB by D-Channel	Not required initially, but need later.
--	3.6.12 5.4 Appendix IV	Automatic Negotiation of Data Link Layer Parameters (XID Command/ Response)	Required
--	5.3.3.1	Multiple TEI Assignment verification	Required
--	5.3.5.1	TEI identity verifyprocedure fornetworkand user equipment	Required
--	5.5.1.2 5.9.8	Timer T 203	Required (See 5.10.1 below)
--	5.8.1 Appendix I	Retransmission of REJ Response Frames	Required
--	5.9	System Parameters	Values shall be adjustable over a wide range, but initially are set to the values/ default values specified in Q. 921/ para. 5.9
	5.10.1	Data Link Layer Monitor Function	Required
Annex A		Point-to-Point Signalling Connection (L3)	TEI-O when this L3 connection is needed
Appendix III		OptionalBasic Access Deactivation	Deactivation Procedures with MPH- DEACTIVATION - IND Primitive applies.

TABLE 7.2. B : ISDN USER - NETWORK INTERFACE DATA LINK LAYER
DIGITAL SUBSCRIBER SIGNALLING SYSTEM NO. 1 (DSSI) DATA LINK LAYER
Recs. Q.920 - Q. 921   OPTIONS SELECTED

```
Messages                                            Notes
--------                                            ------
Call Establishment Messages
     -ALERTing                                      R,A,D
     -CALL PROCeeding                               R,A,D
     -CONNect                                       R,A,D
     -CONNect ACKnowledge                           R,A,D
     -SETUP                                         R,A,C,D
     -SETUP ACKnowledge                             R,A

Call Information Phase Message
     -RESume                                        R
     -RESume ACKnowledge                            R
     -RESume REJect                                 R
     -SUSPend                                       R
     -SUSPend ACKnowledge                           R
     -SUSPend REJect                                R
     -USER INFOrmation                              R,A,B

Call Disestablishment Messages
     -DETach                                        R,D
     -DETach ACKnowledge                            R,D
     -DISConnect                                    R,A,D
     -RELease                                       R,A,C,D
     -RELease COMplete                              R,A,C,D

Miscellaneous Messages
    -CANCel                                         R
    -CANCel ACKnowledge                             R
    -CANC REJect                                    R
    -CONgestion CONtrol                             R,A,B
    -FACility                                       R
    -FACility ACKnowledge                           R
    -FACility REJect                                R
    -INFOrmation                                    R,D
    -REGister                                       R
    -REGister ACKnowledge                           R
    -REGister REJect                                R
    -STATUS                                         R,A,B,C,D
```

TABLE 7.2.C.1: MESSAGES FOR ISDN CONNECTIONS (Rec. Q. 931)

Information Element	Provision	Remarks	Rec.Q.931
Single Octet Information Elements			
-Reserved	R	Coded 000 initially	4.5.2/3/4
-Shift	M	Other codes needed later	
-More Data	O	Not Used Initially Possible later	4.5.19
-Congestion Level	M	Only two states used initially (RR,RNR).Others later	4.5.11
Variable Length Information Elements			
-Bearer Capability	M	-CCITT coding only -No 3.1/7/15kHz or video requirement initially -64kbit/s rate initially -8kHz integrity and service data unit integrity initially -Q.931 L3 Protocol only initially. X .25 later	4.5.5
-Cause	R	-CUG Causes (53,55,86, 87) not used initially; later	4.5.8
-Connected Address	R	-Required	4.5.12
-Call Identity	R	-Required	4.5.6
-Call State	M	-Required	4.5.7
-Channel Identification	R	-Only Basic & Primary (with B-Channels) initially others later.	4.5.10
-CCITT Standardized Facilities	R	-Basic Facilities Required Full Range Later	4.5.9
-Network Specific Facilities	O	Not Required initially Possible Later	4.5.20
-Terminal Capabilities	R		4.5.25
-Display	R	-Required	4.5.14
-Keypad	L	-Required Later	4.5.16
-KeypadEcho	L	-Required Later	4.5.17
-Signal	R	-Required	4.5.23
-Switchhook	R	-Required	4.5.24
-Origination Address	R	-Required	4.5.13
-Destination Address	R	-Required	4.2.21
-Redirecting Address	R	-Required	4.2.22
-Transit Network Selection	N	-Not Required	4.2.26
-Lower Layer Compatibility	L	-Required Later	4.2.18
-Higher Layer Compatibility	N	-NotRequired, except perhaps in very long-term	4.2.15
-User-User Information	R	-Required	4.2.27

```
I.431
para.        Option                              Remarks
-----        ------                              -------
 4           Interface at 1544 kbit/s            Not Applicable

 5           Interface at 2048 kbit/s            Applicable

 -           B-Channel                           Required
 -           Ho-Channel                          Required Later
 -           H11-Channel                         Not Required
 -           H12-Channel                         Required Later

5.2.3        Sa bits (positions 5,6,7)          Not Assigned, but may be
                                                 used in future.
5.2.4.2   Time Slot 16 Assignment               When not used for D-Channel.

                                                 maybeassignedtoB-Channel.
5.9.2        CRC Processing in the                  Utilized as per para.
5.9.2.2.2.
             Transmission Link

 -           Safety Requirements                 Protection against Short-
                                                        Circuit,Overload,
Interchange
                                                 of Wires required. Also ISO

                                                 Publication 950 applies.

 -           Power Feeding across                             Not Applicable
                   Interface
```

TABLE 7.2.D: PRIMARY USER-NETWORK INTERFACE - LAYER 1
      SPECIFICATION (CCITT Rec. 1.431)
                  OPTIONS SELECTED

7.2.4   Terminal Equipment, other than standardized ISDN
         terminals with Basic or Primary Access, can also be
         supported by ISDN provided they comply with the
         appropriate CCITT Recommendations. Terminal adaptors
         (TA) are required for this function.

Terminal Equipment	Relevant CCITT Rec.
X.21, X.21 bis, X.20	X.30
Packet Mode	X.30
V-Series Modems	V.110

The responsibility for compliance with these
Recommendations will depend on T&T policy, regarding
ISDN terminal equipment.

a)   If the customer buys this own TE and AT, the
      responsibility for ensuring the correct R, S and T
      interfaces is his.

b)   If T&T supplies the TE and TA equipment, the
      responsibility will be T&T's

Most Administrations allow the customer to buy his own
ISDN terminals, to give him greater choices to suit his
own particular application, to eliminate the need for the
Administration to carry stocks of a wide variety of
expensive equipment (Approx. Rs. 50,000 per ISDN
terminal) and to avoid the problems of maintaining a wide
range of very sophisticated customer apparatus. With
this approach, as long as the User Network
Interfaces are correct, the Administration is not
concerned with the optional details of the customers and
the headaches of maintenance.

7.2.5.   It should be noted that certain access channels (E
         channel) and access-capabilities (B+D, D) permitted the
         CCITT Red Book are no longer allowed in the Blue Book
         and therefore should not be used.

8.   TONES.

8.1   It is of the utmost importance that customers and operators, both nationally and internationally, be able to distinguish the various tones used and their significance. Therefore tones should be standardized in line with international norms. Strange or unusual tones should be avoided.

8.2   As audible tones are the main means by which the equipment can convey information to the customer about progress (or otherwise) of a call, they are as important element of a signalling plan and must be specified. Recorded announcements can also perform some of these functions, but in the vast majority of cases tones are the only information conveyed to the customer.

8.3   Tones should be in accordance with CCITT Rec. Series E. 18x (See Annex-2). Existing tones in he Pakistan national telecommunications network are within "accepted" limits, as defined by CCITT. However all future tones generated by new switching equipment should comply with the tighter CCITT "recommended" limits for tones.

8.4   Tones should be standardized as much as possible to:

   1) Achieve uniformity in the quality of audible tones.

   2) Minimize customer and operator confusion as to the meaning of audible tones.

   3) Ensure Foreign Customer Recognition of Pakistan Tones.

   4) Enable machine recognition of audible tones.

   5) To minimize interference with multifrequency signalling tones.

   This means that the frequency, cadence and level of tones should be standardized.

8.5   According to CCITT Blue Book (Fascicle II-Suppl. No. 2) there are two Ringing Tones and two Busy Tones in Pakistan:

i)	Ringing Tone	450Hz	1 sec. on.4 sec. off.
	or	400+162/3Hz	0.4sec. on / 0.2 off /0.4 sec on/2 sec off
ii)	Busy Tone	400 Hz sec.off	0.75sec on /0.75

53

or   450 Hz   0.4 sec.on/0.675 sec off
/0.13 sec on/0.17 sec off

This situation where there are different tones is not
acceptable and should be rationalized to avoid customer
confusion. Only the first of each pair of tones should be
used.

.6 Specification of Tones.

The following specification should be applied to tones
(Note: * indicates a tone that does not exist at
present, but should be provided):

Tone	Frequency (Hz)	Cadence	Remarks
Dial Tone	450	Continuous	Existing Tones comply.
PABX Dial Tone	–	–	Not to be specified by T&T
Special Dial Tone	–	–	Not required.
Second Dial Tone	–	–	Not required.
RingingTone	450	1.sec. on 4 sec. off	Within CCITT recommended limits.
Busy Tone.	450	0.75 sec.on 0.75 sec. off	Within CCITT recommended limits.
* Congestion Tone.	450	0.25 sec. on	Often no special congestion tone exists at present. CCITT recommended that such a tone should be provided.
* Special Information Tone (Three Successive Tones)	950 1400 1800	330 mS tone 1 sec. silence	Not used at present
* Warning Tone	1400	350 mS pulse every 15 sec.	CCITT Recommended.
* Intrusion Tone	–	–	As per warning tone.
* Call waiting tone.	450	100 mS on 200 mS off 200 mS on 10 s. off	Should be provided at exchanges where the call waiting service is provided
Pay Tone	450	–	Not specified by CCITT provided in T&T network.
* Pay Tone	–	–	Not specified by CCITT, Provided.
Payphone			Not specified by CCITT

Recognition   –   –   Provided.
Tone.

* ComfortTone –   –   Not specified by CCITT
                                                        but should be
                                                        provided to assure
                                                        caller that call is
                                                        being processed.

* Tone on Hold   –   –   As per comfort tone.

  Record Tone   –   –   As per warning tone.

* Positive   –   –   As per comfort tone.
  Indication
  Tone.

* Negative
  Indication   –   –   As per congestion tone.
  Tone.

Tone level of – 10 $\pm$ 2dBmO applies in all cases.

REFERENCES

1 " Telephone Signalling : An Overview"
   T&T Document No. DIR.   (fpu) 1-7/89

2   EWSD SIGNALLING REQUIREMENTS DEFINITIONS
    CCITT No. 7 Common Channel Signalling Message Transfer Part
    (MTP) for the National National Network of Pakistan
    Issue 11/86   (Siemens Document)

3   CCITT No. 7, Telephone User Part (TUP)
    Projekt PAKISTAN (PAK) Telegraph & Telephone
    starting with EWSD -Version 4.2
    Requirement Specification P 30308- A2760 -A-1-7626
    (Siemens Document)

4   CCITT Blue Book Volume VI : Q-Series Recommendations.
    (Especially Fascicles VI.6-11).

ANNEX 1

SELECTED MESSAGES FOR PAKISTAN NATIONAL APPLICATIONS

Extract from "Telephone Signalling: An Overview"
     Reference 1

ANNEX 1

SELECTED MESSAGES FOR PAKISTAN NATIONAL APPLICATIONS

Note: Header Codes H1 should be changed to comply with
         CCITT Blue Book issued later, as follows:

Message	Old H1 Code	Revised H1 Code
MPM	0010	1010
FRL	1100	0100
TOS	1101	0101
TOR	1110	0110
SNC	1111	0111

SELECTED MESSAGES FOR NATIONAL APPLICATIONS

METER PULSE MESSAGE (MPM)

Function:

This message is used in connection with charging by periodic pulse
metering. The message contains only one metering pulse.

Message format and code:

	D C B A			
Number of Metering pulses	Tariff Indicator	Heading Code H1	Heading Code HO	Label
4	4	4	4	40

                                  Transmission direction >>>>>>

The following codes are used in the fields of the MPM:

a)   Label: as per CCITT REc. 0.723 para. 2.2
b)   The heading codes are coded : HO=1100, H1=0010
c)   Tariff Indicator, not used, fixed coded DCBA= 0000
d)   The number of metering pulses included in the message is
expressed as following:

   0001   1 metering pulse

If the number of metering pulses is coded 0000 a signalling alarm
is given and the call is released.

FORCED RELEASE SIGNAL (FRL)

Function:

As soon as the clear back time supervision expires the supervising
trunk exchange (charging point) sends in backward direction a FRL.
On receipt of the FRL each preceding exchange will repeat the
FRL-signal in backward direction. The originating local exchange Las
to transmit an appropriate tone or announcement the calling party
and to release the connection. In case the interwording with a
channel associated signalling system a corresponding forced release
signal will be sent to the respective incoming trunk.

Message format and code:

```
----------------------------------------
----------------------------------------
Heading          Heading          Label
Code H1          Code HO
----------------------------------------
    4                4                4
```

                          Transmission direction >>>>>>

The following codes are used in the fields of the FRL:

a)   Label: as per CCITT Rec. Q 723 para. 2.2

b)   The heading codes are coded; HO=1100, H1-1100

60

TRUNK OFFERING START SIGNAL (TOS)

Function:

A TOS will be sent in forward direction from the exchange where the
operator is allocated, in order to switch through to the busy party
(parallel connection). The message causes in all exchanges involved
the cancelling of the National trunk time supervision, which was
started after receipt of the address complete message (ACM).
The exchange where the called party is connected to provide the
parallel connection.

Message format and code

```
--------------------------------
--------------------------------
Heading       Heading      Label
Code H1       Code HO
--------------------------------
   4            4           40
```

Transmission direction >>>>>

The following codes are used in the fields of the TOS:

a)   Label: as per CCITT Rec.Q.723 para. 2.2
b)   The heading codes ar coded : HO=1100, H1=1101

TRUNK OFFERING RELEASE SIGNAL (TOR)

Function;

A TOR will be sent from the exchange where the operator is allocated in order to release the parallel connection set-up by means of the trunk offering signal (TOS). If the called subscriber has answered during trunk offering, the associated exchange will send the answer signal unqualified (ANU) immediately after the receipt of TOR.

Message format and code;

```
------------------------------------
------------------------------------
Heading       Heading      Label
Code H1       Code HO
------------------------------------
    4             4            40
```

Transmission direction <<<<<<<<<

The following codes are used in the fields of TOR:

a) Label: as per Rec. Q.723 para 2.2.

b) The heading codes are coded : H1-1100, H1=1110

SUBSCRIBER NUMBER CHANGED (SNC)

Function:

The terminating exchange sends this message in backward direction,
if the called party is put into the state "Changed number".

Message format and code:

```
------------------------------------
------------------------------------
Heading        Heading       Label
Code H1        Code HO
------------------------------------
    4              4            40
```

                          Transmission direction <<<<<<<<<<<<

The following codes are used in the fields of SNC:

a)   Label: as per Rec. Q.723 para 2.2.
b)   The heading codes are coded : HO=1100, H1=1111

ANNEX 2

TONES FOR USE IN NATIONAL SIGNALLING SYSTEMS

Fascicle 11.2 CCITT Blue Book Section 7
Recommendations Nos. E.180-184