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SECTION 3

SPECIAL CASES OF ALTERNATING CURRENT TELEGRAPHY

Recommendation R.40

COEXISTENCE IN THE SAME CABLE OF TELEPHONY AND SUPER-TELEPHONE TELEGRAPHY

(former CCIT Recommendation B.17, Brussels, 1948;

amended at Geneva, 1951 and at Melbourne, 1988)

The CCITT,

considering

(a) that this process provides only one telegraph channel, in addition to the telephone channel, and that it can be applied only in comparatively few cases (lightly loaded or unloaded circuits, which cannot be used for multi-channel carrier telephony);

(b) that in such cases, the Administrations and private operating agencies concerned could in most cases by common agreement contemplate the possibility of making use of some other more suitable process that would provide, in addition to the audio telephone channel, more than one telegraph channel;

unanimously declares the view

that the use of super-telephone telegraphy (Definition 02.25, Recommendation R.140) should not prejudice the quality of transmission over the adjacent telephone channel and that, in particular, it should not limit the band of frequencies necessary for good speech reproduction (300 to 3400 Hz at least).

Recommendation R.43

SIMULTANEOUS COMMUNICATION BY TELEPHONE AND TELEGRAPH ON A TELEPHONE-TYPE CIRCUIT

(former CCIT Recommendation B.50, Geneva, 1956;

amended at Geneva, 1964 and 1980)

The CCITT,

considering

(a) that the use of a leased telephone-type circuit for simultaneous communication by telephone and telegraph is envisaged in Recommendations D.1 [1] and H.32 [2];

(b) that the CCITT has indicated conditions under which the simultaneous use of telephone-type circuits for telephony and telegraphy is technically tolerable;

(c) that standardization of the characteristics of equipment permitting simultaneous use of a telephone-type circuit for telephony and telegraphy is not justified, but that it is necessary to limit the power of the signals transmitted and to avoid the use of frequencies that will interfere with any telephone signalling equipment that may remain connected to the telephone-type circuit;

(d) that new demands for the allocation of particular frequencies for special purposes frequently arise and the number of frequencies used for any one purpose should not be unnecessarily extended;

(e) that the systems described below may be useful when the more modern systems advocated in Recommendation H.34 [3] are not feasible;

unanimously declares the view

(1) that in the case of the simultaneous use of a telephone-type circuit for telephony and telegraphy, the resulting maximum permissible 1-minute mean power loading shall not exceed 50 µW0 (i.e. —13 dBm0);

(2) that where frequency division multiplexing is employed, the general principle concerning the allocation of level to each type of service should be that the allowable mean signal power is proportional to the bandwidth assigned. This case is considered in more detail in Recommendation H.34 [3], resulting in the aggregate power of the telegraph signals being set a level not exceeding 10 µW0 (i.e. approximately —20 dBm0);

(3) that there should not be more than three circuits of this type in a frequency-division multiplexed group of 12 telephone-type circuits and that the number of circuits of this type set up on a wideband carrier system should not exceed the number of supergroups in the system;

(4) that the telegraph signals transmitted must not interfere with any signalling equipment that may remain connected to the telephone-type circuit,

and notes

that some Administrations have permitted the use, for simultaneous telephony and telegraphy of the frequencies 1680 Hz and 1860 Hz both for amplitude and for frequency modulation.

Note — If circuits equipped in accordance with the present Recommendation are used in a private network, it will be impossible to use push-button telephone sets or multifrequency signalling (e.g. Signalling System R2) in the network.

References

[1] CCITT Recommendation *General principles for the lease of international (continental and intercontinental) private leased telecommunication circuits* , Rec. D.1.

[2] CCITT Recommendation *Simultaneous communication by telephony and telegraphy on a telephone-type circuit* , Rec. H.32.

[3] CCITT Recommendation *Subdivision of the frequency band of a telephone-type circuit between telegraphy and other services* , Rec. H.34.

Recommendation R.44

6-UNIT SYNCHRONOUS TIME-DIVISION 2-3-CHANNEL MULTIPLEX TELEGRAPH SYSTEM FOR USE OVER FMVFT CHANNELS

SPACED AT 120 Hz FOR CONNECTION TO STANDARDIZED TELEPRINTER | NETWORKS

(Mar del Plata, 1968, amended at Melbourne, 1988)

The CCITT,

considering

(a) that synchronous modulation enables a larger number of telegraph channels to be constituted by time-subdivision of a standardized telegraph channel (Recommendation R.35);

(b) that such an increase may be of interest in the case of long submarine cables of the telephone type in view of the resulting economies;

(c) that, in addition to the signals of International Telegraph Alphabet No. 2, transmission of the selection and supervisory signals is essential when incorporating the telegraph channels thus provided into the international switching network;

(d) that it is desirable to allow for the provision of half-rate and quarter-rate channels;

(e) that correct phase-relationship should be established and also maintained automatically;

(f) that systems using 5- and 6-unit codes have been proposed,

unanimously declares the view

that, where the synchronous multiplex system uses a 6-unit binary code, the equipment should be constructed to the following standards (Administrations may of course by mutual agreement use a different system with a 5-unit code such as that described in [1].

1 Telegraph modulation

1.1 The character period should be 145 5/6 ms.

1.2 The multiplexing should provide for the derivation of either 2 or 3 time-division channels from each voice-frequency telegraph (VFT) channel. The aggregate modulation rate will be 82 2/7 bauds for a 2-channel multiplex and 123 3/7 bauds for a 3-channel multiplex. Generally it is found that VFT systems conforming to Recommendation R.35 will operate satisfactorily at 82 2/7 bauds, but to ensure satisfactory operation at 123 3/7 bauds, it is necessary to employ characteristic distortion compensation (CDC) at the receiving end of the VFT channel.

1.3 The time derived channels shall be element interleaved to form the aggregate signal.

2 Connection to start-stop circuits

2.1 The channel inputs shall be capable of accepting signals from start-stop equipment conforming to Recommendation S.3 [2] (except § 1.6 of S.3). The channel output should be start-stop with a modulation rate of 50 bauds. Standards of performance are given in § 9 below.

3 Alphabet

3.1 Combinations 1 to 31 of the 5-unit International Telegraph Alphabet No. 2 shall each be preceded by an A-condition element, while the continuous start and continuous stop conditions shall utilize the 6-unit combinations AAAAAA and ZZZZZZ respectively. The remaining combination No. 32 shall be preceded by a Z element.

3.2 The alphabet should be as shown in Annex A.

4 Grouping of multiplex systems

4.1 A common phasing control can be used for a number of multiplex systems carried by different channels of the same VFT system. A group of multiplexes shall comprise a maximum of six systems. Some time-derived channels shall be capable of being further divided to provide sub-channels. The various channels should be identified by a figure denoting the number of the multiplex system within the group of six, i.e. 1-6 followed by a letter denoting the channel within that system, i.e. A, B or C. Thus the complete channel numbering will be as follows:

Multiplex system/channel

1A, 2A, 3A, 4A, 5A, 6A ?04

—, | 2B, 3B, 4B, 5B, 6B ?05 full rate

1C, 2C, 3C, 4C, 5C, 6C ⌡

(1B is not available as a full-rate channel — see § 7 below.)

4.2 Each A channel should be full character rate only.

4.3 Each B channel should be capable of full character rate and subdivision (except 1B, which is permanently subdivided).

4.4 The full-rate channels A and B in the case of 2-channel multiplexing, or A, B and C in the case of 3-channel, should be multiplexed on an element-interleaved basis in the following sequence:

A1, B1, A2, B2, etc. for 2-channel operation (where A1 is the first element of channel A etc.);

A1, B1, C1, A2, B2, C2, etc. for 3-channel operation.

5 Subdivision of channels

5.1 All full character-rate channels B (except B1) and C should be capable of subdivision into quarter character-rate channels, and into multiples of quarter-rate, i.e. one half-rate, using two quarter-rate channels. (Although theoretically three-quarter rate channels could be provided, controlled by means of pulses from the multiplex equipment, provision of this facility is not recommended.)

5.2 The sub-channels should be identified basically in the same manner as the full-rate channels with the addition of a numeral denoting the quarter-rate channel, i.e. 1-4. In the case of half-rate channels, the numbers of the two quarter-rate channels used for it should be shown, i.e. 1/3 or 2/4. Thus the complete sub-channel numbering will be as follows:

Multiplex system/channel/sub-channel

1B1, 2B1, 3B1, 4B1, 5B1, 6B1. 1C1, 2C1, 3C1, 4C1, 5C1, 6C1 ?04

1B2, 2B2, 3B2, 4B2, 5B2, 6B2. 1C2, 2C2, 3C2, 4C2, 5C2, 6C2 | ?05 quarter

1B3, 2B3, 3B3, 4B3, 5B3, 6B3. 1C3, 2C3, 3C3, 4C3, 5C3, 6C3 | rate

—, 2B4, 3B4, 4B4, 5B4, 6B4. 1C4, 2C4, 3C4, 4C4, 5C4, 6C4 ⌡

(1B4, phasing control only)

1B1/3, 2B1/3, 3B1/3, 4B1/3, 5B1/3, 6B1/3 ?04

—, 2B2/4, 3B2/4, 4B2/4, 5B2/4, 6B2/4 | |

(1B2/4 not available) ?05 | half rate

1C1/3, 2C1/3, 3C1/3, 4C1/3, 5C1/3, 6C1/3 |

1C2/4, 2C2/4, 3C2/4, 4C2/4, 5C2/4, 6C2/4 ⌡

5.3 The sub-channels 1, 2, 3 and 4 shall be operated in the following character sequence:

A B1 A B2 A B3 A B4 A B1, etc. for 2-channel operation,

A B1 C1 A B2 C2 A B3 C3 A B4 C4 A B1 C1, etc. for a 3-channel operation.

5.4 All the sub-channels shall be transmitted with the same polarity except those of channel 1B, which should be inverted.

6 Transposition pattern

6.1 To avoid inadvertent cross-connections between channels when the system is out of phase, element transpositions should be allocated to the channels and sub-channels as follows:

Channel A 1 | | | | | ?04

Channel B 1 | | | | | ?05 sub-channel 1

Channel C 1 | | | | | ⌡

Channel A	1 | | | | |	?04
Channel B	1 | | | | |	?05 sub-channel 2
Channel C	1 | | | | |	
Channel A	1 | | | | |	?04
Channel B	1 | | | | |	?05 sub-channel 3
Channel C	1 | | | | |	
Channel A	1 | | | | |	?04
Channel B	1 | | | | |	?05 sub-channel 4
Channel C	1 | | | | |	

6.2 Full character-rate and half character-rate channels should take that sequence which is allocated to their lowest-numbered sub-channel, i.e. a full character-rate channel should take the sequence for its sub-channel 1, a half character-rate sub-channel using sub-channels 1 and 3 should take the sequence for its sub-channel 1, and a half character-rate sub-channel using sub-channels 2 and 4 should take the sequence for its sub-channel 2.

6.3 The element transpositions shall be carried out in the permanent wiring to the start-stop input and output units so that each of these units may be used in any position without alteration.

7 Phasing

7.1 Provision should be made for:

a) automatic phasing, automatically initiated (normal working condition);

b) automatic phasing, manually initiated;

c) manual phasing.

7.2 One quarter-rate channel of the group (1B4) should be permanently allocated for phasing control purposes, and should continuously send the character ZZAAZZ (the phasing signal).

7.3 Automatic initiation of phasing should occur when three successive phasing signals have not been recognized.

7.4 Automatic phasing may be in steps of one element per expected reception of the phasing signal, i.e. every four transmission cycles (583 ms), or alternatively a method that will carry out rephasing in one operation thus reducing the time spent on phasing. Phasing shall automatically cease when the phasing signal is recognized on the phasing sub-channel receiving unit.

7.5 Visual indication of the correct reception of the phasing signal should be given.

8 Telex and gentex signalling

8.1 The multiplex equipment should be capable of accepting CCITT types A, B and C signals and shall sensibly reproduce them with minimum delay or change.

8.2 It is especially desirable to transmit the signals used for calling and call confirmation with the minimum delay in order to minimize the probability of simultaneous seizure from both ends where circuits are used for both-way working.

8.3 To meet this requirement of minimum delay it is necessary that both the normal character storage inherent in a random arrival system should be bypassed during the free-line condition and the incoming signal from telex should be inspected at the most frequent intervals possible, with element interleaving between channels. Thus effectively the line input circuit is connected directly to the multiplex aggregate, and is inspected at intervals of 24 11/36 ms causing an element of this length and input polarity to be transmitted over the aggregate signal path. At the receiving end this element would be distributed to the appropriate channel and produce an element of like polarity at the output. The result of this is to transmit elements of 24 11/36 ms of a polarity determined by the channel input.

8.4 With the character store bypassed in this way the transmission of pulse signals, which may be signalling or dialling, during the setting up of a telex call is also permitted. The character store must, however, be switched into use prior to the transmission of teleprinter characters whether these are signalling or traffic.

8.5 The method of switching start-stop stores into the connection depends on the type of signalling and it may vary with the direction of calling. Normally each direction of signalling may be considered separately and the stores can be switched into the connection within a period less than one character length of the inversion to stop polarity’s being recognized, but with calls to type B dial selection systems switching must be deferred until such conversion has occurred on both signalling paths.

8.6 It seems desirable to guard against reproduction of short spurious pulses on the input line as full elements. Pulses of up to 8-10 ms should therefore be rejected. Thus pulses would result as follows:

Input to system	Multiplex aggregate	Output from system
0-9 (± |) ms of either polarity	No pulse	No pulse
9 (± |)-33 11/36 ms	1 element (24 11/36 ms)	For A polarity 45 ms For Z polarity 33 ms
33 11/36-57 11/18 ms	2 elements (48 11/18 ms)	Both polarities 48 11/18 ms

8.7 An alternative method of producing pulses, as follows, would be acceptable:

0-9 (± |) ms No pulse

9 (± |)-24 11/36 ms 1 element (24 11/36 ms) For A polarity, 45 ms

24 11/36-48 11/18 ms 1 element (24 11/36 ms) For Z polarity, 33 ms

or 2 elements (48 11/18 ms) Both polarities 48 11/18 ms

48 11/18-72 11/12 ms 2 elements (48 11/18 ms)

or 3 elements (72 11/12 ms) Both polarities 72 11/12 ms

8.8 Dial pulse trains when received within the speed and ratio limits specified in Recommendation U.2 should be regenerated within the bypass unit, to be retransmitted by the multiplex equipment when the store is bypassed with a minimum duration of Z polarity of 32-34 ms and that of A polarity of 44-46 ms. Two or more elements of either A or Z polarity should be transmitted as multiples of 24 11/36 ms and within the ratio limits specified should not exceed 73 ms for Z polarity and 98 ms for A polarity.

8.9 The type B call confirmation or proceed-to-select signal when received by the multiplex equipment within the limits specified by Recommendation U.1 should, on retransmission by the multiplex equipment, fall within the limits of 32-50 ms. The interval of A polarity between call-confirmation and proceed-to-select signals should be not less than 60 ms.

8.10 In order to discriminate between the various type B backward path signals and to preserve their duration within acceptable limits it may be necessary to delay their transmission. This delay should be kept to a minimum in all cases.

9 Standards of performance

9.1 The stability of the master oscillator controlling the timing of each group should not be worse than ± | part in 10^6.

9.2 The degree of isochronous distortion of the aggregate output should not exceed 3%. The degree of synchronous start-stop distortion of the channel output should not exceed 3%.

9.3 The receiving input margin for both the aggregate and start-stop channel input should not be less than ± | 5%.

9.4 The maximum speed error for the start-stop output signals should not be greater than ± | .5%.

10 Miscellaneous facilities

10.1 It should be arranged that when phase is lost the output of the multiplex channels becomes a continuous condition. When a channel is used for telex, the continuous condition should be A. When a channel is used for other services the condition may be Z if required.

10.2 With the exception of combination No. 32, the 6-unit equivalents to the combinations of International Telegraph Alphabet No. 2 have the first element of condition A. If the first element is received erroneously as condition Z, the character need not be rejected but may be passed to the channel output.

Note — The requirements to be met by synchronous multiplex equipment for telex and gentex operation are defined in Recommendation U.24.

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ANNEX A

(to Recommendation R.44)

Code conversion table

H.T. [T1.44]

{
Combination No.
in International
Telegraph Alphabet
No. 2
}
Code in International Telegraph
Alphabet
No. 2
(see Note 1)
}
Code in International Telegraph
Alphabet
No. 4
(see Note 1)
}
	Letter case
	{
		Figure case	{	

1	A	—	ZZAAA	AZZAAA
2	B	?	ZAAZZ	AZAAZZ
3	C	:	AZZZA	AAZZZA
4	D	Note 2	ZAAZA	AZAAZA
5	E	3	ZAAAA	AZAAAA
6	F		ZAZZA	AZAZZA
7	G	Note 2	AZAZZ	AAZAZZ
8	H		AAZAZ	AAAZAZ
9	I	8	AZZAA	AAZZAA
10	J	Note 2	ZZAZA	AZZAZA
11	K	(	ZZZZA	AZZZZA
12	L	)	AZAAZ	AAZAAZ
13	M	.	AAZZZ	AAAZZZ
14	N	,	AAZZA	AAAZZA
15	O	9	AAAZZ	AAAAZZ
16	P	0	AZZAZ	AAZZAZ
17	Q	1	ZZZAZ	AZZZAZ
18	R	4	AZAZA	AAZAZA
19	S	’	ZAZAA	AZAZAA
20	T	5	AAAAZ	AAAAAZ
21	U	7	ZZZAA	AZZZAA
22	V		AZZZZ	AAZZZZ
23	W	2	ZZAAZ	AZZAAZ
24	X	/	ZAZZZ	AZAZZZ
25	Y	6	ZAZAZ	AZAZAZ
26	Z	+	ZAAAZ	AZAAAZ
27	carriage-return	AAAZA	AAAAZA	
28	line-feed	AZAAA	AAZAAA	
29	letter-shift	ZZZZZ	AZZZZZ	
30	figure-shift	ZZAZZ	AZZAZZ	
31	space	AAZAA	AAAZAA	
32	not normally used	AAAAA	ZAAAAA	
—	phasing signal	—	ZZAAZZ	
—	signal α	permanente A polarity	AAAAAA	
—	signal β	permanente Z polarity	ZZZZZZ	

Note 1 — Symbols A and Z have the meanings defined in Definition 31.38 of Recommendation R.140.

Note 2 — See Recommendation S.4 [3].

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H.T. [T1.75]

TABLE 1/R.75

{ Number of channels in tandem within international section } The limit of bias distortion on sequences of significant intervals each having a duration of one or two unit intervals at the modulation rate employed for adjustment shall be equivalent to the following values at 50 bauds } Isochronous distortion with standardized text } Inherent start-stop distortion with standardized text }	{ { {		
2	7%	18%	13%
3	10%	24%	17%
4	12%	28%	21%
5	—	—	25%

Note 1 — The above values are valid whether the channels are amplitude-modulated or frequency-modulated.

Note 2 — The columns giving the limits for degrees of isochronous distortion and start-stop distortion on the text are not intended to establish a law relating the degree of start-stop distortion to the degree of isochronous distortion; this law of relationship depends on the constitution of the distortion (relative magnitudes of characteristics and fortuitous distortion).

Table 2/R.70 | is (a l'italienne) [T2.70], p.

Recommendation R.71

ORGANIZATION OF THE MAINTENANCE | fR OF INTERNATIONAL TELEGRAPH CIRCUITS

(former CCIT Recommendation B.30, Brussels, 1948; amended 1951 and at Geneva, 1956)

The CCITT,

considering

that, in order to ensure satisfactory cooperation between Administrations and private telegraph operating agencies interested in the maintenance of international telegraph circuits, and in order to ensure the maintenance of satisfactory transmission in the international telegraph service, it is necessary to unify the essential action to be taken for the establishment and maintenance of international telegraph circuits,

unanimously declares the view

1 Periodical maintenance measurements should be taken on international voice-frequency telegraph (VFT) systems, and documents relating to such measurements should be exchanged.

2 The responsibilities for the maintenance of satisfactory transmission, and (as and when necessary) the removal of faults on an international VFT system should be assumed by one of the terminal stations of the system to be known as the *system control station.* The said station is to be appointed for the purpose by the Administrations and private telegraph operating agencies concerned on the occasion of the establishment of the VFT system concerned. The system control station is to be entrusted with coordination of the execution of the maintenance measurements to which § 1 above relates.

3 The responsibilities for the maintenance of satisfactory transmission, and (as and when necessary) the removal of faults on an international telegraph system should be allocated between the different stations concerned as indicated below.

3.1 One station of the circuit should assume the principal responsibility for the maintenance of satisfactory service on the circuit. The station in question should be known as the *control station* .

3.2 This station should be equipped with testing equipment to enable it to make telegraph transmission measurements and in this connection it exercises an executive control over all the other stations on the circuit.

3.3 It should be appointed by agreement between the Administrations concerned on the occasion of the establishment of the telegraph circuits concerned. It should be, wherever possible, one of the terminal stations of the circuit, save in so far as otherwise agreed by the services concerned. For example, in the case of VFT circuits, the control station should be one of the terminal VFT stations as nominated by common agreement between the Administrations concerned.

3.4 The control station is responsible for coordinating all operations required when there is a breakdown in the circuit. It keeps a record of all circuit breakdowns. To facilitate supervision, a reference number must be allocated to each breakdown reported.

3.5 When a fault comes to the notice of another station on the circuit, this station should take steps to secure suitable action on the part of other stations concerned; but the control station is nevertheless responsible for ensuring that the fault is cleared as soon as possible.

3.6 The control station should be in a position to furnish all requisite information in reply to inquiries on the subject of faults — e.g. in regard to the time of any fault, the location of the fault, the orders given for dealing with it and the times of restoration of the circuit.

3.7 In order, however, to increase the flexibility of the organization and the rapidity of the removal of faults, the control station will confine itself in each foreign country to securing the cooperation of a station to be known as the *sub-control station* of the circuit. The sub-control station should assume, within its own territory, the responsibilities indicated above in the case of the control station and should therefore be equipped with testing equipment to enable it to make telegraph transmission measurements. Such delegation of responsibility shall not affect the authority of the control station, with which the primary responsibility for the maintenance of satisfactory service on the circuit will continue to rest.

3.8 The sub-control station shall be appointed by the technical service of the Administration concerned. It shall furnish detailed information to the control station regarding faults occurring in its own country.

4 Administrations or private recognized telegraph operating agencies shall be free to organize the maintenance measurements on those portions of international point-to-point circuits and switched connections (including apparatus) that lie wholly within their control, but the methods adopted should be not less efficacious than those recommended for international circuits.

5 To facilitate the control of tests, circuits shall be divided into *test sections* (parts of a circuit between two telegraph stations). Each section shall be under the control of a *testing station* responsible for the localization and removal of faults on the section concerned. The testing station shall furnish detailed information as to the faults occurring in the section under its control to the sub-control station (or, if necessary, the control station).

6 In the case of VFT channels, each channel shall constitute a test section. The testing station will in this case be the principal VFT station at the end of the section concerned.

Recommendation R.72

PERIODICITY OF MAINTENANCE MEASUREMENTS TO BE CARRIED OUT ON THE CHANNELS OF INTERNATIONAL VFT SYSTEMS

(former CCIT Recommendation B.34, 1951; amended at New Delhi, 1960

and Geneva, 1964)

The CCITT,

considering

that, for technical supervision of operations, maintenance measurements on international voice-frequency telegraph (VFT) channels are necessary,

unanimously declares the view

(1) that maintenance measurements be carried out on international VFT channels once every three months (once every six months for 50-baud channels spaced at 240 Hz conforming to Recommendation R.35 **|** fIbis);

(2) that there is no need to carry out measurements more frequently on channels making up long circuits or circuits used in a switched network;

(3) that, when it is observed that the number of maladjustments is too high, supplementary measurements should be performed by agreement between the Administrations concerned.

Recommendation R.73

MAINTENANCE MEASUREMENTS TO BE CARRIED OUT ON VFT SYSTEMS

(former CCIT Recommendation B.35, 1951; amended at New Delhi, 1960;

Geneva, 1964; Mar del Plata, 1968 and Malaga-Torremolinos, 1984)

The CCITT,

in view of

Recommendation R.72 on the periodicity of maintenance measurements to be made on international voice-frequency telegraph (VFT) channels,

considering

that it should be clearly laid down what maintenance measurements are indispensable to ensure the correct operation of VFT channels, *unanimously declares the view*

(1) that maintenance measurements and any necessary adjustments of *amplitude-modulated* VFT channels should be made in the following order:

a) the power supply voltages;

b) the value of the frequency transmitted to line by the channel;

c) the output level of each send filter in condition Z and in condition A;

d) the output level of each send filter after the control current has been interrupted;

e) the output level of each receive filter in condition Z;

f) the degree of distortion with sequences of significant intervals each having a duration of one or two unit intervals. (It would be advisable for this measurement to be made at normal, maximum and minimum levels. All the modifications of level should be made after the receive filter.) The measurement and adjustments may be first carried out on local and then on line, or on line only, so as to minimize the degree of distortion;

g) the receiving relay if any (if the results obtained at point f) should make this desirable);

h) the threshold of the receiver;

i) the degree of distortion, in accordance with the method described in Recommendation R.5 and bearing in mind § (1) and § (2) of Recommendation R.74;

(2) that maintenance measurements and any necessary adjustments of *frequency-modulated* VFT channels should be made in the following order:

a) the power supply voltages;

b) the values of the frequencies transmitted to line by the channel;

c) the frequency emitted after the control current has been interrupted;

d) the output levels of each send filter for the characteristic frequencies A and Z;

e) the output levels of each receive filter for the characteristic frequencies A and Z, if possible;

f) the frequency drift, if the channel is used for this measurement (see below);

g) the degree of distortion with sequences of significant intervals each having a duration of one or two unit intervals; the measurement and adjustment should be first carried out on local and then on line, or on line only, so as to minimize the degree of distortion;

h) the receiving relay, if any;

i) the threshold of the receiver (at blocking);

j) the degree of distortion, in accordance with the method described in Recommendation R.5 and bearing in mind § (1) and § (2) of Recommendation R.74.

The measurement referred to in f) above must be carried out to check, where necessary, whether there is any frequency drift on the VFT bearer circuit by measuring the pilot frequency when the system is operated with one; otherwise, Administrations should agree to measure a characteristic frequency at the output of the line for a mutually determined channel. The result of this measurement will be compared with the result of the measurement made when this frequency is sent; the difference will show any drift due to transmission on the VFT bearer circuit;

(3) that, unless otherwise specified, the measurements should be effected at the nominal modulation rate of the channel (50, 100 or 200 bauds). However, if a 100-baud channel is operated with a rate of 50 bauds, in accordance with Recommendation R.35 | fIbis , the measurements should be effected at the rate of 50 bauds and adjustments made if the limits mentioned for 50 bauds in Recommendation R.57 are no longer respected;

(4) that the results of the measurements made on the international channels should be exchanged directly by telegraph or telephone between the measuring stations, at the request of one of these stations;

(5) that, since maintenance work is a cause of interference on circuits in service, maintenance measurements should be made outside busy hours as far as possible;

(6) that, when maintenance measurements are carried out on circuits in operation, every precaution should be taken in accordance with Recommendation R.76 to avoid disturbances.

Recommendation R.74

CHOICE OF TYPE OF TELEGRAPH DISTORTION-MEASURING EQUIPMENT

(former CCIT Recommendation B.52, Geneva, 1956;

amended at Geneva, 1964 and 1980)

The CCITT,

in view of

Recommendation R.90,

considering

(a) that measurements of isochronous distortion made with the text specified in Recommendation R.51 **|** fIbis should normally be applied to code-independent telegraph channels;

(b) that it may in principle be desirable to measure the distortion of telegraph channels in terms of start-stop distortion;

(c) that all important terminals of voice-frequency telegraph systems are equipped with isochronous distortion-measuring equipment and that their replacement by start-stop instruments would be expensive,

unanimously declares the view

(1) that, for the maintenance of code-independent telegraph channels, isochronous distortion measuring equipment should normally be used;

(2) that Administrations may nevertheless, by common consent, use for this purpose start-stop distortion measuring equipment,

considering also

(d) that measurements of the quality of start-stop signals cannot normally be made without start-stop distortion measuring equipments;

(e) that the planning and establishment of telegraph networks are to be judged in terms of conventional degrees of start-stop distortion, and that degrees of start-stop distortion may also prove to be the best basis for calculations of the summation of degrees of distortion and for calculation of conventional start-stop distortion;

(f) that, for the maintenace of telegraph channels incorporating code-dependent systems, start-stop test equipment is essential,

unanimously declares the view

(3) that all international switching and testing centres (ISTCs) should be equipped with start-stop distortion-measuring equipment.

Blanc

Recommendation R.75

MAINTENANCE MEASUREMENTS ON CODE-INDEPENDENT | INTERNATIONAL SECTIONS

OF INTERNATIONAL TELEGRAPH CIRCUITS

(former CCIT Recommendation B.44, Arnhem, 1953;

amended at New Delhi, 1960, and at Geneva, 1980

and Malaga-Torremolinos, 1984)

The CCITT,

in view of

Recommendations R.50, R.57 and R.90,

considering

(a) that, for the technical supervision of international telegraph circuits, it is necessary to make periodic measurements of distortion on their international sections when they are made up of two or more channels;

(b) that certain Administrations consider it desirable to have available apparatus for making simple measurements automatically and periodically, giving an indication of the performance rating and transmitting an alarm when this rating exceeds the limits permitted for automatic switched channels,

unanimously declares the view

(1) that it is desirable to make distortion measurements every three months on the international sections of international telegraph circuits made up of at least two channels;

(2) that these measurements should be made at a modulation rate of 50 bauds;

a) with sequences of significant intervals each having a duration of one or two unit intervals,

b) preferably with the standardized text specified in Recommendation R.51 **|** fIbis ;

(3) that the values shown in Table 1/R.75 for the inherent distortion in service (extracted from Recommendation R.57) must not be exceeded on the international section of a telegraph circuit;

H.T. [T1.75]
TABLE 1/R.75

{ Number of channels in tandem within international section }	{ The limit of bias distortion on sequences of significant intervals each having a duration of one or two unit intervals at the modulation rate employed for adjustment shall be equivalent to the following values at 50 bauds }	{ Isochronous distortion with standardized text }	{ Inherent start-stop distortion with standardized text }
2	7%	18%	13%
3	10%	24%	17%
4	12%	28%	21%
5	—	—	25%

Note 1 — The above values are valid whether the channels are amplitude-modulated or frequency-modulated.

Note 2 — The columns giving the limits for degrees of isochronous distortion and start-stop distortion on the text are not intended to establish a law relating the degree of start-stop distortion to the degree of isochronous distortion; this law of relationship depends on the constitution of the distortion (relative magnitudes of characteristics and fortuitous distortion).

Table 1/R.75 [T1.75], p.145

(4) that these values do not take into account the possibility of regenerative repeaters or other code-dependent systems in the international section;

(5) that, in future, measurements made with the apparatus mentioned in (b) above will no doubt make it possible to eliminate the maintenance measurements referred to above.

Recommendation R.75 | fR *bis*

MAINTENANCE MEASUREMENTS OF CHARACTER ERROR RATE ON | INTERNATIONAL

SECTIONS OF INTERNATIONAL TELEGRAPH CIRCUITS

(Malaga-Torremolinos, 1984)

The CCITT,

in view of

Recommendations R.51 | fIbis | and R.54,

considering

(a) that, for the technical supervision of international telegraph circuits, it is necessary to make periodic character error rate measurements on their international sections when they are made up of two or more channels;

(b) that certain Administrations consider it desirable to have available apparatus for making simple measurements automatically and periodically, giving an indication of the performance rating and transmitting an alarm when this rating exceeds the limits permitted for automatic switched channels,

unanimously declares the view

(1) that it is desirable to make character error rate measurements after commissioning the transmission system and for maintenance purposes on the international sections of international telegraph circuits made up of at least two channels;

(2) that these measurements should be made at the nominal modulation rate of the circuit under test preferably with the stardardized text specified in Recommendation R.51 | fIbis ;

(3) that it is desirable to define the effective net margin as follows:

a) for regenerative equipment use the appropriate Recommendation,

b) non-regenerative equipment, error rate tests should use a margin of no less than 40% and should be made in conjunction with distortion measurements.

Note — Recommendation R.54 gives an allowable character error rate of 3 per 100 | 00 for the complete circuit. The proportion of this character error rate allowable on the international section only is for further study.

Recommendation R.76

RESERVE CHANNELS FOR MAINTENANCE MEASUREMENTS

ON CHANNELS OF INTERNATIONAL VFT SYSTEMS

(former CCIT Recommendation B.38, 1951; amended at Geneva, 1964)

The CCITT,

considering

that it is desirable that maintenance measurements on the channels of international voice-frequency telegraph (VFT) systems should disturb communications as little as possible,

unanimously declares the view

(1) that, whenever possible, measurements on a working channel of a VFT system should be carried out only after the channel concerned has, if necessary, been replaced by a spare channel;

(2) and to this end, the CCITT considers that it is desirable that one channel should be reserved for this purpose in each VFT system.

(3) When this change is not possible, the channel user will be informed in advance that measurements or tests are about to be carried out on his circuit.

Recommendation R.77

USE OF BEARER CIRCUITS FOR VOICE-FREQUENCY TELEGRAPHY

(former CCIT Recommendation B.39, Brussels, 1948;

amended at New Delhi, 1960 and Mar del Plata, 1968)

1 Composition and nomenclature

Figure 1/R.77 illustrates the composition of an international voice-frequency telegraph (VFT) system and the nomenclature used.

2 The international voice-frequency telegraph system

2.1 This is the whole of the assembly of apparatus and lines, including the terminal VFT equipment. In Figure 1/R.77 the system illustrated provides 24 duplex international telegraph circuits but other numbers of telegraph circuits can be provided.

2.2 *The international VFT bearer circuit*

2.2.1 Four-wire telephone-type circuits are used as VFT bearer circuits. The circuit comprises two unidirectional transmission paths, one for each direction of transmission, between the terminal VFT equipments.

2.2.2 The VFT bearer circuit consists of an international line together with any terminal national sections connecting the international line to the VFT terminal equipment and may be constituted entirely on carrier channels (on symmetric pair, coaxial pair or radio-relay systems) or an audio-frequency lines or combinations of such lines.

See also Recommendation M.800 [1].

Figure 1/R.77, (M), p.

2.2.3 VFT bearer circuits have no terminating units, signalling equipment or echo suppressors.

2.3 *The international line of a VFT bearer circuit*

2.3.1 The internaional line of a VFT bearer circuit may be constituted by using a channel in a carrier group or channels in tandem on a number of groups. National and international sections can be interconnected to set up an international line. See Figure 1/R.77 but note that § 2.3.2 below details the preferred method. The international line could equally well be set up between, for example, only A and C or between C and D, in which case A and C, or C and D would be the terminal international centres.

2.3.2 Wherever possible an international line for a VFT bearer circuit should be provided on channels of a single carrier group, thereby avoiding intermediate audio-frequency points. In some cases, such a group may not exist or, for special routing reasons, it may not be possible to set up the international line in the preferred way. In such cases, the international line will consist of channels in tandem on two or more groups with or without audio sections, depending on the line available and the routing requirements.

2.4 *Terminal national sections connected to the international line of a VFT bearer circuit*

In many cases the VFT terminal equipment is remote from the terminal international centre of the international line (Figure 1/R.77), and such cases necessitate the provision of terminal national sections in order to establish international VFT bearer circuits. These sections may be in short-distance local audio cables, amplified or unamplified, or may be routed in long-distance carrier groups or amplified audio plant as available.

3 Reserve arrangements for international VFT bearer circuits

3.1 *General*

3.1.1 All necessary action should be taken to enable the duration of interruptions on international VFT bearer circuits to be reduced to a minimum and, for this purpose, it is expedient to standardize some of the methods to be adopted for replacing defective portions of the circuit.

3.1.2 Although it does not appear necessary for these methods to be the same in detail in every country, it would be advisable to reach agreement regarding the general directives to be followed.

3.1.3 The make-up of the reserve VFT bearer circuits will in general be similar to that of the normal VFT bearer circuits. However, if the VFT terminal equipment is not located at the terminal international centres, the line portion of an international telephone circuit can be used to replace only the international line of the VFT bearer circuit.

3.2 *Reserve international lines*

3.2.1 Wherever possible a reserve international line should be provided between the two terminal international centres by means of the international line of an international telephone circuit (between A and B in Figure 1/R.77).

3.2.2 The telephone circuit used as a reserve should be chosen wherever possible so as to follow a different route from that of the normal international line. Where this cannot be done, as much as possible of the circuit or its sections should be alternatively routed.

3.2.3 If there is a choice, the use of manually-operated circuits as reserve lines for VFT is technically and operationally preferable to the use of automatic circuits. It should be possible after prior agreement between the controlling officers at the international terminal exchanges concerned for an operator to break into a call in progress to advise the correspondents that the circuit is required and that the call should be transferred to another circuit if it lasts longer than six minutes.

3.2.4 If the reserve telephone circuit is automatic or semi-automatic a direct indication should be given at the changeover point. If it is not available when needed the reserve circuit should be blocked against any further call.

3.3 *Reserve sections for the sections of the international VFT bearer circuit*

3.3.1 Where it is not possible to provide reserve international circuits either because there are no suitable telephone circuits or because the number of telephone circuits does not permit the release of a circuit for reserve purposes, reserve sections should be provided wherever possible for each of the component sections. For these sections, national or international telephone lines or, where they exist, spare channels, circuits, etc., should be used.

3.4 *Reserve arrangements for the terminal national sections connecting the VFT terminal equipment to the international line*

3.4.1 Reserve sections should be provided by means of national telephone circuits or by the use of spare channels, particularly in the case of long sections and of sections forming part of a category B VFT bearer circuit (see [2]).

3.5 *Changeover arrangements from normal to reserve lines*

3.5.1 When an international telephone line (i.e. part of an international telephone circuit) is used to provide a reserve for the international line (or for one of its sections as mentioned in § 3.3 above), there should be changeover arrangements to enable the changeover from the normal line to the reserve line to be made as rapidly as possible. The changeover arrangements (Figure 2/R.77) should be such that on changeover, all signalling equipment, echo suppressors, etc., associated with the telephone circuit that is used as a reserve for the international line, are disconnected on the line side. When the fault is cleared on the normal line, it should be possible to join it to the signalling equipment, echo suppressors, etc., and put it into service as part of the telephone circuit until the agreed time for the restoration of the line to the normal routing. It is desirable to introduce as little disturbance as possible when changing back from reserve to normal. Arrangements of cords and parallel jacks can be devised to achieve this.

3.5.2 The changeover arrangements shown in Figure 2/R.77 could be applied to sections of the international line mentioned under § 3.3 above when it is not possible to obtain an overall reserve for the international line. Normal sections and the corresponding reserve sections should be routed via suitable changeover arrangements at the stations concerned.

Figure 2/R.77, (M), p.

3.5.3 Should the alarm indicating that the VFT bearer circuit is faulty be received by a station other than the group control station, this other station shall interrupt the return direction of the alarm channel towards the group control station in order to advise the latter to take the necessary action.

3.5.4 Making manual, automatic or semi-automatic international telephone circuits available for reserve circuits for voice-frequency telegraphy should be in accordance with the instructions issued and the arrangements made by the respective Administrations. Should the normal and reserve lines both be faulty, the technical services of the Administration concerned should take immediate joint action to find a temporary remedy.

3.6 *Designation and marking*

3.6.1 Normal and reserve circuits, etc., should be clearly distinguishable from other circuits both from the point of view of designation (see Recommendation M.140 [3]) and marking (see Recommendation M.810 [4]).

References

[1] CCITT Recommendation *Use of circuits for voice-frequency telegraphy* , Rec. M.800.

[2] CCITT. White Book, Preface to Vol. IV, ITU, Geneva, 1969.

[3] CCITT Recommendation *Designation of international circuits, groups, etc.* , Rec. M.140.

[4] CCITT Recommendation *Setting-up and lining-up an international voice-frequency telegraph link for public telegraph circuits (for 50, 100 and 200 baud modulation rates)* , Rec. M.810.

Recommendation R.78

PILOT CHANNEL FOR AMVFT SYSTEMS

(former CCIT Recommendation B.43, Arnhem, 1953;

amended at New Delhi, 1960)

The CCITT,

considering

(a) that use of a pilot channel is suggested to give an alarm in the case of an abnormal drop in the receiving level of the bearer circuit in amplitude-modulated voice-frequency telegraph (AMVFT) systems;

(b) that service channels could have been used as pilot channels for this alarm signal, but since there is not always a service channel in each VF group, it is suggested that channels be chosen for the alarm signal,

unanimously declares the view

(1) that it is advisable to use a pilot channel to give an alarm in the case of an abnormal drop in the receiving level of the bearer circuit carrying an AMVFT system;

(2) that the level at which the alarm should work should be fixed by the Administration at the receiving end;

(3) that the pilot channel frequency should, as far as possible, be 300 Hz, transmitted with a power level corresponding to that of a frequency-modulated channel in accordance with Table 1/R.35;

(4) that, if such an arrangement cannot be adopted, the Administrations concerned should agree on the use of one of the standardized frequencies for the pilot channel used for alarm purposes.

Note — The case of 50-baud frequency-modulated systems is dealt with Recommendation R.35.

Recommendation R.79

AUTOMATIC TESTS OF TRANSMISSION QUALITY

ON TELEGRAPH CIRCUITS BETWEEN SWITCHING CENTRES

(Previous Recommendation R.79 — Mar del Plata, 1968: amended at

Geneva, 1972, 1976, 1980 and Malaga-Torremolinos, 1984 and R.79 | is,

Geneva, 1976; amended at Geneva, 1980 and Melbourne, 1988)

The CCITT,

considering

(a) that maintenance measurement on a telegraph circuit made in the course of routine maintenance measurements takes a relatively long time to carry out and occupies staff at both ends of the circuit. This applies as much to circuits in a satisfactory condition (the majority of cases) as to faulty circuit;

(b) that automatic tests of the transmission quality on telegraph circuits between switching centres can be organized without intervention of personal;

(c) that transmission characteristics for international links are contained in Recommendation R.58;

(d) that the specification of muldexes is given for MCVFT equipment in the R.30-Series of Recommendations and for TDM equipment in the R.100-Series of Recommendations;

(e) that tests of TDM telegraph channels are possible using maintenance loops according to Recommendation R.115;

(f) that standardized texts for distortion testing are given in Recommendations R.51 and R.51 | fIbis ; and

(g) that the signalling aspects are contained in the U-Series of Recommendations,

unanimously declares the view

(1) that Administrations (or recognized private operating agencies) may organize between international switching and testing centres (ISTCs) an automatic maintenance test service for testing the international trunk circuits of telex and Gentex networks with automatic switching consisting of one or two multi-channel code independent transmission links connected in tandem;

(2) that automatic maintenance tests of telegraph circuits should be based on the following principles:

1 Purpose of automatic tests

1.1 The purpose of automatic testing is to make it possible to perform rapid tests; circuits found to be ‘‘satisfactory’’ in the course of these will not be subjected to full maintenance tests and the maintenance staff can thus concentrate on making full tests of circuits identified as ‘‘doubtful’’ during the rapid tests.

1.2 Automatic tests should be organized in such a way that at least at one end of the group of circuits under test, no staff is required. This end of the circuit will then be said to be ‘‘in the passive position’’, while the end initiating the tests will be said to be ‘‘in the active position’’.

For these tests it is necessary to distinguish between trunks including regenerative equipment and those without. Tests on trunks were no regeneration is involved are dealt with in § 2. Tests on trunks where regeneration is involved are dealt with in § 3.

Note 1 — Unless stated otherwise, the end of the circuit in the active position will be denoted by the letter A and the end of the circuit in the passive position by the letter B throughout this Recommendation.

Note 2 — Where regenerative and non-regenerative sections of the telegraph circuits are connected in tandem (e.g. national extension DT in Figure 3/R.79) the tests to be conducted shall be defined in the framework of bilateral agreements.

2 Test of transmission quality of non-regenerative telegraph circuits

2.1 *Introduction*

2.1.1 This test method is intended for trunks set up with code-independent transmission systems. Figure 1/R.79 presents a typical block diagram for this case. Station A is in active position and station B in passive.

2.1.2 The tests shall consist of measurements of the degree of gross start-stop distortion made independently in each direction of transmission of the trunk circuit with the test text chosen.

2.1.3 The tests shall check that, on each transmission direction of the circuit, the degree of gross start-stop distortion measured does not exceed a level called the ‘‘decision level’’, which is established at 10% if the circuit consists of a single code independent transmission link or at 14% if the channel consists of two code independent transmission links in tandem. The degree of gross start-stop distortion at the transmission end shall not exceed 0.5% and the tolerance for the decision level at the receiving end shall not exceed 0.5%.

2.2 *Circuits tested*

2.2.1 It must be possible for the end of the circuit in the active position to be connected up automatically with the automatic testing equipment at the passive end. Rapid automatic tests should therefore only be envisaged over circuits connected at the incoming end to an automatic circuit switching centre, i.e. on circuits of the telex and Gentex networks.

2.2.2 For practical reasons, which will be explained later, tests are limited to circuits connecting two international switching centres. No tests are envisaged for the time being on chains of circuits set up through a transit switching centre.

2.2.3 If a trunk circuit system between two centres A and B is divided into groups of circuits made up, say, of a group of circuits confined to traffic from A to B, a group of circuits confined to traffic from B to A and a group of both-way circuits, station A can be in the active position only for the both-way circuits and the circuits confined to traffic from A to B; and, vice versa, station B will be active for tests concerned with traffic from B to A and may also be active on both-way circuits.

2.2.4 Separate tests must be made in each direction of transmission of the circuit being tested since, if tests are made in the two directions in tandem, an inadmissible bias distortion on the forward path can be masked by a bias distortion of opposite sense on the backward path.

2.2.5 The test is carried out over only one circuit of a trunk group. The test of the next circuit begins when the last circuit tested can be used for traffic.

2.2.6 The automatic tests should take place in a slack period. To prevent collision between two international centres A trying to seize the same passible station B at the same time, a timetable for the automatic tests should be established by the Administration concerned to enable Administrations to have access to a particular passive station one after the other.

2.2.7 To make sure that circuits that are busy when due to be tested, or on which busy conditions from the distant network are encountered when testing, are not overlooked during automatic testing, the Administrations concerned shall agree on when new attempts should be carried out on these circuits.

2.3 *Test station equipment*

An automatic measurement station will consist of two main groups of equipment (see Figure 1/R.79):

2.3.1 A transmission unit consisting of a test transmitter TT and a test analyser TA. The test analyser will be adjusted to a particular degree of distortion, called the decision level, in such a way that if the latter value is exceeded in the signals received during the measurement, the transmission channel being tested will be classified as ‘‘doubtful’’; otherwise it will be classified as ‘‘satisfactory’’. (To allow for very occasional distortion of a fortuitous nature, it would be useful to classify a channel as ‘‘doubtful’’ only if the decision level is exceeded twice during the measurement.)

Figure 1/R.79, (N), p.

2.3.2 A switching unit for access operations; selection and signalling on the A-to-B circuit to be operated in accordance with the characteristics of switching centre B, checking at station A the call-connected signal originating at station B; receiving the call, transmitting the call-connected signal and the identification signals when the station is in the passive position.

2.3.3 In an ISTC, a station is normally in the passive condition. In this condition it can be seized by an incoming call for automatic tests and can participate in these tests without the intervention of an operator.

2.4 *Test text : decision levels and decision signals*

2.4.1 The texts chosen for the tests by bilateral agreement between Administrations are given in Recommendations R.51 (Q9S) and R.51 **|** fIbis (QKS).

Note 1 — For tests over circuits with regeneration of telegraph signals, the use of the test pattern of Recommendation R.51 (Q9S) is only possible when the pattern is modified such that an average character length of at least 150 ms is maintained.

Note 2 — It should be noted there there is equipment in use that applies the test text specified in Recommendation R.51 (the Q9S text) but with 1.5 units stop element length.

Note 3 — In some cases predistorted test signals may be used by Administrations for testing code independent transmission systems.

2.4.2 The choice of the decision level is complicated by the fact that, while most international telex or Gentex circuits are made up of a single voice-frequency telegraph (VFT) channel, these are also links in which these circuits consist of two VFT channels in tandem. International circuits consisting of three interconnected VFT channels in tandem are very rare and can be ignored as far as the organization of automatic maintenance tests is concerned (which means that these circuits can only with difficulty be subjected to automatic maintenance tests).

2.4.3 Recommendations R.57 and R.58 specify the following values for the limit of inherent start-stop distortion on standardized texts:

a) 8% for a switched network circuit consisting of a single VFT channel;

b) 13% for a switched network circuit consisting of two VFT channels.

2.4.4 The following decision levels are recommended:

a) 10% for a circuit consisting of a single VFT channel or equivalent;

b) 14% for a circuit consisting of 2 VFT channels or equivalent.

These decision levels for automatic tests are slightly in excess of the limits given in § 2.4.3 in order to give a greater assurance that the circuits identified are genuinely ‘‘doubtful’’ and also because automatic tests can be more stringent than manual tests which can give rise to optimistic results due to missed peaks.

2.4.5 Distortion tests on the backward signalling path will commence as soon as possible after the start of the test signals on the forward signalling path.

2.4.6 The test check results made at the passive station will be sent to the active station by means of the following decision signals:

a) combination No. 20 (letter T) of International Telegraph Alphabet No. 2 (ITA2) for an affirmative reply (satisfactory channel AB of the circuit);

b) combination No.22 (letter V) for a negative reply (doubtful channel AB of the circuit).

2.5 *Method of access and identification signals*

2.5.1 The circuits to be tested will be seized at the output of the switching equipment of A. A seized circuit will be market ‘‘busy’’ for outgoing calls from switching unit A (and at switching equipment B in the case of a both-way circuit). Station A will call test station B on the circuit seized for the test in accordance with the selection and signalling system applicable to calls from A to B.

2.5.2 In choosing between measurements with a decision level of 10% or of 14%, one of the following principles can be selected by bilateral agreement.

a) For automatic maintenance tests between SPC type switching systems the decision level is contained in the trunk group description table of both stations; one access number to station B is sufficient.

b) If station B is not of SPC-type the receive decision level can be determined from the identification sequence of station A, as explained in § 2.5.8. There is only one access number to station B in this case.

c) For other switching systems station B may be given two access numbers, one for access to the 10% decision level and another one to access the 14% decision level.

These call numbers must be as short as possible and they should if possible be chosen from among the service position numbers. The call numbers for access to the test analyser should if possible be the same for both telex and Gentex circuit tests.

2.5.3 Safeguards against seizure of test stations by telex subscribers are strongly recommended. It is also recommended that calls made in connection with automatic tests should not be included in traffic accounting on the international circuits.

2.5.4 It would be useful if the outgoing access could be so arranged as to include the supervisory and other elements normally associated with the trunk circuits used for calls to make sure that these elements are not subject to faults liable to have an adverse effect on transmission. It is considered that normal switching equipment should be used to permit access to the testing equipment at the incoming end of the circuits. This will obviate the need for special access equipment and enable normal signalling functions to be tested in addition to transmission performance.

2.5.5 If station A wishes to initiate automatic tests on an AB circuit (i.e. one permitting a call from centre A to centre B), station A:

i) Goes into the active position.

ii) Checks that the AB circuit to be tested is not being used by switching unit A for a call and, if it is free, seizes this circuit on the outgoing side of switching equipment A. This seizure of the AB circuit marks the latter as busy for outgoing calls from switching unit A.

iii) Calls the automatic testing station B in accordance with the selection and signalling system to be used on circuit AB.

2.5.6 As soon as station B, in the passive position, is seized by the call, it sends the call-connected signal. This will be followed by the identification sequence (either automatically returned or returned in response to the WRU sent by station A) and then by the RFT signal [consisting of 4 x combination No. 11 (K) of ITA2] with a delay not exceeding 500 ms after the end of the preceding block.

2.5.7 The identification of the station obtained should be indicated by the return of an answerback consisting of:

— letter-shift, carriage-return, line-feed, one or two letters representing the telex network identification code of the country of the station and space;

— the letters MAT;

— the figures 00 if station B is reached by one access number as outlined under item b) of § 2.5.2 or the figures 10 or 14 in the other cases depending whether equipment with 10% or a 14% decision level adjustment is involved.

For networks that have to send an answer-back in accordance with Recommendation S.6 [1], the requisite additional letter shifts will be added.

2.5.8 If two access numbers are used to access the measuring equipment of station B, the characters indicating the decision level in the answerback return by station A may be replaced by figure shifts.

When only one access number is provided at station B and when the decision level can not be obtained from tables related to the trunk circuits that are to be tested, then station B has to solicit the identification of station A, containing either figure 10 or 14 corresponding to the decision levels involved, after sending its own identification containing the figures 00.

The passive station, on receipt of identification, shall adapt itself to the required received decision level.

2.5.9 Station A will receive the call-connected signal, the identification code and the RFT signal. It may be necessary either as part of the normal signalling requirements of network B or because station B uses station A's identification to adapt itself to the required decision level for network B to sent the WRU signal to network A. Station A will always return its identification in response to the WRU signal. Station B will delay transmission of the RFT signal until the identification code has been received in response to the WRU signal. The RFT signal will be sent with a delay not exceeding 500 ms after the last character of this block has been received.

2.5.10 The identification codes returned by station A will correspond to those described under § 2.5.7 above. If two access numbers are used to access the measuring equipment of station B, the characters indicating the decision level in the identification code returned by station A may be replaced by figure shifts. For networks that have to send an answer-back in accordance with Recommendation S.6, the requisite additional letter-shifts will be added.

2.6 *Test procedure*

2.6.1 The transmission tests will be carried out with 6 cycles of test signals (see Figure 2/R.79).

2.6.2 Having verified that the RFT signal is correct, station A will then send six cycles of test signals with a delay not exceeding 500 ms from the end of the reception of the RFT signal. In the event that the block of signals representing the RFT signal proves to be erroneous or the signal was not received in the time permitted the circuit under test will be indicated as doubtful.

2.6.3 Station B shall begin to transmit six cycles of test signals on the BA channel, as soon as the first test signal is received.

2.6.4 The test analyser of station B will check whether or not the degree of distortion on the test signals received at B has exceeded the decision level, If it has not, station B will send the signal T of ITA2 over channl BA. If it has, station B will send signal V of ITA2 over the BA channel 500 ms (± | 0%) shall elapse between the end of the transmission at B of the last test cycle and the beginning of decision signal V or T.

2.6.5 The test analyser of station A will check whether the degree of distortion of the test signals received at A exceeds the decision-level. The decision will be indicated locally at A.

2.7 *Clearing procedure*

2.7.1 After receiving signal V or signal T, station A will send the clearing signal to B within 500 ms. Any call set up for the automatic testing of a circuit shall be automatically cleared if it lasts longer than 30 s. The circuit on which a call has been released in this manner will be marked doubtful for further examination.

Figura 2/R.79 (N), p.

3 Test of transmission quality of telegraph circuits when regeneration of the telegraph signals is involved

3.1 *Introduction*

There are various possible combinations of regenerative and non-regenerative sections on a telegraph circuit, including exchanges. Only if the last section in one direction is non-regenerative the test according to § 2 can give information about faulty circuits.

In these cases the use of the tests in §§ 2 and 3 (either one or both of them) in either direction of the telegraph circuit can be used by bilateral agreement.

3.2 *Integrated muldexes*

The introduction of new equipment in the telex network makes it possible to regenerate the telegraph signal in the muldex equipment (e.g. R.101 equipment).

The muldex equipment can be located either (Figure 3/R.79):

— externally to the switching equipment (access then being on a channel-by-channel basis)

— or form an integral part of the switching equipment (access then being a multiplexing frame and switching consisting of a transfer of time slots from one frame to another).

Note — If the external muldex or exchange is without distortion supervision facility it may be needed to carry out distortion measurements according to § 2 on some part of the circuit which can be exposed to transmission errors caused by distortion (e.g. DT in Figure 3/R.79).

Figure 3/R.79 (N), p. 16

3.3 *Test method*

Regeneration of the telegraph signal makes it pointless to carry out distortion measurements. Instead:

— to verify the quality of the circuits the bit error rate shall be monitored.

— and to verify the traffic switching capabilities a test call shall be made.

To ensure a proper end-to-end function of circuits with regeneration, two complementary methods may be used (to be defined in the framework of bilateral agreements):

3.3.1 To provide permanent supervision of the link either by:

a) supervision of the synchronisation bits as described in Recommendation R.101 or by

b) supervision of the bits which are sent on a test and maintenance channel in the muldex conveying the telegraph circuits.

3.3.2 To set up automatic tests on a complete link outside busy periods two method are possible:

a) by automatic calls on every circuit to a designated terminal on the remote exchange, and by verifuing the terminal's answerback;

b) in line with the general rules of § 2 but limiting the tests to text monitoring only.

The text consists of QKS signals (or Q9S — with 150 ms average character length) and shall be sent for a duration of one minute.

If the test shows one or more errors the test will be repeated. If the second test also detects errors, the circuit is declared doubtful.

Recommendation R.80

CAUSES OF DISTURBANCES TO SIGNALS IN VFT CHANNELS

AND THEIR EFFECT ON TELEGRAPH DISTORTION

(former CCIT Recommendation B.41, 1951;

amended at Arnhem, 1953 and Geneva, 1956 and 1964)

The CCITT,

considering

(a) that the great majority of international telegraph circuits are routed on voice-frequency telegraph (VFT) channels;

(b) that VFT channels are liable to disturbance from the following causes:

i) variations in the voltage and frequency of the source of telegraph carrier frequency due to variations in the power supply, and variations in the signalling load in the case where the carrier source supplies several channels;

ii) abrupt or gradual changes in the transmission equivalent of the telephone-type circuit;

iii) intelligible crosstalk from other telephone-type circuits, particularly near-end crosstalk;

iv) unintelligible crosstalk resulting from the cross-modulation of telephone-type circuits when operated by carrier currents;

v) noise induced from electrical power and traction systems;

vi) telegraph crosstalk from other telegraph channels, e.g. production of odd harmonics of the telegraph carrier frequencies in certain channels falling within the passband of other channels, intermodulation in filter coils, etc.;

vii) variations of power supplies affecting the amplifier and detector of the VFT channel and sometimes the receiving relay;

viii) the effects of mechanical vibration upon valves (microphonics) and relays;

ix) bad contacts (e.g. test points and valve bases) and badly soldered joints;

x) deterioration of component parts, e.g. ageing valves;

xi) failure of power supplies, e.g. on changeover from main to reserve supply;

xii) accidental disconnections made during the course of maintenance and construction work;

xiii) on overhead lines, effects of atmospheric electricity, frost, etc.;

(c) that the disturbances account for practically all the distortion in telegraph channels, except for characteristic distortion (which is chiefly a function of filter and amplifier-detector design), some bias (due to misadjustment of controls and relays, etc.) and, in the case of the lower frequency channels, the distortion that arises from the low ratio of carrier frequency to signalling frequency;

(d) that many of the causes of disturbance are individually negligible and the more important of the others have been found, in the experience of several Administrations, to be capable of elimination by careful maintenance both on the VFT equipment and at all points on the bearer circuit;

(e) that the CCITT is also studying the causes of disturbance in telephone circuits and the precautions to be taken to minimize their occurrence;

(f) that the results of the CCITT study will be of great importance to telegraphy;

(g) that, as a result of the considerable investigations already made by certain Administrations on the causes of disturbances in telephone and telegraph circuits, the relative order of importance of these causes appears to be approximately as follows:

i) *in the case of telephone circuits* :

— high resistance and unsoldered connections;

— noisy and microphonic valves, and poor contact between valve pins and valve holders;

— working parties engaged on cable operations;

— noisy and high-resistance U-links;

— changes in line level not compensated at the detector input;

— crosstalk;

— errors in setting up, for example incorrect equalization, line transformers incorrectly connected, faulty components;

ii) *in the case of VFT equipment*

— high resistance and unsoldered connections;

— valves deteriorated beyond permissible limits;

— bad contacts;

— faults on power changeover equipment;

— frequency error of the carrier supply;

unanimously declares the view

(1) that it is desirable for Administrations to undertake investigations of the causes, and frequency of occurrence of disturbances of VFT channels routed on the various types of bearer circuit likely to be employed for international telegraph circuits;

(2) that in doing these tests and in order that the results may be of the greatest use to telegraphy and telephony, the incidence of disturbances should be measured according to their duration as follows: less than 1 ms, 1 to 5 ms, 5 to 10 ms, 10 to 20 ms, 20 to 100 ms, 100 to 300 ms and those more than 300 ms;

(3) that the results should be classified according to the type of bearer circuit, viz. audio or carrier, cable or overhead line.

(4) Measurements of disturbances should be made at the direct current output of the VFT channel that is under observation.

Recommendation R.81

MAXIMUM ACCEPTABLE LIMIT FOR THE DURATION OF INTERRUPTION OF TELEGRAPH CHANNELS ARISING FROM FAILURE

OF THE NORMAL POWER SUPPLIES

(former CCIT Recommendation B.40, 1951)

The CCITT,

considering

that in switched telegraph networks a 300-millisecond interruption of the telegraph current would be translated into a release of switches, and that the relays controlling the release are arranged to operate in slightly less than 300 ms,

unanimously declares the view

(1) that it is desirable that no interruption of the telegraph current should occur as a result of failure of a normal power supply.

(2) If, however, it is impracticable to avoid an interruption, then its duration should in no case exceed 150 ms.

Recommendation R.82

APPEARANCE OF FALSE CALLING AND CLEARING SIGNALS
IN CIRCUITS OPERATED BY SWITCHED TELEPRINTER SERVICES

(former CCIT Recommendation B.42, 1951;

amended at Arnhem, 1953 and Geneva, 1964)

The CCITT,

in view of

Recommendation R.80, on the causes of disturbances affecting signals in telegraph channels, and their effect on the distortion of telegraph signals,

considering

(a) that precautions should be taken with circuits used in switched teleprinter services to prevent the appearance of parasitic signals that would give rise to false calling and clearing signals;

(b) that special monitoring or indicating devices should be provided on voice-frequency telegraph (VFT) systems, the channels of which are used for international switched circuits;

(c) that special steps might well be taken to discover the causes of false signals due to transient changes in transmission level or momentary increases in noise level, on VFT circuits;

(d) that it would be desirable to draw up operating standards in this connection,

unanimously declares the view

(1) that the following precautions should be taken to avoid false calling and clearing signals:

— the security and stability of power supplies and of sources of carrier frequencies, both telegraph and telephone, should be ensured;

— a characteristic marking should be used to denote telegraph and telephone-type circuits used for the operation of switched teleprinter circuits, both in terminal and intermediate stations;

— precise instructions should be given to staff in order that false entry into the above-mentioned circuits may be avoided;

— the number of non-soldered connections should be reduced as much as possible, together with the number of break points; unsoldered connections, e.g. U-links and screw terminals, etc., should be checked with particular care. In this connection, attention is drawn to the methods of inspection by vibration tests;

— the amplitude of level variations in VFT bearers should be limited, and abrupt variations in the level should be particularly avoided;

— limit the crosstalk mentioned in Recommendation R.80;

— limit induced voltage caused by electric power and traction systems;

— limit the microphonics of valves in repeaters and of valves used in VFT;

— reduce the sensitivity of voice-frequency modulators to disturbing signals;

— avoid, in switched teleprinter services, the use of supervision signals having a short duration in relation to the transitory phenomena due to filters and time-constants in the level-regulators of VFT systems.

(2) These precautions, inasmuch as they concern telephone-type circuits used for voice-frequency telegraphy, must be taken simultaneously on normal and reserve circuits.

(3) For the permanent monitoring of VFT systems the channels of which are used for international switched circuits, it is advisable to use a pilot channel. An alarm should be given to indicate when either the system or the pilot channel is out of order (see Recommendation R.78).

(4) It would be advisable to record the transmission level, in order to discover and localize the causes of the false signals on circuits behaving particularly badly.

(5) It is not yet possible to lay down operating standards in this connection.

Recommendation R.83

CHANGES OF LEVEL AND INTERRUPTIONS IN VFT CHANNELS

(former CCIT Recommendation B.53, Geneva, 1956;

amended at Geneva, 1964)

The CCITT,

considering

(a) that an alarming situation for the telegraph service has been created by interruptions on voice-frequency telegraph (VFT) channels, and by changes of level that have the same effect as interruptions;

(b) that the consequences are such that, at present, the error rate that is attributed to VFT channels is still very far above the tolerable limit fixed by considerations of operational requirements (see Recommendation R.54, a) and f);

(c) that certain Administrations have observed an improvement in the situation, and that this improvement seems to result from the measures taken by the telephone services, for instance, symmetric percussion tests, precautions in the switching or power supplies, etc.;

(d) that it has been confirmed that the number of interruptions increases markedly during the normal hours when maintenance staff are present, and is reduced when, despite very heavy traffic, maintenance is suspended, so that telegraph Administrations are now convinced that one of the principal causes of interruptions on telegraph channels is intervention by maintenance personnel and perhaps by operating personnel;

(e) that it has also been observed that the number of interruptions appears greater on international circuits than on national circuits,

unanimously declares the view

that the drive against interruptions should be continued vigorously and that, in order to observe the progress of this drive, Administrations should continue to make symmetric observations of the frequency and duration of interruptions on voice-frequency telegraph channels,

and draws the attention

of the maintenance Study Group especially to the study of practical measures to remedy the situation.

Recommendation R.90

ORGANIZATION FOR LOCATING AND CLEARING FAULTS

IN INTERNATIONAL TELEGRAPH SWITCHED NETWORKS

(former CCIT Recommendation B.55, Geneva, l956; amended at New Delhi, 1960)

and Malaga Torremolinos, 1984)

The CCITT,

considering

(a) that it is desirable that faults affecting communication between stations on international switching networks (e.g. telex and gentex service) should be reported and cleared as quickly as possible;

(b) that it is necessary to unify the essential action to be taken and methods to be employed for locating and clearing faults;

(c) that, for this purpose, it is necessary to determine the essential testing equipment that is to be provided at the switching centres responsible for locating and clearing faults, *unanimously declares the view*

1 that it is necessary to set up switching and testing centres (STCs), defined as switching centres equipped with measuring equipment for testing telex subscribers' and public station lines and equipment and also telegraph channels.

2 Each telex subscriber and each public station in the general switching service should have access to an STC for the purpose of reporting faults and cooperating in tests.

3 International switching and testing centres (ISTCs) are the STCs that are also international line-head offices.

4 All STCs should be subscribers to the telex network, both for the purpose of receiving fault reports and for communication for maintenance purposes. They should also be provided with a telephone subscriber's line.

5 Each STC should be responsible for coordinating action in locating and clearing faults on all station lines connected to the exchange and on all trunk circuits for which it is nominated as the controlling office. It should also cooperate with other STCs in locating faults on connections established through two or more exchanges.

5.1 It should carry out a preliminary location of faults by finding out whether they affect channels, switching gear or apparatus. The faults are then accurately located by the engineers responsible for each part of the circuit and the STC cooperates with them for this purpose. It may assume the direction of the fault-locating procedure should there be disagreement between these services. Internationally, it is responsible to the STCs of other countries with which it has telex connections.

5.2 The organization of the liaison between the STC and the different technical services is shown in Figure 1/R.90. The STCs must check that the performance given by the equipment involved in the switching service, i.e. VF channels, switching equipment and apparatus, is satisfactory.

Figure 1/R.90, (M), p.

6 The staff employed at STCs should be selected with a view to avoiding language difficulties and should be conversant with all types of telegraph equipment used in the switching network, i.e. automatic or manual switching equipment, VFT equipment, telegraph machines and regenerative repeaters. The staff need not necessarily be fully competent to maintain all these items of equipment, but should have sufficient knowledge of them to be able to form an appreciation of the effect that faults on any of them may have on a switched connection. In addition, the staff of ISTCs should have some general knowledge of the types of equipment used in the countries to which they are connected, particularly of the signalling conditions that will be encountered.

7 Each STC should be provided with the following measuring equipment:

a) 50-baud start-stop distortion meter;

b) test transmitter for generating undistorted 50-baud start-stop signals;

c) apparatus to measure the modulation rate of teleprinters at a distance;

d) apparatus for measuring the speed and pulse ratio of dials, where appropriate;

e) apparatus for measurement of the condition of direct current lines; for example, continuity, resistance, insulation.

7.1 The arrangements for access to established connections for making test measurements should be such as not to cause interruptions or reduce the quality of transmission.

7.2 Considering that some Administrations have found it desirable to have available at the STC other items of apparatus to expedite the clearing of faults, all Administrations are invited to consider the utility of these devices, namely:

a) apparatus for measuring teleprinter margin;

b) recording distortion meters for testing established connections;

c) apparatus for measuring continuously, periodically and automatically, the distortion on subscribers' lines and apparatus.

8 The following procedure for reporting, locating and clearing faults should be adopted.

8.1 Faults should be reported to the STC concerned by the subscribers or operators who have experienced difficulty in operation. In the same way, it would be useful, in order to give the STCs a full picture of the situation, that the maintenance engineers should inform them of faults noted during the periodic maintenance operations. Faults should preferably be signalled by teleprinter, if their nature does not preclude this procedure.

8.2 A reference number should be given by the STC to the subscriber or service notifying the fault. This number can then be quoted in any subsequent inquiries as to the progress of fault clearance.

8.3 On account of the difficulties that may arise in the detection of faults on the international section of a communication (due to lack of knowledge of languages, etc.), care should be taken in each country to see that the national sections of the communication, including subscribers' lines and apparatus, are not involved before approaching the STC of the corresponding country.

8.4 Complete holding of a connection that is reported to be faulty should be avoided.

8.5 The STC notified of a fault should therefore begin by ascertaining that it is not located in the national section of the communication and for this purpose should, if necessary, approach the other STCs of its country concerned in the circuit. The STC of the distant country is then advised and, in turn, checks the national section routed over its network. The international section of the communication is not checked until the terminal national sections of telegraph circuits have been definitely exonerated. The STCs in different countries will communicate with one another, either directly or via their ISTCs, as determined by the Administrations concerned.

8.6 If the tests of the two local ends fail to reveal any fault conditions, the STC should report the fault to its ISTC, which will decide what further action, if any, is necessary. As a rule, isolated fault reports would not justify a test of all trunk circuits on a route, and it would be assumed that the condition giving rise to the fault would be cleared on the next routine adjustment. If however, several fault reports were received, some of which might have been due to a faulty circuit on a particular route, then a special routine test of all the circuits on the route might be justified.

8.7 In general, it is considered that the procedure will be broadly the same for manual, semi-automatic and automatic systems.

9 The abbreviations annexed below should be used in calls exchanged between services responsible for the maintenance of telegraph equipment.

ANNEX A

(to Recommendation R.90)

List of service abbreviations for maintenance of telegraph circuits

No.	*Abbreviation*	*Meaning*
30 | fIbis	**BL**	Holding
30	**BL . | | SVP**	Please hold . | |
2	**BR TR . | |**	Bad transmission on . | |
39 | fIbis	**CCT . | | IN**	I have restored circuit No. . | |
39	**CCT . | | IN SVP**	Please restore circuit No. . | |
38 | fIbis	**CCT . | | OUT**	I have taken circuit No. . | | out of service
38	**CCT . | | OUT SVP**	Please take circuit No. . | | out of service
43	**CRD . | |**	The connection is released after selection on circuit No. . | |
37 | fIbis	**CSR**	I am receiving your calling signal
8	**DER CCT**	Circuit faulty
51	**DER REG**	Register does not operate
52	**DER TAPE**	Your perforated tape is faulty
33	**DER VF . | |**	Fault on voice-frequency system . | |
7	**DERA**	Machine faulty
9	**DERPS**	Position equipment faulty
10	**DERR**	Fault now cleared
64	**DEVD**	Deviation of distributor speed at your end
23	**DEVS . | |**	Speed deviation is . | | %
16	**. | | DIS . | |**	The distortion on . | | is . | | %
62	**DS . | |**	Distribution switched over to . | |
25	**EDIS . | |**	The transmitter distortion is . | | %
1	**ICI . | |**	Here is . | |
53 | fIbis	**LOOP . | |**	I have looped circuit . | |
53	**LOOP . | | SVP**	Please loop circuit . | |
24	**MAR . | |**	The margin is . | | %
18	**MEET . | |**	Meet me on circuit No. . | |
50	**N IND**	I am not receiving your answer-back code
40	**N PER A**	I am not receiving your permanent start polarity signal

41 **N PER Z** I am not receiving your permanent stop polarity signal

66 **NARQ . | |** Multiplex . | | unprotected; please re-establish automatic request for repetition (ARQ)

31 | fIbis **NBL . | |** Clearing

31 **NBL . | | SVP** Please clear . | |

27 **NCFM . | |** No call-confirmation signal on . | |

26 **NCS . | |** No call-connected signal from . | |

11 **NDER** No fault found

42 **NPS** I am not receiving your proceed-to-select signal

28 **OCC OCC . | |** Permanent busy signal from . | |

65 **OPH . | |** Out of phase on system . | |

46	**PER A . | |**	Permanent start polarity on . | |
48	**PER A . | | SVP**	Please send permanent start polarity on . | |
47	**PER Z . | |**	Permanent stop polarity on . | |
49	**PER Z . | | SVP**	Please send permanent stop polarity on . | |
29	**PERC . | |**	Permanent call on . | |
63	**PH . | |**	Please phase system . | |
34 | fIbis	**Q DIS A**	Is there bias distortion (prolonged start polarity) on the received signals?
35 | fIbis	**Q DIS Z**	Is there bias distortion (prolonged stop polarity) on the received signals?
13	**QDIS . | |**	Please measure distortion on . | | and report result
37	**QRCS**	Are you receiving my calling signal?
3	**QREF**	Please give reference number
4	**QRES**	Please report result
15	**RAP . | | MNS**	I shall recall you in . | | minutes
14	**RAP . | | MNS SVP**	Please call me in . | | minutes
5	**REF . | |**	Reference number is . | |
6	**RES . | |**	Here is result of test on . | |
55	**RFC . | |**	I am receiving errors in 5-unit code. Please check channel No. . | |
70	**RMUT . | |**	I am receiving garbled signals on multiplex channel . | | please check your 7-unit code
54	**RQFS . | |**	Your repetition cycle transmission contains 7-unit code faults. Please check channel No. . | |
59	**RS . | |**	Reception switched over to . | |
44	**SIG 1/1 SVP**	Please send 1 : 1 signals
45	**SIG 2/2 SVP**	Please send 2 : 2 signals
61	**SS . | |**	Storage switched over to . | |
12	**TESTD . | | SVP**	Please send test message with . | | % distortion on . | |
67	**TRAS . | |**	Please send alpha signal on multiplex channel . | |
68	**TRBS . | |**	Please send beta signal on multiplex channel . | |
60	**TRS . | |**	Transmission switched over to . | |
21	**VERED**	Please check the transmitter distortion
22	**VERM**	Please check the margin
20	**VERS**	Please check the speed
19	**VERX . | |**	Please check subscriber No. . | |
34	**ZKWA . | |**	The received signals have . | | % bias (start polarity prolonged)
35	**ZKWZ . | |**	The received signals have . | | % bias (stop polarity prolonged)
32	**ZOK**	I am receiving correctly

17 **ZSU** Your signals are unreadable

71 **ZYA** Cease traffic on all channels; send **As** on A channel for line-up

69 **ZYC** Your transmitter is sending permanent ARQ

56 **ZYK . | |** Your keying on channel . | | is affected; please check

57 **ZYM** Change from single printer to multiplex

36 **ZYN** Reduce the bias

58 **ZYP** Change from multiplex to single printer

Recommendation R.91

GENERAL MAINTENANCE ASPECTS FOR THE | fR MARITIME SATELLITE TELEX SERVICE

(Malaga-Torremolinos, 1984)

The CCITT,

considering

(a) that it is desirable to define the relationship between the maintenance organizations for the international telex service and the maritime satellite telex service ;

(b) that it is advantageous that the maintenance procedures used in the maritime satellite telex service are similar to those used in the international telex service;

(c) that, from a maintenance and transmission point of view, the maritime satellite system may be regarded as analogous to a national network and the ship earth stations as somewhat analogous to subscriber terminals within that network;

(d) that the ship earth stations are connected to a coast earth station on a demand assignment basis and, therefore, the coast earth station may not have the direct responsibility for the maintenance of a particular ship earth station all the time;

(e) that the required staff and facilities may not be available at a ship earth station for maintenance purposes,

unanimously recommends

that the maintenance of telex circuits in the maritime satellite service should be based on the following principles:

1 The principles and methods for the maintenance of telegraph circuits contained in the Series R, Recommendations should be followed.

2 The coast earth stations or the associated telex switching centre should act as a control station for the maritime satellite telex circuits as defined in Recommendation R.71.

3 Similar principles as those defined in Recommendation M.1110 for the cooperation between maintenance elements of the INMARSAT system and the international telephone network should also apply to the INMARSAT system and the international telex network. The overall maintenance organization of the INMARSAT system is described in Recommendation M.1110.

4 The coast earth stations or the associated telex switching centres should act as STCs (switching and testing centres) as defined in Recommendation R.90 for access by ship earth stations for the purpose of fault reporting and testing.

4.1 The ship earth stations would access the STC at a coast earth station or its associated telex switching centre by using the telex access code 33 (technical assistance) as defined in Recommendation F.121.

4.2 Automatic test equipment at the STC is to be accessed by the telex access code 91 (automatic test line) as defined in Recommendation F.121.

Note — In the first generation INMARSAT system the test access will be to a termination which returns the ‘‘QUICK BROWN FOX . | | ’’ sequence.

5 In order to facilitate end-to-end testing of telex connections without involving a ship earth station, the maritime test terminal required by INMARSAT to be associated with each coast earth station should be used.

The description of the maritime test terminal and its capabilities is given in Recommendation M.1100.

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