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INTERNATIONAL TELEGRAPH CONSULTATIVE COMMITTEE
C.C.I.T.

SUPPLEMENTS

to the

DOCUMENTS OF THE VIIIth PLENARY ASSEMBLY

GENEVA (1956)

PUBLISHED BY THE
INTERNATIONAL TELECOMMUNICATION UNION

MAY 1957

INTERNATIONAL TELEGRAPH CONSULTATIVE COMMITTEE
C.C.I.T.

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GENEVA (1956)

In accordance with Recommendation No. A.2 of the C.C.I.T. (Arnhem, 1953), extracts from contributions to studies, notes, comments etc., of which the publication in the form of annexes to the Recommendations was decided upon by the VIIIth Plenary Assembly of the C.C.I.T., were included in the volume of Recommendations entitled " Documents of the VIIIth Plenary Assembly of the C.C.I.T., Geneva, 1956 " (Violet Book).

In accordance with Recommendation A.2 of the C.C.I.T., extracts from contributions, notes, comments, etc., of which the publication in the form of an annex to the questions was decided upon by the first Plenary Assembly of the C.C.I.T.T., have been annexed to the questions contained in Volume I of the C.C.I.T.T. Red Book.

Other extracts from contributions received by the C.C.I.T. in the 1953-1956 period which are of lasting interest or which are useful for further studies, are contained in these « Supplements » ; in principle, they have been selected by the C.C.I.T. Study Groups.

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STUDY OF TELEGRAPH DISTORTION

ITALY

Document S.G. I/21
6 November 1956

Revision of some of the definitions of degrees of telegraph distortion

(C.C.I.T. Question 1 — C.C.I.T.T. Question I/9)

1. This contribution is due to the fact that the probability of a certain degree of distortion being exceeded is normally indicated as the ratio between the number of cases in which distortion exceeds the degree in question and the number of significant instants of modulation (or restitution).

Hence, at least as far as the degree of isochronous distortion is concerned, we must define what we mean when we talk about distortion exceeding a certain degree. It is possible, we feel, here and now to clarify somewhat the definition of " degree of isochronous distortion " where the probability of exceeding a certain distortion is spoken of.

1.1 We might, for example, complete the definition as follows:

" For a prolonged modulation (or restitution) it will be appropriate to consider the probability that an assigned value of the degree of distortion will be exceeded. This probability will be given by the ratio, to the total number of significant instants observed, of the number of those significant instants which are separated from any other observed significant instant by time intervals differing, in absolute values, from the corresponding theoretical intervals by amounts exceeding the product of the unit interval and the assigned value of the degree of distortion. "

1.2 The definition of " degree of start-stop distortion " could be completed as follows:

" For a prolonged modulation (or restitution) it will be appropriate to consider the probability that an assigned value of the degree of distortion will be exceeded. This probability will be given by the ratio to the total number of significant instants observed, other than start instants, of the number of such significant instants the differences of which, considered in the definition, exceed in absolute values the product of the unit interval and the assigned value of the degree of distortion."

2. On this occasion, we might observe that the two definitions, of degrees of isochronous and start-stop distortion, might be made more homogeneous if they were based on the idea of " degree of individual distortion ", *once the definition of ideal instants has been suitably completed.*

The amended definition might run as follows:

2.1 " *Ideal instants of modulation (or restitution)*

Instants with which the significant instants would coincide under certain ideal conditions. For every particular case it will be necessary to indicate how one (or more) of these ideal instants is determined, all the others being placed in relation to it (or them) at intervals equal to the corresponding theoretical significant intervals.

For the significant instants of a start-stop modulation (or restitution) other than the start instants, the ideal instants are determined on the basis of the immediately preceding start instants, at time intervals equal to the corresponding theoretical intervals. "

With this modification, the definitions of the degree of isochronous distortion and of the degree of start-stop distortion could be simplified, as follows :

2.2 " *Degree of isochronous distortion*

The difference, in absolute values, between the algebraically maximum and minimum degrees of individual distortion of the significant instants in an isochronous modulation (or restitution).

Notes :

1. This degree of distortion will be indicated together with the time interval, generally limited, during which the observation has been made.
2. For a prolonged modulation (or restitution), it will be appropriate to consider the probability that an assigned value of the degree of distortion will be exceeded. This probability will be expressed as the ratio between the total number of significant instants observed and the number of couples of these significant instants the individual distortion of which presents differences, in absolute values, exceeding the assigned value of the degree of distortion. "

2.3 " *Degree of start-stop distortion*

The greatest of the absolute values of the degrees of individual distortion of the significant instants of a start-stop modulation (or restitution), other than the start instants.

Notes :

1. The indication of this degree of distortion will be accompanied by an indication of the time, generally limited, during which the observation was made.
2. For a prolonged modulation (or restitution), it will be appropriate to consider the probability that an assigned value of the degree of distortion will be exceeded. This probability will be determined by the ratio between the total number of significant instants observed, other than start instants, and the number of such significant instants of which the degrees of individual distortion exceed the assigned value of the degree of start-stop distortion. "

3. As regards definition No 2.2, we might consider whether or not, in calculating probabilities, it might be well to take the double of the number of couples instead of the number of couples. This would make the probability definition in question coincide with that in paragraph 1.1.

UNITED KINGDOM

Extract from Document S.G. I/9
16 June 1955

Determination of the law of distribution of the various values of degree of distortion pertaining to a prolonged modulation (or restitution)

(C.C.I.T. Question 6 — C.C.I.T.T. Question 3/9)

An instrument has been developed in the United Kingdom for analysing the frequency distribution of the various values of degree of distortion of a prolonged start-stop telegraph modulation. (A description is given by Wheeler and Frost in the Post Office Electrical Engineers' Journal, Vol. 47, Part 1, April 1954.) The analyser operates with a 6.5 unit start-stop cycle and can be set to examine the distortion of all or any of the characteristic instants of modulation,

other than the start instants, with respect to the latter as reference instants. The analyser therefore measures start-stop distortion. The analyser can also be set to examine mark to space or space to mark transitions only. The analyser uses a 100 point start-stop distributor providing a time scale dividing the unit element period into 1 % periods. Twenty counters are provided which can be connected to chosen points on the distributor, so as to record the frequency of occurrence of values of distortion within chosen ranges. Whilst the instrument is too large and costly to be used for ordinary maintenance purposes, it is proving very valuable for statistical analysers.

In use the analyser can be set to stop operating after recording 100, 1000, 10 000 or 100 000 characteristic instants. The signals may be either those of operating circuits in service or signals generated by the analyser itself. The counters can be arranged to record the instants falling within their chosen range or the cumulative count, including all earlier ranges.

From the counter readings the frequency distribution can be conveniently plotted as a curve having distortion as ordinate and percentages of transitions earlier than the ordinates as abscissae on an arithmetical probability scale.

The same instrument can be used to make analyses of individual [1] distortion when the signal generator and analyser can be controlled by the same master frequency source, i.e. when making measurements round a loop. The start-stop cycle is suppressed and the analysing distributor runs continuously. If used without the start-stop cycle on a point to point circuit the common master frequency control has to be replaced by a synchronizing device in the analyser, which adjusts the phase of the distributor according to the preponderance of earliness (or lateness) in previous signal transitions. A true record of individual distortion is not then obtained and it will be a matter for trial to determine whether any use can be made of this type of record.

FRANCE

Extracts from Document S.G. II/37-E
S.G. III/22-E
25th January 1956

Statistical study of channel distortion

To provide the basis for a reply to C.C.I.T. Question No. 34 (Arnhem 1953), tests were made with a view to finding the statistical distribution of start stop distortion on V.F. telegraph channels.

1. *Organization of the tests*

The principle of the measurements was the emission of a given text, repeated as often as necessary, with distortion practically nil. The modulation was transmitted on a loop and received on a distortion measuring set fitted with statistical counting units.

---

[1] Individual or isochronous ? (Note from C.C.I.T. Secretariat.)

In each test a simultaneous count was made of :

a) the total number of telegraph signals received ;

b) the number of signals with distortion, counted in degree and in direction, exceeding an assigned value, adjustable from one test to another.

It must be confessed that such a method is not absolutely correct from the statistical point of view, since it leads to the double counting of certain signals which have both " fast " and " late " distortion.

The phenomenon will be the more obvious as the modulation has less bias distortion : the minimum distortion and the maximum distortion, inside a given signal, will actually be more or less grouped together.

But, because of this phenomenon, the asymptotic form of the distortion probability density curve will be comparatively maintained. The accumulative effect due to the measurement method will simply mean that the integral of the apparent densities will be more than one.

2. *Measurement Method*

The apparatus was as follows :

a) at the transmitting end, a type 53 transmitter of calibrated telegraph signals providing a modulation perfect within 1 % at a modulation rate not differing by more than 1 % from the standardized modulation rate of 50 bauds. The modulation was of the double current type at 20 mA and was constituted by the French text standardized by the C.C.I.T., repeated as often as necessary. This test, including a preliminary distortion announcement, comprises 79 signals ;

b) at the receiving end, with double current reception at 20 mA, a type 53 start-stop distortion measuring set with a metering section specially modified for the tests. One of the meters counted the signals received ; the other counted the signals which showed distortion exceeding a certain value previously displayed on the apparatus. For the metering proper, endeavours were made to test 10 sentences (790 signals) at least and to obtain at least 10 exceeding signals during each test. However, to limit the length of the tests, it was agreed to stop them after 100 000 signals.

This method of operating has its arbitrary side : there is no doubt that with the experience acquired during these tests, another more adequate method will eventually be chosen.

3. *Results of the tests*

The tests were made successively on a Paris-Reims channel and back, and on a Paris-Nancy channel and back. The V.F. telegraph equipment was amplitude modulated.

Tables I and II summarized the results obtained.

It will be seen that the numbers of the 4th column are the differences between two consecutive numbers, in the 3rd. They show the frequency of signals with distortion included within a 2 % band limited by the distortion corresponding to the preceding numbers.

The numbers of the 5th column are obtained by dividing the corresponding 4th column numbers by 2, in accordance with the definition of frequency density.

The numbers of the 6th column show the mean distortion corresponding to the above densities.

Figures 75/1 and 75/2 summarize the results entered in columns 5 and 6 of Tables I and II respectively.

TABLEAU I
TABLE I

Distorsion affichée à la réception Degree of distortion displayed at reception	Nombre de signaux affectés d'une distorsion au moins égale à la valeur affichée Number of signals with distortion at least equal to the degree displayed	Fréquence en % Frequency in %	Fréquence des signaux de distorsion comprise entre 2 valeurs consécutives de la colonne de gauche en % Frequency of occurrence of signals with distortion comprised between 2 consecutive figures in the column on the left (%)	Densité de fréquence Density of occurrence	Distorsion moyenne correspondant à la distorsion de fréquence Average distortion corresponding to the density of occurrence
0 % Avance - Early	27/79	34	14	7	1 % Avance - Early
2 %	16/79	20	13	6,5	3 %
4 %	10/140	7,1	5	2,5	5 %
6 %	10/470	2,1	1,5	0,75	7 %
8 %	10/1790	0,56	0,54	0,27	9 %
10 %	10/44 900	0,022	0,02	0,01	11 %
12 %	2/100 000	0,002	< 0,002	< 0,001	13 %
0 % Retard - Late	79/79	100	3	1,5	1 % Retard - Late
2 %	77/79	97	6	3	3 %
4 %	72/79	91	13	6,5	5 %
6 %	62/79	78	12	6	7 %
8 %	52/79	66	19	9,5	9 %
10 %	37/79	47	5	2,5	11 %
12 %	33/79	42	10	9	13 %
14 %	19/79	24	11	5,5	15 %
16 %	21/158	13	7,6	3,8	17 %
18 %	10/185	5,4	0	0	19 %
20 %	10/185	5,4	2,1	1	21 %
22 %	10/300	3,3	3,2	1,6	23 %
24 %	10/10 200	0,1	0	0	25 %
26 %	11/11 770	0,1	0,1	0,05	27 %
28 %	2/100 000	0,002	< 0,002	< 0,001	29 %

RÉPARTITION DES DENSITÉS
DE FRÉQUENCE DE DISTORSION
VOIE PARIS-REIMS

DISTRIBUTION OF DISTORTION
OCCURRENCE DENSITIES
CHANNEL PARIS-REIMS

TABLEAU II
TABLE II

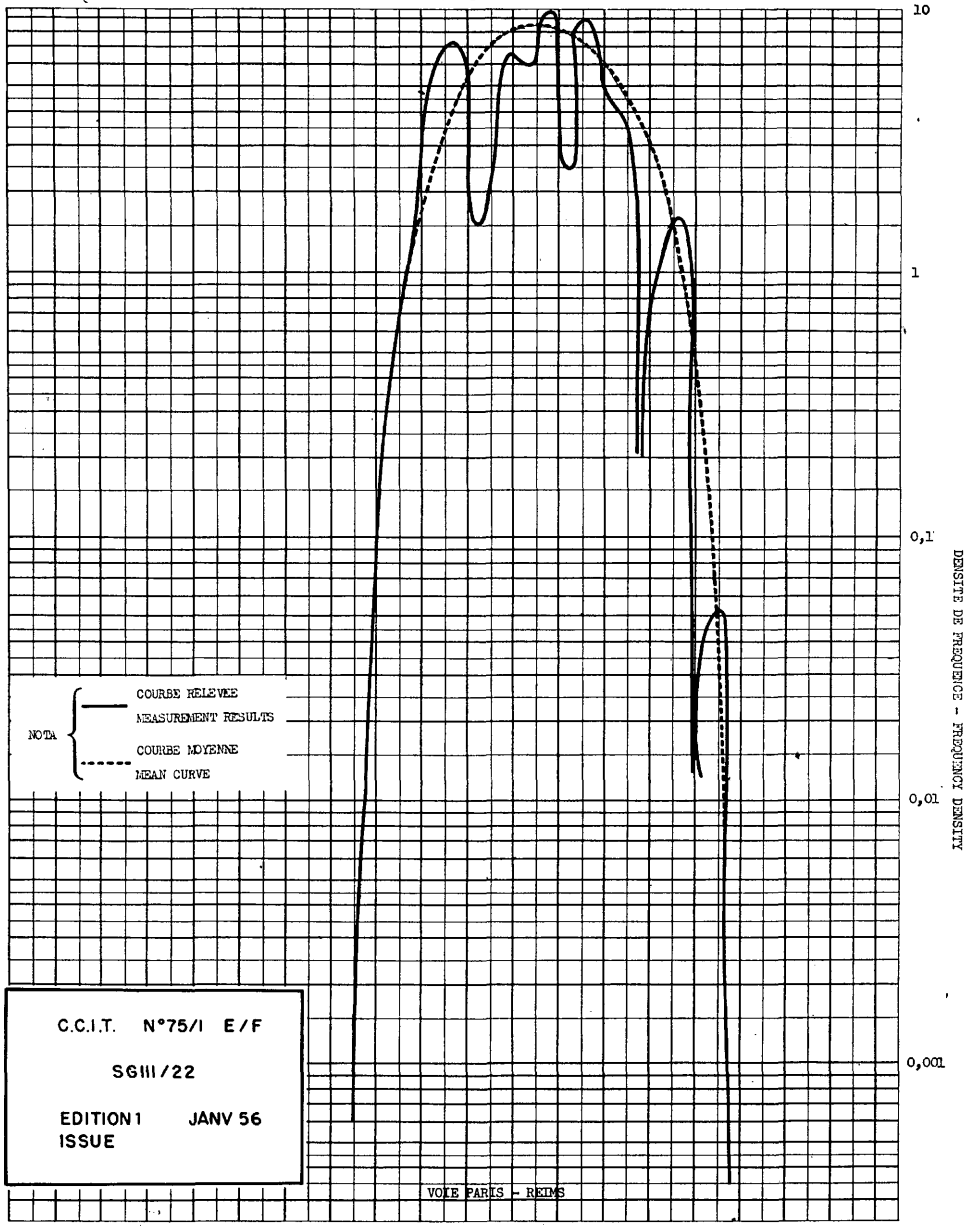
Distorsion affichée à la réception Degree of distortion displayed at reception	Nombre de signaux affectés d'une distorsion au moins égale à la valeur affichée Number of signals with distortion at least equal to the degree displayed	Fréquence en % Frequency in %	Fréquence des signaux de distorsion comprise entre 2 valeurs consécutives de la colonne de gauche en % Frequency of occurrence of signals with distortion comprised between 2 consecutive figures in the column on the left (%)	Densité de fréquence Density of occurrence	Distorsion moyenne correspondant à la distorsion de fréquence Average distortion corresponding to the density of occurrence
0 % Retard - Late	699/790	88	23	11,5	1 % Retard - Late
2 %	511/790	65	22	11	3 %
4 %	343/790	43	13	6,5	5 %
6 %	236/790	30	22	11	7 %
8 %	62/790	7,9	7,6	3,8	9 %
10 %	10/3634	0,28	0,26	0,13	11 %
12 %	10/46 345	0,022	0,021	0,010	13 %
14 %	10/84 760	0,012	0,010	0,005	15 %
16 %	2/100 000	0,002	< 0,002	< 0,001	17 %
0 % Avance - Early	621/790	79	35	17,5	1 % Avance - Early
2 %	351/790	44	29	14,5	3 %
4 %	115/790	15	12	6	5 %
6 %	27/790	3,4	3,3	1,7	7 %
8 %	10/13 540	0,074	0,073	0,007	9 %
10 %	1/100 000	0,001	< 0,001	< 0,0005	11 %

RÉPARTITION DES DENSITÉS
DE FRÉQUENCE DE DISTORSION
VOIE PARIS-NANCY

DISTRIBUTION OF DISTORTION
OCCURRENCE DENSITIES
CHANNEL PARIS-NANCY

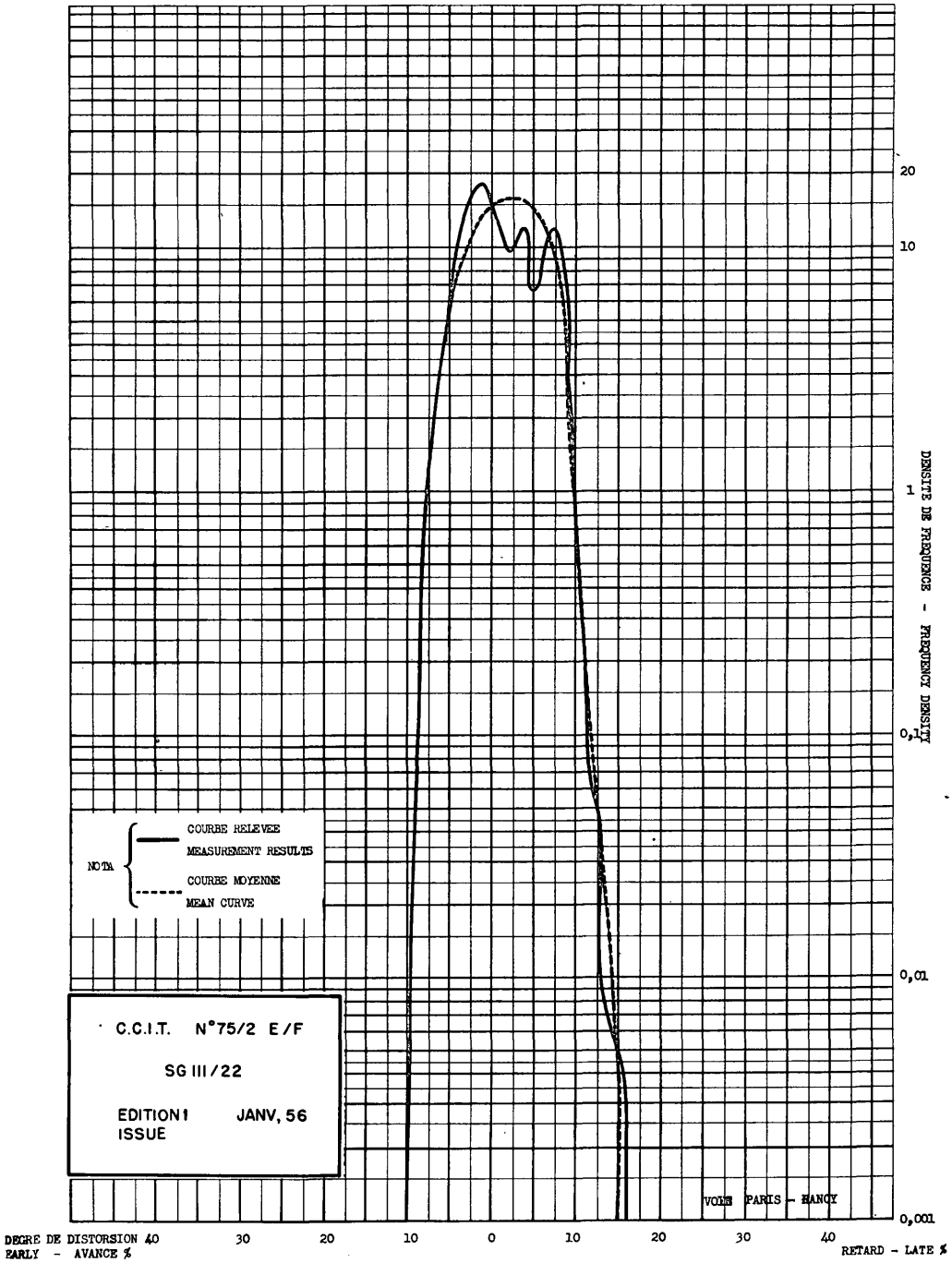
ETUDE STATISTIQUE DE LA DISTORSION DES VOIES

STATISTICAL STUDY OF CHANNELS DISTORTION



ETUDE STATISTIQUE DE LA DISTORSION DES VOIES

STATISTICAL STUDY OF CHANNELS DISTORTION



It will immediately be seen that these curves show sudden dips. This is not at all surprising, because of the " fibrous " structure of the distortion ; a theoretical study of the question shows that the distribution of the characteristic instants distorted by a channel shows a preference for certain areas. It is, however, remarkable that the blurred nature of channel transmission characteristics caused by the random processes acting on them does not manage entirely to eliminate the particular structure of the distortion : it could be concluded that the channels tested show, making due allowance for a degree of average stability, the full record of a density curve requiring two days work.

The mean shape of these curves is parabolic, with the logarithmic scale adopted. These are not strictly speaking true parabolas : the distribution law found is only an approximation to the standard distribution, which is not surprising in view of the observation in the previous paragraph. Assuming, as a first approximation, that the distribution is standard, in the case of the curve in Figure 75/1, we find substantially the following, taking the average of several determinations :

bias distortion : 7.5 % late ;

standard deviation of the distortion : = 6.6 %. The following probability density is thus obtained, x being the percentage distortion :

$$p(x) = 6.0.\ e^{-\frac{(x-7.5)^2}{87.2}}$$

In these circumstances, the probability that the distortion will be at least 35 % is of the order of 1.6×10^{-3} %.

If 4 channels with similar characteristics were placed end to end, an identical distribution law would be found, with a standard deviation twice as great, i.e. :

$$p(x) = 3.0.\ e^{-\frac{(x-7.5)^2}{348.8}}$$

The probability that at least 35 % distortion will appear is then of the order of 0.5 %.

We shall not revert to the analogous calculation for the curve in Figure 75/2, which has a much more favourable appearance (bias distortion 3 % late, standard deviation of distortion 5.5 %).

4. *Conclusion*

These tests, however incomplete and imperfect they may be, seem to show the following :

1. The almost standard distribution of the density of occurrence of start stop distortion on a given channel.

2. Systematic irregularities in the distribution law corresponding to theoretical forecasts.

3. In the most unfavourable cases, a very small occurrence of distortion corresponding to the minimum effective margin of the apparatus.

From this last fact, it may be concluded that even mediocre teleprinters, with, for example, a fault probability of from 1 °/$_{oo}$ to 35 % distortion, will still be capable of providing satisfactory service for the user (overall fault probability due to the apparatus and the channels of the order of 5×10^{-6}).

U.S.S.R.

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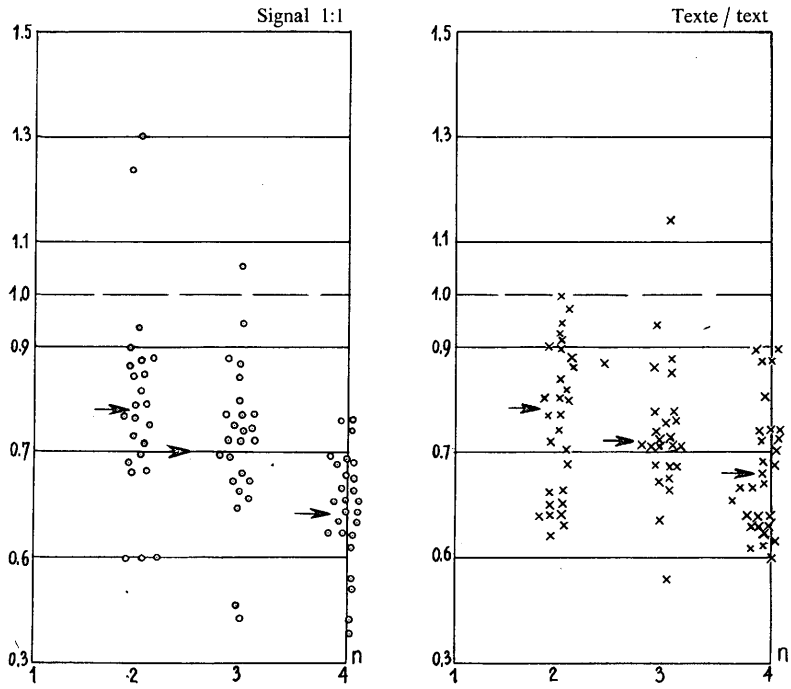
Composition of distortion under service conditions

(C.C.I.T. Question 12 bis II B)

For rhythmic service distortion, and in the case in which the distortion on symmetrical signals has been previously reduced to a minimum by a suitable adjustment, can the results obtained be expressed by a law of addition of distortion lying between arithmetical and quadratic additions of the component values ?

Reply :

In order to determine, under service conditions, the law governing the addition of distortion of the component channels, numerous measurements have been made on our instructions.



$$K_1 = \frac{\delta_0}{\sum_{n=1}^{N} \delta n}$$

Fig. 1. — Coefficients d'addition arithmétique des distorsions des voies composantes.

Fig. 1. — Coefficients of arithmetical addition of distortion in component channels.

The results obtained were estimated according to the two addition coefficients K_1 and K_2:

$$K_1 = \frac{\delta_0}{\sum_{N=1}^{N} \delta N} \quad \text{and} \quad K_2 = \frac{\delta_0}{\sqrt{\sum_{N=1}^{N} \delta n}}$$

where δ_0 = the measured gross distortion in the resultant channel;

and δn = the measured distortion in each component section.

Thus the addition coefficients are the relations between the actual distortion in the resultant channel to the arithmetic or quadratic sum of distortion in individual sections.

For the purpose of these measurements, we constructed channels by successively connecting loops on distant stations.

Each retransmission section was made up of two direct channels. Loops were established on principal overhead channels as well as on principal cables, one loop per principal channel.

Measurements were carried out on amplitude-modulation voice-frequency telegraph channels. The receivers of these channels were equipped with automatic level regulators enabling the input level to be varied by $\pm$ 0.7 nepers.

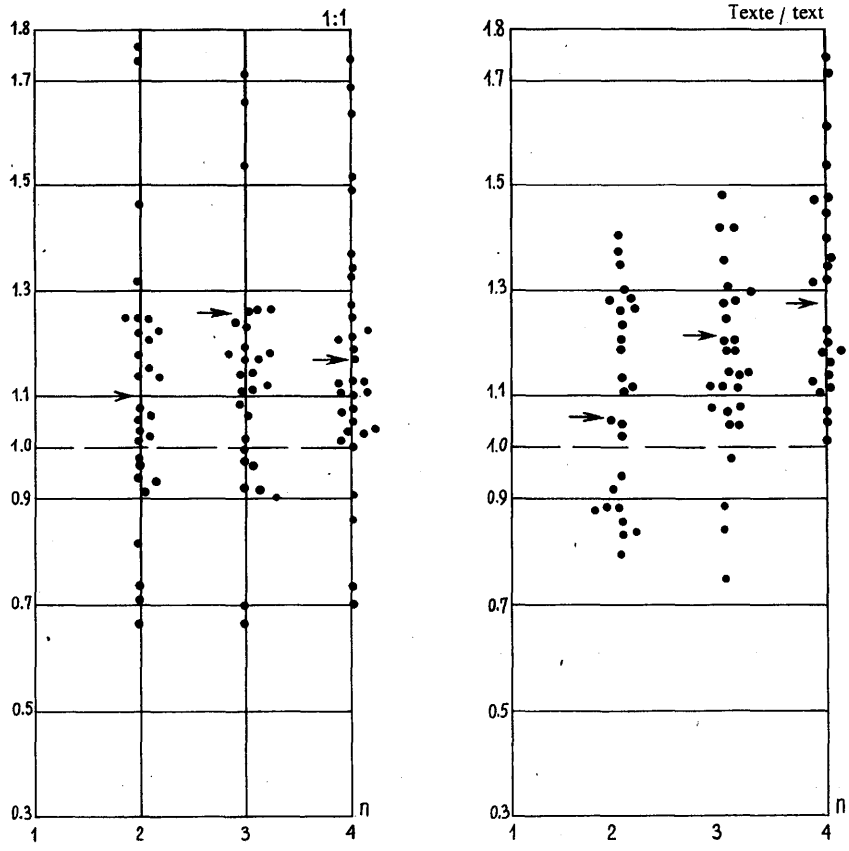


Fig. 2. — Coefficient d'addition d'après la loi quadratique moyenne des distorsions des voies composantes.

$$K = \frac{\delta_0}{2\sqrt{\delta_1^2 + \delta_2^1 + \delta_3^2 \ldots}}$$

Fig. 2. — Addition coefficient according to the mean quadratic law of distortion on component channels.

Only after careful adjustment and elimination of bias were these measurements effected.

The figures obtained by measurement, as set forth in Figure 1, show that in most cases $K_1 < 1$ (in 4 cases out of 180 only was K_1 more than 1). Mean value of addition coefficients: $K_1 = 0.6 + 0.8$ for 1/1 signals and $K_1 = 0.7 + 0.8$ for the text.

K_1 fell off as retransmissions became more numerous. After analysis of the results of calculation as set forth in Figure 1, it may be said that the real distortion in the resultant channel is less than the arithmetic sum.

To see how far these measurements gave results in accordance with the law of quadratic addition, we show (Figure 2) the results of assessment of K_2. It will be seen that the mean value for 1/1 signals is $K_2 = 1.1 + 1.28$, and for the text $K_2 = 1.08 + 1.28$.

Comparison of the results of evaluation in Figures 1 and 2 seems to show that distortion in the resultant channel is actually less than the arithmetic sum of distortion, but more than the sum of distortion obtained by a law of quadratic addition.

Hence this Administration replies to the question in the affirmative.

However, the results received are not enough for mistakes to be assessed in calculation of the circuit in accordance with these laws of addition, because of the great variety of results as to the mean value. Hence it is at present impossible to draw any definite conclusions with regard to Question 12 *bis* B.

This Administration notes that the measurements carried out both by it and by other Administrations were performed on homogeneous amplitude-modulation channels.

Since in several countries, including the U.S.S.R., frequency-modulation voice-frequency equipments are used, we think that a question could usefully be set for study in connection with the law of addition of distortion in the component channels of frequency-modulation voice-frequency systems, under service conditions.

U.S.S.R.

C.C.I.T. Document S.G. I/19-E
S.G. II/64-E
30 October 1956

Factor of safety and measurements of service distortion

(C.C.I.T. Questions 10 and 13 — C.C.I.T.T. Questions 5/9, 23/9 and 24/9)

Reply to Question 10

Question 10. Is there a need to introduce the idea of " factor of safety of a telegraph connection " as the difference between the margin of the receiving apparatus and the degree of distortion of the restitution measured at the input of this apparatus?

Reply : The introduction of the idea of " factor of safety of a telegraph connection " deserves attention, as it provides the easiest and most practicable means of evaluating the quality of a telegraph connection in accordance with Recommendation B.25 of the C.C.I.T.

The Administration of the U.S.S.R. agrees to the introduction of the idea of " factor of safety of a telegraph connection " and gives in the Annex hereafter a " Report on the Procedure of Telegraph Distortion Measurements " treating the problems which arise in connection with the study of Question 10.

Reply to Question 13

Question 13. Should measurements of service distortion on telegraph channels using the standard text mentioned in Recommendation B.32 be made with a rhythmic distortion meter or with a start-stop distortion meter ?

Reply : The Administration of the U.S.S.R. agrees to the Draft Recommendation II/2 concerning the Question 13, issued by Study Group II (now Recommendation B.52 of the C.C.I.T.).

The Administration of the U.S.S.R. has drawn up a report appearing in the Annex hereafter and intended to provide a theoretical treatment of problems arising in connection with the study of question II/13.

Annex : " Report on the Procedure of Telegraph Distortion Measurements. "

Annex

THE TELEGRAPH AND TELEPHONE ADMINISTRATION OF THE U.S.S.R.

Report on the Procedure of Telegraph Distortion Measurements

By K.P. Lishai, Chief Engineer of the Central Telecommunications Research Institute.

Study Group I of the C.C.I.T. has submitted for study question 10 : " Is there a need to introduce the idea of ' factor of safety of a telegraph connection ' as the difference between the margin of the receiving apparatus and the degree of distortion of the restitution measured at the input of this apparatus ? "

Study Group II has submitted question 13 : " Should measurements of service distortion on telegraph channels using the standard text mentioned in Recommendation B.32, be made with a rhythmic distortion meter or with a start-stop distortion meter ? "

Study Group II drew up at its last meeting the Draft Recommendation II/2, now Recommendation B.52 of the C.C.I.T., concerning its question 13 ; in this recommendation it declares the view that for distortion measurements on telegraph channels rhythmic distortion meters should be used, whereas for measurements on telex circuits use of start-stop distortion meters is recommended, and that for this latter purpose administrations should be advised to establish standards ; it also expresses the opinion that the measurement of start-stop transmission quality is only feasible when use is made of a start-stop distortion measuring set, and that the value of start-stop distortion is the best criterion for the estimation of the conventional value of start-stop distortion.

However, the Administration of the U.S.S.R. deems it necessary to submit the following report dealing with problems arising in connection with the study of questions 10 and 13.

A. *Measurement of telegraph distortion with a rhythmic distortion meter.*

1. *Fortuitous distortion*

It may be assumed at present that the curves of the distribution of fortuitous distortion probability densities very nearly agree with the normal distribution law.

In a particular case, no other distortion types being present, such as bias distortion, characteristic distortion, and cyclic distortion, the curve of the distribution of fortuitous distortion probability densities may be assumed to be symmetrical with respect to the axis of ordinates.

If this condition is realized in practical measurements, use may be made of a simple method to determine various types of distortion, and to establish the relationship between the measured values and the margin of the receiving apparatus of rhythmic type.

The distribution density of light spots on a rhythmic meter dial will correspond to the shape of a curve showing the distribution of fortuitous distortion probability densities. The centre of light spot distribution density will be the determining factor for the location of the imaginary axis of ordinates and, hence, for the location of the ideal characteristic restitution instant of signal elements received. To read the values of isochronous distortion, zero setting on the meter dial must be made to coincide with the imaginary axis of ordinates, i.e. with the centre of the distribution density of light spots.

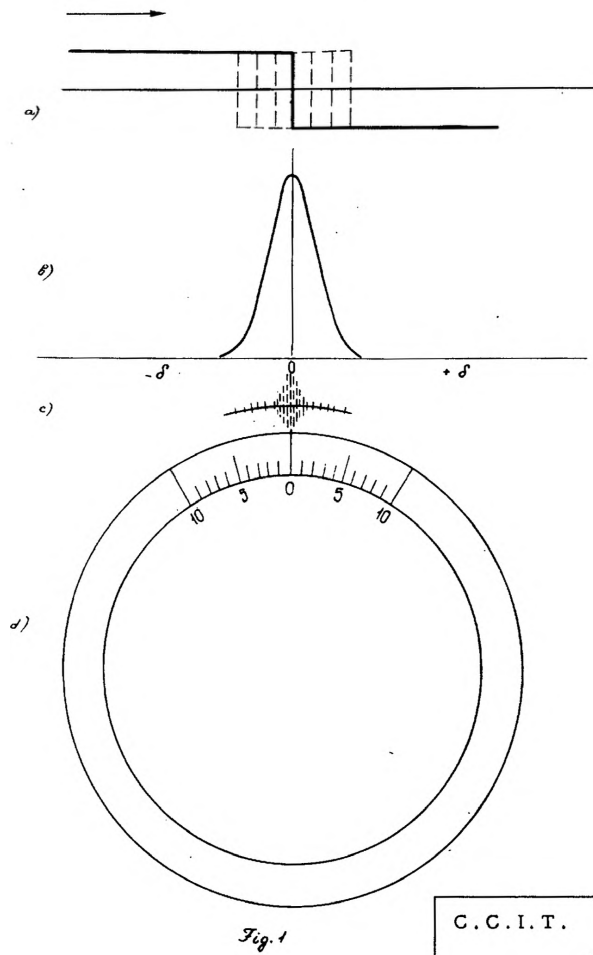


Fig. 1

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The degree of the fortuitous isochronous distortion will be equal to the doubled maximum value of light spot deflection to any side from zero on the meter dial, related to the unit interval. It is generally known that these percentage relations are used to calibrate the meter dial. Hence, to determine the degree of distortion, it is only necessary to read the value of maximum per cent deflection from zero setting, and to double the reading.

Figure 1 illustrates the relative positions of : *a)* a curve showing the passage of receiving relay armature ; *b)* a curve showing the probability distribution density of fortuitous distortion ; *c)* a graphical representation of light spot distribution density on a rhythmic distortion meter dial ; and *d)* a graphical reprensentation of a rhythmic distortion meter dial.

The fortuitous isochronous distortion, shown in figure 1, is equal to 8 %.

To establish the relationship between the measured values and the margin of rhythmic receiving apparatus, figure 2 gives a plot of relative positions of : *a)* a curve showing the passage of receiving relay armature ; *b)* a graphical representation of light spot distribution density on a rhythmic distortion meter dial ; *c)* a meter dial stretched out ; and *d)* the positions of the receiving apparatus selection points. All

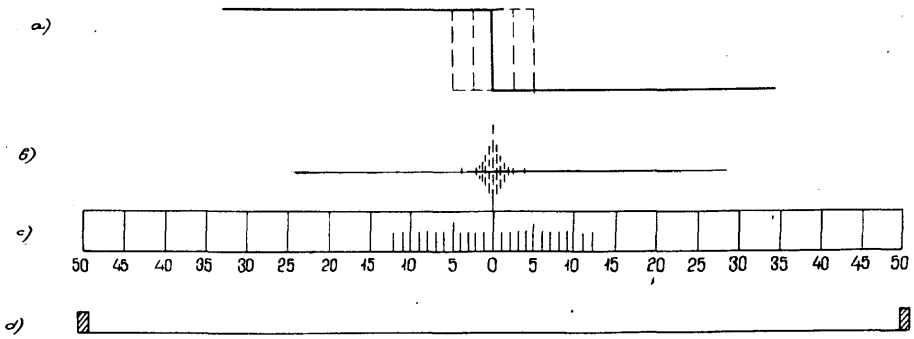


Fig. 2

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restitution instants distorted are located between adjacent selection points (shortened contacts) of the receiving apparatus. If the ideal restitution instant is located half-way between the selection points, the relation between the apparatus margin and the distortion of signal elements received is determined by way of comparing the apparatus margin with one half of the value of the isochronous distortion of signal elements, i.e. with the maximum light spot deflection to anyone side from zero setting on the meter dial.

The maximum light spot deflections from zero setting, shown in figure 1 and 2, are equal to $\pm$ 4 %.

If the margin of a rhythmic receiving apparatus is assumed to be equal to 35 %, the difference 35 — 4 = 31 % will be the excess value of the margin of a receiving apparatus, or a factor of safety of a telegraph connection.

2. *Characteristic distortion*

To proceed to the measurement of characteristic distortion, it is necessary to adjust first the channel in accordance with the existing standard rules. There must be no bias distortion on the channel. In the same way as fortuitous distortion is measured, the ideal characteristic instant of restitution is determined using I : I signal elements, and zero setting of the dial of a rhythmic distortion meter is made to coincide with this instant.

Thereafter the displacement of restitution instants from zero on the meter dial resulting from characteristic distortion is determined using a 6 : 1 or a 1 : 6 test combination of signal elements.

In figure 3 are plotted : *a)* a curve showing the input current in the receiving relay windings (solid line—for a 6 : 1 test combination ; dotted line—for a 1 : 1 combination) ; *c)* a graphical representation of light spot distribution densities on the meter dial when a 6 : 1 combination is received ; *d)* a meter dial stretched out ; and *b)* light spot distribution density for a 1 : 1 test combination.

The values of fortuitous and individual characteristic distortion, shown in figure 3, are : fortuitous distortion 2 × 2 = 4 % (doubled value of the maximum deflection of light spots to either side from the ideal restitution instant), and individual characteristic distortion + 12 % and — 8 %.
Isochronous distortion is equal to 20 + 4 = 24 %.

To establish the relation between the measured values and the excess value of the margin of a rhythmic apparatus, the maximum deflection of light spots from the ideal restitution instant must be used, determined for a certain combination 1 : 1. For the values of individual characteristic distortion, shown in figure 3, maximum distortion is equal to + 12 %.

Maximum individual fortuitous distortion is equal to 2 %. Total distortion (to anyone side from zero dial setting) is equal to 14 %.

The excess value of the margin of a rhythmic apparatus (or the factor of safety of a telegraph connection) will be equal to 35 — 14 = 21 %, for the case considered.

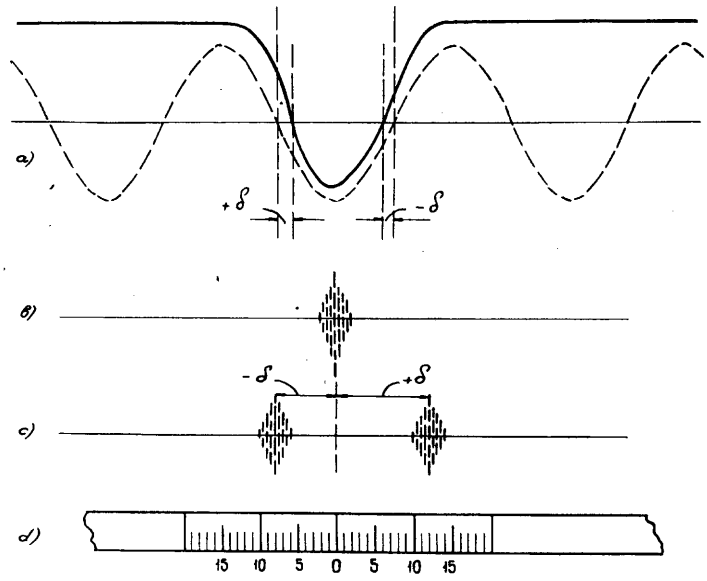


Fig. 3

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3. *Bias distortion*

In figure 4 are shown : *a)* a graphical representation of the passage of receiving relay armature, if a 1 : 1 test combination is used ; (dotted line — no bias distortion present ; solid line — bias distortion present) ; *b)* light spots on the meter dial due to fortuitous distortion (without bias distortion) ; *c)* light spots with both the fortuitous distortion and bias distortion present ; *d)* meter dial stretched out.

In a general case, when two types of distortion, i.e. fortuitous distortion and bias distortion are simultaneously present, and the suppression of bias distortion is not feasible, the ideal restitution moment for a 1 : 1 test combination may be determined by setting the dial zero as shown in figure 4, i.e. midway between two distribution density centres of light spots.

Isochronous distortion will be equal to bias distortion, i.e. $2\,\delta = 32\,\%$ plus 4 % of fortuitous distortion which makes it equal to 36 %.

To establish the relation between the results of measurements and the rhythmic apparatus margin, maximum deflection of light spots from the ideal restitution instant must be considered. With the bias distortion value, shown in figure 4, maximum individual distortion is equal to $\pm\,\delta = \pm\,16\,\%$.

The maximum fortuitous individual distortion is equal to 2 %. Total maximum individual distortion is equal to $16 + 2 = 18\,\%$.

For the case considered, the excess value of the margin of a rhythmic apparatus or the safety factor of a telegraph connection will be equal to $35 - 18 = 17\,\%$.

4. *Cyclic distortion*

Cyclic distortion is observed in the presence of a periodic disturbance changing in phase and originating as a result of adjacent channel interference, or interference by disturbing alternating currents, or else of irregularities in the operation of distributor and transmitter contacts ; it shows itself in the form of periodic shifts to the right and left (oscillations) of the light spots on the meter dial.

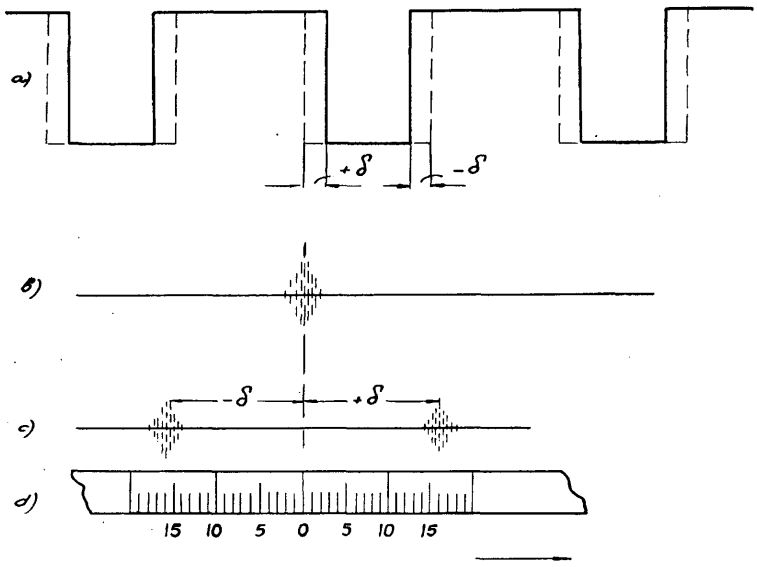


Fig. 4

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Figure 5 is a plot of : *a)* current wave form in the receiving relay windings ; *b)* disturbing current ; *c)* resulting current in the receiving relay windings ; *b bis)* disturbing current changed in phase with respect to a ; *c bis)* current resulting from the addition of a and b ; *d)* light spots on the meter dial ; *e)* rhythmic distortion meter dial.

The plot of figure 5 displays the character of the occurrence of cyclic distortion resulting from adjacent channel interference.

The disturbing current differs but slightly in frequency from the modulation rate, and its phase is continuously shifted with respect to the ideal characteristic restitution instant. If only fortuitous distortion is present, light spots on the meter dial are located just opposite the zero setting of the dial, as shown in figure 5 *d)*. In the presence of a periodic disturbing current changing in phase with respect to the ideal restitution instant, the group of light spots will shift from zero setting to the right by + δ and to the left by — δ.

For the case illustrated in figure 5, isochronous cyclic distortion will have value of 2 δ.

Total isochronous distortion will be equal to the sum of cyclic and fortuitous distortion, i.e. 16 + 4 = 20 %.

To establish the relation between the measured values and the value of rhythmic apparatus margin, the maximum displacement of light spots to anyone side from the ideal restitution instant must be considered. It will make 8 + 2 = 10 % for the values of cyclic and fortuitous distortion shown in figure 5.

The excess value of the margin of a rhythmic receiving apparatus or the safety factor of a telegraph connection will be equal to 35 — 10 = 25 % for the case considered.

Conclusions

1. A method of determination of the ideal characteristic instant of restitution, using the ordinates of a fortuitous distortion probability density curve for a 1 : 1 test combination, makes it possible to determine easily the component types of telegraph distortion.

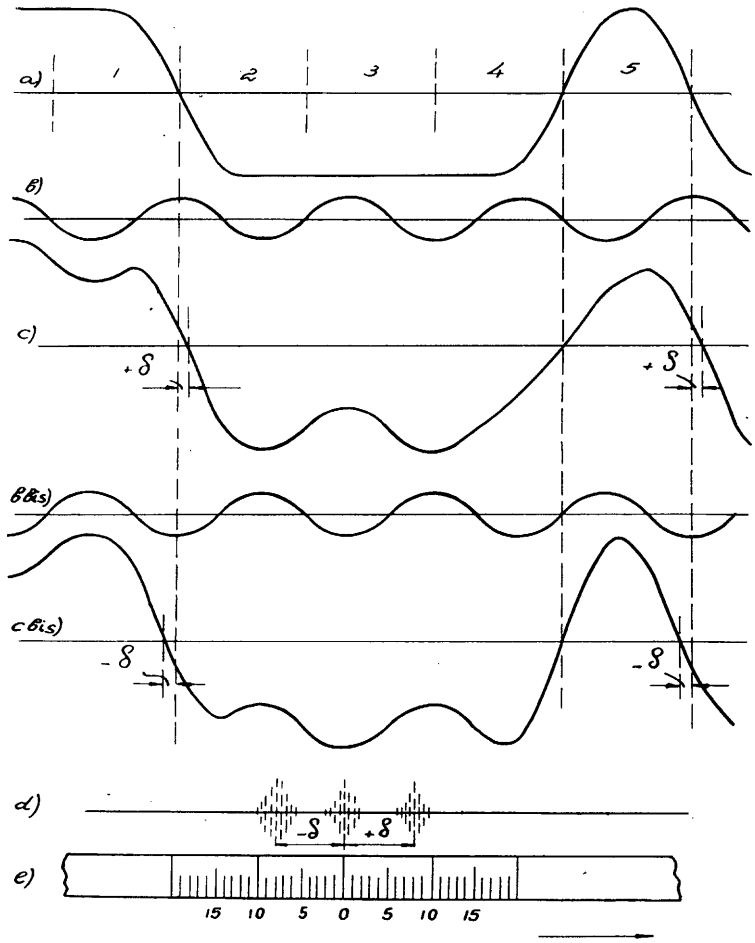


Fig. 5

C.C.I.T. N°89/5

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2. Knowing the values of different distortion types measured in the above mentioned way, it is possible to use computation methods to evaluate the transmission quality of a telegraph channel.

3. As a result of the addition of maximum individual values found for the distortion types observed, using the ideal characteristic instant of restitution, the factor of safety of a telegraph connection may be determined.

B. *Measurement of telegraph distortion with a start-stop distortion meter*

1. *Special features of meter indication*

In accordance with the principle of operation of a start-stop distortion meter, the characteristic instants of the restitution of start-stop signal elements are displayed on the meter dial. The positions of characteristic instants on the meter dial will depend upon the value and sign of the distortion of the beginning of a start element.

The distortion of the beginning of a start element is added algebraically to the distortion of code elements making up the signal.

On meters with horizontal sweep of every signal element the value and sign of distortion are read from a vertical line located in the dial centre[1]. This line is the ideal cha acteristic instant of the restitution of received signal elements. This ideal characteristic instant of restitution is determined for each value of the telegraph speed by means of an appropriate meter adjustment.

To relate the measured values to the receiving start-stop apparatus margin at synchronism, in figure 6 are shown : *c)* an undistorted start-stop signal ; *a)* characteristic instants of the restitution of this signal, distributed on the meter dial along the zero line, and represented by points; *e)* distorted start-stop signal having only the start element distorted (late distortion) ; *a)* characteristic restitution instants of the signal, represented by crosses on the dial; *d)* distorted signal with bias distortion of its elements; *a)* restitution instants of this signal, represented by points at zero and 20 % dial settings; *f)* distorted signal, with start element and code elements distorted in different ways ; *b)* restitution instants of this signal, represented by points on the dial.

Signal distortions, shown on the dial *a)*, are distributed on the one side of zero setting, thus facilitating the reading of the distortion value, viz., plus 10 % for signal *e)*, and minus 20 % for signal *d)*. For signal *f)* readings are taken on the dial *b)* on both sides of zero setting. Effective distortion will be given by the greatest value of distortion read from zero setting. In this particular case the value of plus 30 % is read for the stop element and that of plus 20 % for the fourth signal element.

For the cases considered, the excess value of start-stop receiving apparatus margin, the latter being for instance equal to 35 % at synchronism, is given by the difference between 35 % and the values shown.

2. *Comparison of start-stop meter readings with rhythmic meter readings.*

Signal *f)* has the start element disto ted by 10 % as a result of early distortion (start element has commenced before time). This distortion value has been added algebraically with distortion values of single signal elements. If the same signal were measured with a rhythmic distortion meter and ideal restitution instants had been preliminarily fixed, the distortion values, as shown in figure 6 *f)*, would be equal to δ', and would be distributed on the dial *b)* as shown by crosses.

Comparison of the values of start-stop distortion with those of rhythmic distortion shows that, if a rhythmic distortion meter is used, its readings will be lesser by the value of start element distortion than the readings of a start-stop distortion meter.

To obtain comparable result, the observation time of a start-stop distortion meter must be evidently increased as compared to that of the rhythmic distortion meter. E.g., if the fortuitous distortion probability of one instant of a significant restitution interval of one of the seven impulses is put as P, the distortion probability of the start element will be $\frac{P}{7}$.

The distortion probability of one of the code elements is equal to $\frac{5}{7}$ P. The probability of occurrence of distortions indicated within one cycle is $\frac{1}{7} P \times \frac{5}{7} P$.

The probability of signs of a start element and a code element being mutually opposite is two times less, and is equal to :

$$\frac{1}{2} \cdot \frac{1}{7} P \frac{5}{7} P = \frac{5}{98} P^2$$

Assuming that in the telegraph circuit considered the disturbances occur on the average once in a second, P = 0,15 if the duration of a start-stop cycle is equal to 150 msec.

The sought for probability of occurrence of the coincidence indicated above will be equal to $\frac{5}{98} P^2 = 0{,}001$.

Hence, the coincidence of distortion values observed on both the start-stop and rhythmic meters may occur only once per every 1000 evolutions of the start-stop transmitter, or once per every 2.5 min, the transmitter shaft speed being 400 r.p.m.

This elementary example demonstrates quite convincingly that, to discover maximum distortions with a start-stop distortion meter, a much greater observation time is necessary than with a rhythmic distortion meter, this time being equal in this example to 2.5 min and 1 sec.

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[1] As, for instance, is the case with meters used in the U.S.S.R.

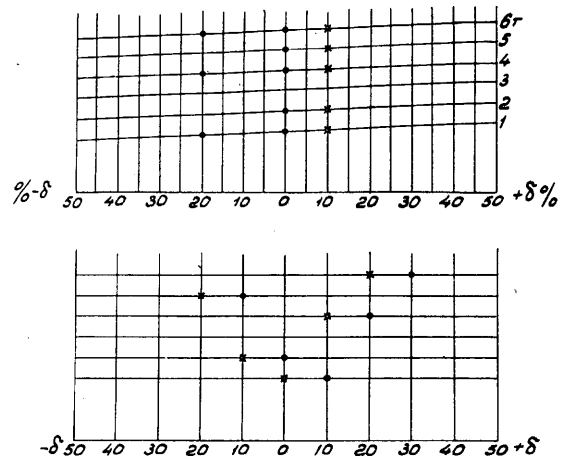
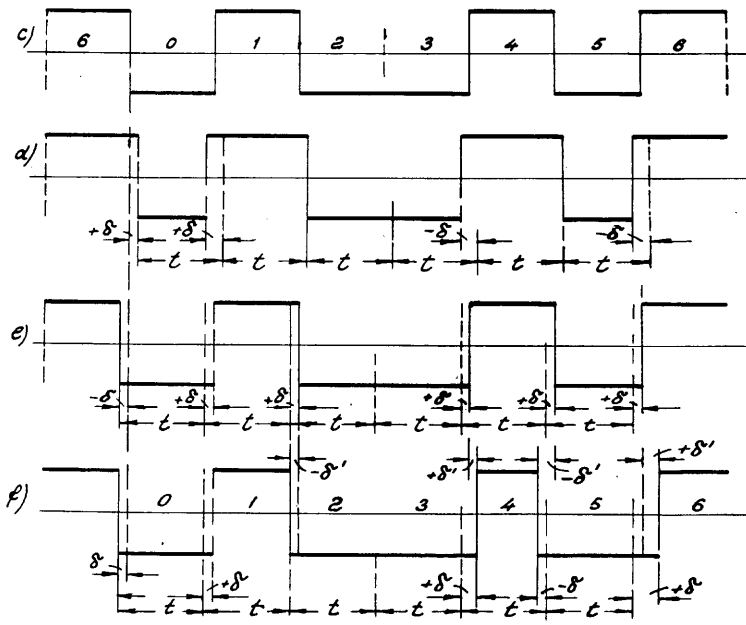


Fig 6



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In practical measurements it is impossible to select the value of start element distortion from the readings of a start-stop distortion meter. Hence, using this meter, it is impossible to determine signal distortion types, whereas this is possible if a rhythmic distortion meter is used.

Therefore, a start-stop distortion meter cannot replace a rhythmic distortion meter, the latter remaining the main instrument to measure the quality factors of telegraph circuits.

In so far as the start-stop meter provides for the indication of start-stop distortion, it may be advantageously used in the practical operation of start-stop circuits to determine the transmission quality for a given time moment with a practically reasonable accuracy.

Conclusions

1. In the measurement of telegraph distortion with a start-stop meter, the maximum distortion value is read as the maximum deflection of a light spot to anyone side from zero setting on the dial.

2. Every distortion value read from the meter dial is an algebraic sum of the start element distortion and the corresponding code element distortion.

3. In the same conditions of measurement the observation time needed to detect maximum distortion is considerably greater for a start-stop distortion meter than it is for a rhythmic distortion meter.

Chief Engineer K. LISHAI
Moscow, October 10, 1956

U.S.S.R.

Document S.G. II/65-E
30 October 1956

Verification of the proposed formula for the addition of distortion

(C.C.I.T. Questions 12 and 12 bis — C.C.I.T.T. Questions 8/9 and 9/9)

Does the formula proposed by the Netherlands Administration for determining the distortion in a composite channel correspond to practical results ?

Reply

The formula proposed by the Netherlands Administration for calculating distortion in a composite circuit on the basis of measurements made on individual links :

$$\delta^{\text{inherent}} = \sum_{1}^{n} \delta_c + \sqrt{\sum_{1}^{n} (\delta_{\substack{1:1\\2:2}} + \delta_{\text{irreg.}})^2} \qquad (1)$$

$(n > 1)$

where $\delta_{pr.}$ is the degree of distortion in the composite channel during the standardized test;

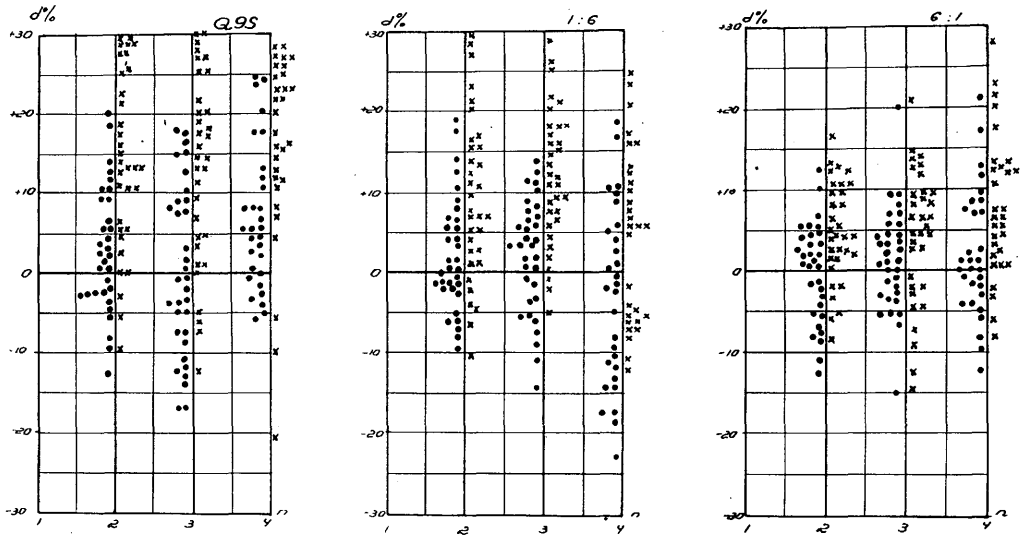
δ_c is the degree of characteristic start-stop distortion of a single channel;

$(\delta_{\substack{1:1\\2:2}} + \delta_{\text{irreg.}})$ are the degree of start-stop distortions on one channel with signals 1 : 1 or 2 : 2;

was verified by means of multiple measurements at a speed of 50 bauds with both amplitude-modulation and frequency-modulation in the channels over land and cable routes 800 to 2000 km long.

Channels made up of links were constituted by interconnecting in series the loops formed in distant stations. Each transmission section was composed of the go and return channels, and no route had more than one loop. The channels to be measured were adjusted according to the 1 : 1 combination for the minimum of distortion.

In formula (1) proposed by the Netherlands Administration, characteristic distortion is added arithmetically and fortuitous distortion by R.M.S. addition. Measurements obtained under operational conditions give the aggregate of characteristic and fortuitous distortion;



Legend : ● — δ_c calculated according to formula (2).

× — δ_c calculated according to formula (3).

Légende : ● — δ_c calculé d'après la formule (2).

× — δ_c calculé d'après la formule (3).

Fig. 1

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therefore, when calculating the distortion of a composite circuit from measurements obtained for individual links, it is necessary to separate the figures for fortuitous distortion and those for distortion measured during the transmission of combinations Q9S, 1 : 6 or 6 : 1.

This may be done approximately by applying expressions (2) or (3) Q9S.

$$\delta_c = \delta_{\substack{Q9s \\ 1:6 \\ 6:1}} - \delta_{\substack{1:1 \\ 2:2}} \qquad (2)$$

$$\delta_c = \delta_{\substack{Q9s \\ 1:6 \\ 6:1}} - \Delta_{\substack{Q9s \\ 1:6 \\ 6:1}} \qquad (3)$$

where $\delta_{\substack{Q9s \\ 1:6 \\ 6:1}}$ is the distortion measured on combinations Q9S, 1 : 6 or 6 : 1.

$\delta_{\substack{1:1 \\ 2:2}}$ is the distortion measured on combinations 1 : 1 or 2 : 2, after the elimination of bias distortion in the channel.

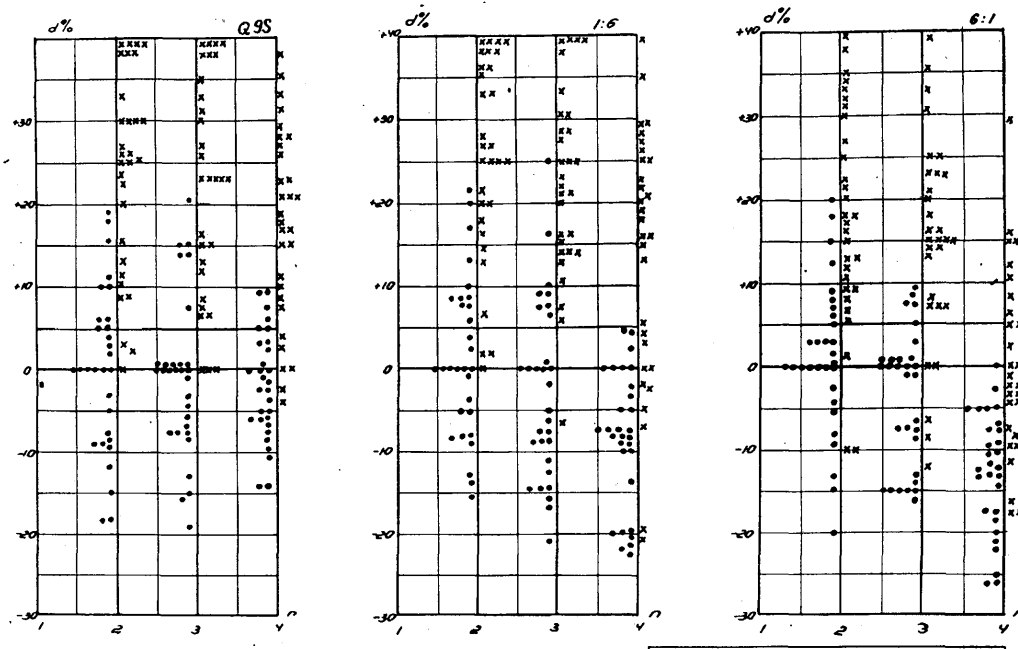
$\Delta_{\substack{Q9s \\ 1:6 \\ 6:1}}$ are the limits of the oscillations of each light spot on the stroboscope, during the measuring of distortion with combinations Q9S, 1 : 6 or 6 : 1.

To find out where the distortion of a section calculated from formula (1) approaches the measured figure, the relative errors

$$d\% = \frac{\delta_{propre} - \delta_{mes}}{\delta_{mes}} \cdot 100$$

were determined.

For each channel made up of links, the error was twice defined : once by substituting in formula (1) the characteristic distortion δ_c resulting from expression (2), and once from expression (3). All in all, 822 measurements were made on channels made up of links.



Legend : ● — δ_c calculated according to formula (2).

× — δ_c calculated according to formula (3).

Légende : ● — δ_c calculé d'après la formule (2).

× — δ_c calculé d'après la formule (3)

Fig. 2

C.C.I.T N°90/2

SG II/65

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Figure 1 shows the scatter of error "*d*" as a function of the number of sections, of the method used for determining the characteristic distortion δ_c and of the type of combinations to be measured for amplitude-modulation channels with 80 c/s pass-band.

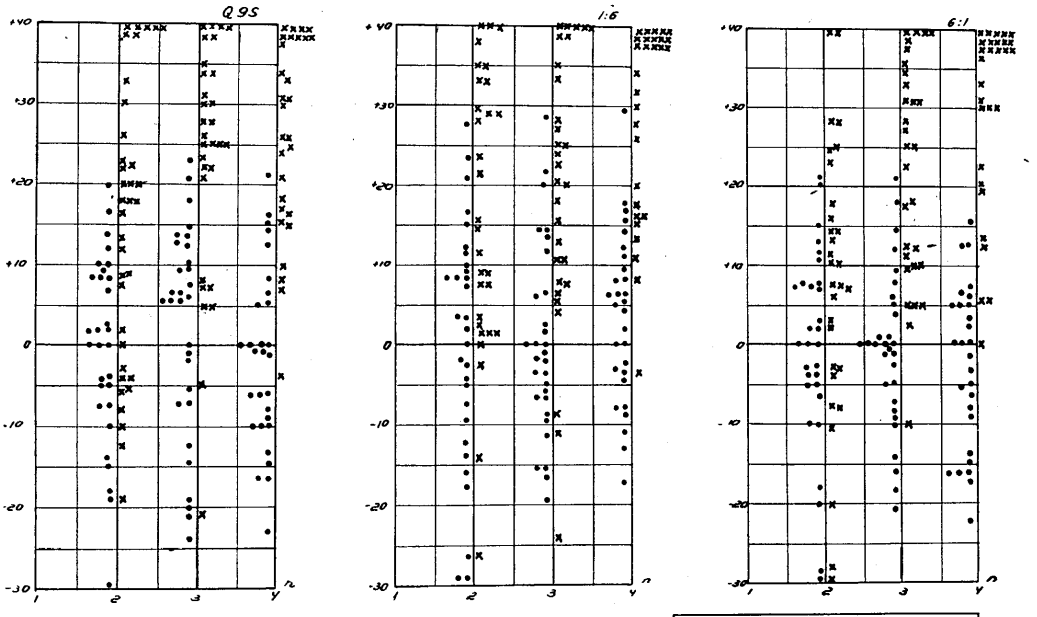
Figure 2 shows the same thing for frequency-modulation channels.

Figure 3 shows the scatter of error for frequency-modulation channels with 130 c/s pass-band.

The above-mentioned results point to the following conclusions :

1. The distortion of the composite circuit calculated from formula (1) shows closer agreement with the distortion measured when the characteristic values of the distortion δ_c are defined by expression (2).

2. The relative error between the calculations and the measurements did not exceed 20 % for 96 % of the measurements and 10 % for 73 % of the measurements.



Legend : ● — δ_c calculated according to formula (2).

× — δ_c calculated according to formula (3).

Légende : ● — δ_c calculé d'après la formule (2).

× — δ_c calculé d'après la formule (3).

Fig. 3

C.C.I.T. N°90/3

SG II/65

EDITION 1 OCTOBRE 56

FRANCE

Document S.G. II/68-E
12 November 1956

Verification of the formula for the addition of start-stop distortion (van Lommel formula)

(C.C.I.T. Questions 12 and 12 bis — C.C.I.T.T. Questions 8/9 and 9/9)

In reply to C.C.I.T. Question 12 *bis* B, the French Administration has undertaken experiments to verify the formula for the addition of start-stop distortion proposed by the Netherlands Administration.

Measurements were made in loop on a circuit Paris-Troyes-Paris, on the third and sixth telephone channels of a basic group on coaxial cables, representing a distance of three hundred and fourteen kilometres. The channels were measured with a rhythmic distortion measuring set on 1/1 signals and text and with a start-stop distortion measuring set on 1/6 signals and text. Operations were carried on successively on channels equipped for standardized type 44 amplitude modulation voice-frequency systems and on channels equipped for standardized type 51 L frequency-modulation voice-frequency systems. The results are tabulated below.

1. *1944-type amplitude-modulation systems*

Channels	Distortion on rhythmic signals		Distortion on start-stop signals	
	1/1	text	1/6	text
3	3	5	6	4
4	3	5	4	3
5	2	8	3	5
6	2	5	6	4
7	1	6	7	5
8	4	7	7	5

2. *1951-L type frequency-modulation systems*

Channels	Distortion on rhythmic signals		Distortion on start-stop signals	
	1/1	text	1/6	text
7	5	7	5	6
8	3	4	3	4
9	4	4	3	4
10	5	5	5	5
11	3	3	3	4
12	4	7	4	7

We thereafter combined the channels as described in the following diagrams. For the sake of an exhaustive inquiry, distortion on text was measured with both rhythmic and start-stop distortion measuring sets. We assumed that the characteristic distortion was represented by the distortion measured on 1/6 signals, which is not certain. The following were calculated:

1. For start-stop distortion, the inherent distortion δ_c from the first formula proposed by the Dutch Administration, and δ_q assuming quadratic addition of distortion.

2. For rhythmic distortion, the inherent distortion δ_c from a formula we suggested in 1951 (Statistical Aspects of the Concept of Rhythmic Distortion, in the Annales des Télécommunications, August-September 1951). For application of this formula, we assumed:

$$\delta = m\text{-}n + s\sqrt{2_n}\ \mathrm{erf}^{-1}(1 - \overline{\omega}_o)$$

(admissible probability of error = 1/1000)

and the parameters m and s of the equipment characteristics were calculated in the following manner:

— For amplitude-modulation systems $m = 4 \quad s = \sqrt{2}$

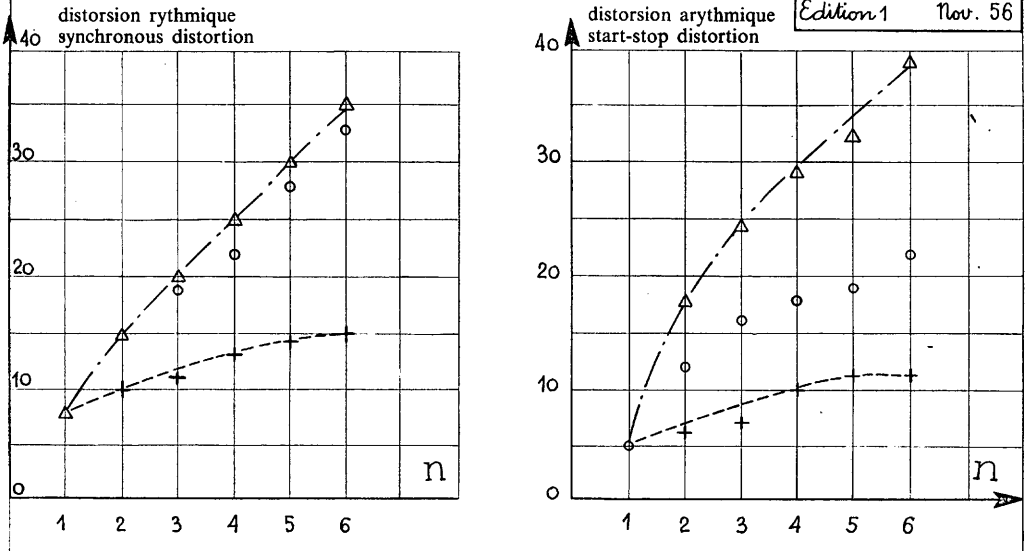
— For frequency-modulation systems $m = 2 \quad s = \sqrt{2}$

We likewise calculated the rhythmic distortion resulting from quadratic addition δ_q.

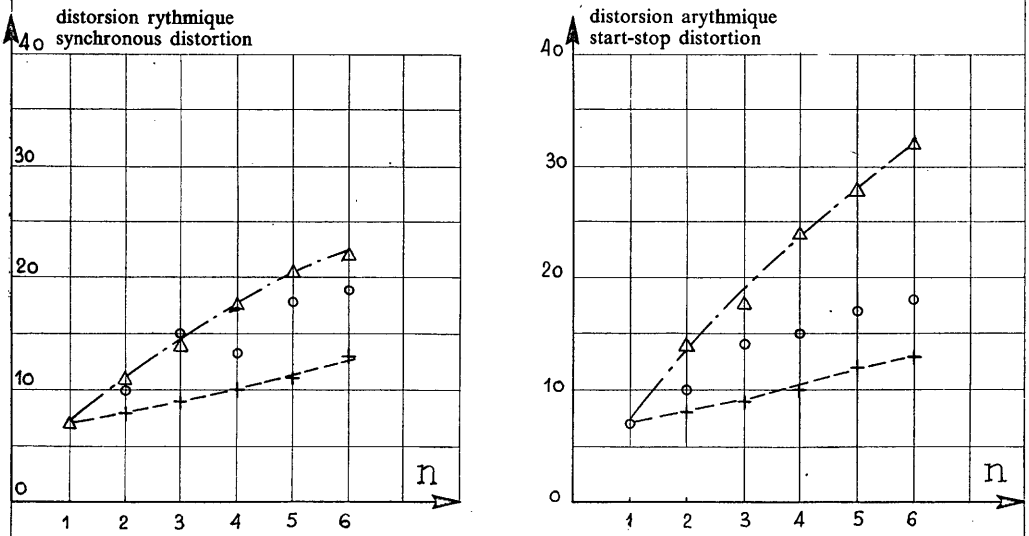
The results are set forth in the following tables, where δ_m represents the distorsion measured, and have been carried into diagram INST No. 12 396 (C.C.I.T. No. 98).

CCIT N° 98 E
SG. II/68
Edition 1 Nov. 56

I. Modulation d'amplitude — Amplitude modulation



II. Modulation de fréquence — Frequency modulation



o: Measured values. +: Values calculated according to a quadratic addition law. △: Values calculated: — For synchronous distortion according to the formula of the French Administration; — For start-stop distortion according to the formula of the Netherlands Administration. n: Number of channels (for each value of n, the maximum corresponding distortion, measured or calculated, has been taken).

Paris 17-10-56

o: Valeurs mesurées. +: Valeurs calculées suivant une loi quadratique de composition. △: Valeurs calculées: — Pour la distorsion rythmique suivant formule de l'Administration française; — Pour la distorsion arythmique suivant formule de l'Administration des Pays-Bas. n: Nombre de voies (pour chaque valeur de n, on a porté la distorsion maximum mesurée ou calculée correspondante).

1. *1944-type amplitude-modulation systems*

Channel combination	Rhythmic signal distortion rate			Start-stop signal distortion rate		
	δ q	δ m	δ c	δ q	δ m	δ c
3 + 4	7	10	15	5	7	14
4 + 5	10	13	15	6	10	11
5 + 6	10	13	15	7	9	12
6 + 7	8	14	15	8	11	16
7 + 8	9	15	15	7	12	18
3 + 4 + 5	11	18	20	7	13	18
6 + 7 + 8	11	19	20	8	16	24
5 + 6 + 7 + 8	13	22	25	10	18	28
3 + 4 + 5 + 6	12	20	25	8	17	24
4 + 5 + 6 + 7 + 8	14	26	30	10	19	32
3 + 4 + 5 + 6 + 7	14	28	30	11	22	32
3 + 4 + 5 + 6 + 7 + 8	15	33	35	11	26	39

2. *1951 L-type frequency-modulation systems*

Channel combination	Rhythmic signal distortion rate			Start-stop signal distortion rate		
	δ q	δ m	δ c	δ q	δ m	δ c
7 + 8	8	4	11	7	4	14
8 + 9	6	10	11	6	9	11
9 + 10	7	5	11	7	5	14
10 + 11	6	10	11	7	10	14
11 + 12	8	6	11	8	6	12
7 + 8 + 9	9	7	14	8	7	18
10 + 11 + 12	9	15	14	9	15	18
7 + 8 + 9 + 10	10	9	17.5	10	8	24
9 + 10 + 11 + 12	10	13	17.5	10	10	24
7 + 8 + 9 + 10 + 11	11	12	20.5	11	12	28
8 + 9 + 10 + 11 + 12	11	18	20.5	12	16	27
7+8+9+10+11+12	13	19	22	13	17	33

The following conclusions may be drawn:

1. As regards rhythmic distortion, the formula proposed by us in 1951, which is of the same type as that suggested by the Netherlands Administration for start-stop distortion, in the form $\delta = h\,n + k\,\sqrt{n}$, where n is the number of the channels, seems fairly accurately to reflect the measurements made.

2. As regards start-stop distortion, the formula proposed by the Netherlands Administration still seems too pessimistic: the figures for distortion, as measured, come within those resulting from a quadratic addition and those computed from the Netherlands formula.

We have carried out no additional tests to verify the second formula proposed in the note to Questions 12 and 12 *bis*, which takes into account synchronous distortion and distortion for speed variations. But in all probability this formula, like the previous one, gives a somewhat pessimistic view of distortion, not justified in actual practice.

EFFICIENCY FACTOR AND QUALITY INDEX

(C.C.I.T. Question 5 — C.C.I.T.T. Question II/9)

MR. ALBANESE
Chairman, Study Group I

Extract from Document S.G. I/6
15 February 1955

1. *Efficiency factor of a telegraph communication*

Since the telegraph communication comprises terminal apparatus, the efficiency factor of the communication will obviously refer to well-defined types of apparatus and to the transmission channel considered (as stated in the definition, the efficiency factor may be different for the two directions of transmission).

Further, if the telegraph system used has a standardized modulation rate (as with start-stop apparatus), the factor in question will obviously refer to this modulation rate, whereas in the other cases we would have to indicate the modulation rate to which the measured factor would refer.

Lastly, since the efficiency factor could normally be different for different specified periods of time (for example, during the day or at night, and in general during the period between x o'clock and y o'clock), we could talk of factor relative to the time interval considered.

As regards the manner in which this notion would be applied, we should obviously take into consideration the results of observations made further to very prolonged transmissions carried out during the periods of time in question. Theoretically this determination should present no difficulties, especially if effected by special transmissions using specified test texts; however, since we should have to prolong the tests over a very long period to be sure that the results of the observations are acceptable as an index of the quality of the communication, it would, I feel, be better to use the notion of " repetition rate ", in accordance with the proposal reproduced in the annex to Document A.P. VII/4 [1]. This notion would enable us to determine the quality of the telegraph communication in the light of the transmissions made in the course of the service.

For the reader's convenience, I reproduce below the paragraphs dealing with this notion [1]:

" 2) as regards degrees of distortion in excess of the margin of the receiving apparatus (i.e., those which result in errors of reception), the concept of degree of distortion should be replaced by the concept of the ratio to the time required for corrected reception of a fairly long text, of the difference between this time and the time required for the reception of the same text without errors, the modulation in both cases being both perfect and uninterrupted;

3) the definition of the new concept should subsequently be studied, taking account of the van Duuren system which, although it does not possess all the characteristics required for complete evaluation, would make it possible to assess the quality of a telegraph transmission channel objectively on the basis of the time lost as a result of repetitions. "

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[1] Supplements to the Arnhem Documents, pages 61 and 62.

Of course, the choice of a telegraph system with automatic repetition (for example, van Duuren), and the drawing up of a definition for the new notion, would be a matter for the C.C.I.R., which is especially interested in this matter.

2. *Index of the quality of a telegraph operation*

This notion is exceedingly broad in scope. No special method can be recommended, except that the definition should be simply applied, and that observations should be prolonged until we can be sure that the percentage of errors noted is sufficiently representative of the percentage that would be noted were the observations to be continued over an even longer period. To ensure that the period of observation is sufficient, we might have recourse to one of the methods recommended by the theory of probability.

3. *Index of the quality of a modulation or of a restitution*

To apply this notion we should have to establish what degree of distortion should not be exceeded. Obviously, this figure cannot be the same for all cases. For example, we should have to set a higher figure for restitution at the end of a complete transmission channel than for restitution at the end of one of the component channels. Further, the value relative to a modulation ought to be less than that relative to a restitution. In this connection it might be said that for modulation, the degree of distortion which should not be exceeded should be set at a very low figure in relation to all the others, unless the modulation is effected by a non-regenerative repeater, even though, in this case, the modulation might be considered rather as a restitution of signals transmitted by the channel further up.

UNITED KINGDOM

Extract from Document S.G. I/9
16 June 1955

1. *Efficiency factor of a telegraph communication*

Note by the Secretariat : This is really the error rate.

The measurement of the efficiency factor of a telegraph communication is inevitably rather laborious since the number of correctly translated signals cannot be counted completely automatically. However, the factor has been usefully applied in the United Kingdom to radio-telegraph communications in which automatic error-correction is achieved by the use of an error-detecting code and of automatic request for repetition (ARQ) according to the method of van Duuren. It has been found convenient to use a test message of 4000 characters (including functions) subdivided for ease of checking into blocks of five standard lines of page teleprinter text. The number of ARQ cycles can be counted automatically, leaving only those errors which pass undetected by the decoder or which are due to faulty translation in the receiving apparatus to be counted on the received copy. The results from one such test would only be of value as a comparison with earlier more extensive tests, on account of the wide variations in performance which occur on H.F. radio-telegraph circuits. In practice it is desirable to make tests spread over at least one complete day. Even so, the presentation of the results as the average for the days would usually be misleading, and it is more satisfactory to plot points for the individual tests to show the scatter. It has to be noted that when using ARQ operation the efficiency factors

for the two directions of transmission are not completely independent. Thus the efficiency factor gives a true idea of the efficiency of handling traffic, but not necessarily a true appraisement of the transmission quality of the channel.

In the case of telegraph communications not employing automatic error correction, the counting of errors might become a considerable task during periods of bad radio propagation, even when using a standard test message. However, it might be practicable on a synchronous system to count errors automatically by using a very short standard test message.

Considering the alternative notion of " repetition rate " [1] derived from Annex 8 to Document A.P. VII/4 [2], this is based upon the time required for repetitions to correct errors, rather than upon the number of errors corrected. In the case of communications employing ARQ, the " efficiency factor " and " repetition rate " could both be derived from the same data and would be alternative ways of stating the same result. When, however, the correction of errors is under manual control, the time spent bears no fixed relation to the number of errors ; in this case the efficiency factor would probably more nearly state the transmission quality, whereas the repetition rate might more accurately assess the value of the communication in traffic and, additionally, be easier to measure.

2. *Quality index of telegraph operation*

In applying the index to the case of the keying or reception of an unequal length code, such as Morse, it would seem to be appropriate to consider the probability of element errors rather than character errors, but this might be more difficult in practice.

3. *Quality index of a modulation (or of a restitution)*

In his discussion (Document S.G. I/6) [3], Mr. Albanese has tentatively proposed the establishment of standard indices of quality for modulation and restitution on radiotelegraph communications. I agree that this would be the ideal way in which to apply the notion, but there may be insuperable difficulties in practice.

There would probably be no great difficulty in applying a standard index to the modulated output of a radio transmitter, but this is mainly a matter for the C.C.I.R. and the values chosen would not be of direct interest to the C.C.I.T. The C.C.I.T., however, would have to specify the conditions to be assumed at the input to the radio transmitter.

The application of standard indices to the restitution at the radio receiver, however, is much more difficult. Presumably it would be hoped that such an index could be used in conjunction with maintenance measurements to decide upon the fitness of a radiotelegraph communication for service. In view of the very wide variations in performance of some radio circuits from day to day and from hour to hour, it seems very doubtful whether such an index could usefully be applied in maintenance. It could, perhaps, be used on first setting up a radio-telegraph channel, as a measure of the performance based on extensive tests.

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[1] This notion of " repetition rate " is near to the notion of " efficiency factor ". (Note by the Secretariat of the C.C.I.T.)

[2] Supplements to the Arnhem Documents, pages 61 and 62.

[3] Page 38.

ABRUPT VARIATIONS IN LEVEL AND DISTURBANCE ON CIRCUITS CARRYING VOICE-FREQUENCY TELEGRAPHY

(C.C.I.T. Questions 16 and 16 bis — C.C.I.F. Question 3 of the 9th Study Group)
(C.C.I.T.T. Questions 6/9, 7/9 and 13/9)

C.C.I.F. (9th Study Group)

C.C.I.T. Document S.G. II/21
1 February 1955

Abrupt variations in the equivalent of a telephone circuit

Note by the C.C.I.T. Secretariat

The old C.C.I.F. Question 8 (Study Group 3) became Question 3 (C.C.I.F. Study Group 9) after the C.C.I.F. XVIIth Plenary Assembly. The text of the question, with the remarks appended thereto, is attached.

Question 3 (Study Group 9 in cooperation with Study Groups 3 and 8 and C.C.I.T. Study Group II) (Category A.2) (urgent) (further to Question 8 of Study Group 3, 1952-1954)

a) Statistical study of the duration, amplitude and frequency of occurrence of abrupt variations of the equivalent of an international telephone circuit.

b) Research into the most likely causes of these variations.

Comments on part a) *of the Question*

1. Study of this question should:

a) give the C.C.I.T. some idea of the scope and frequency of circuit interruptions and abrupt variations in equivalent. Such disturbances may, besides causing wrong characters to be printed, give rise to false calls, routing errors or interruptions in the switched telegraph network (see C.C.I.T. Recommendation B.42);

b) provide useful information as regards the exchange of signals in international automatic telephone switching.

2. In accordance with C.C.I.T. Recommendation B.41, and also in accordance with a request by C.C.I.F. Study Group 8, interruptions in transmission and abrupt variations in equivalent must be counted, and classified as follows:

a) lasting less than 5 milliseconds;
b) lasting between 5 and 20 milliseconds;
c) lasting between 20 and 100 milliseconds;
d) lasting between 100 and 300 milliseconds;
e) lasting more than 300 milliseconds.

3. For these measurements, each Administration will use such equipment as it has available. In October, 1954, the Sub-Committee on Maintenance was of the opinion that there was no need to provide detailed information about how the counting was done. This Sub-Committee

commented that in the case of circuits on carrier systems, counts effected on telegraph channels or on telephone channels give more representative results than the counting of transmission interruptions from system pilots. The results submitted in 1953/1954 showed, in fact that there was a very considerable difference between the number of interruptions in a system pilot and the corresponding number obtained by metering on a frequency within a telephone channel or voice-frequency telegraph channel, the latter number being about ten times the former.

4. The data on which the study of this question was based in 1952-1954 are given in the following " C.C.I.F. — 1952-1954 — 3rd Study Group " documents :

*Document 4 — Swedish Administration (pages 3 and 4).

Document 30 — French Administration (pages 2 and 3).

**Document 42 — Record of the Permanent Sub-Committee on Maintenance, October, 1953 (pages 13 to 32).

(This document gives, in its annexes, the information contained in the above-mentioned documents 4 and 30, together with the results of the observations made before the C.C.I.F. XVIth Plenary Assembly by the United Kingdom Administration, and a study made by the Dutch Administration for the C.C.I.T. VIIth Plenary Assembly, Arnhem, 1953.)

Document 58 — French Administration.

Document 63 — Swiss Administration.

Document 70 — Swedish Administration.

Document 79 — Administration of the Federal German Republic.

Document 87 — Irish Administration.

5. Annexes 1 to 6 hereinafter give the essentials of these documents. Reference should be made to the documents themselves for more detailed information about the way in which the observations were made.

6. During 1954, it was possible to make certain comparisons between the results of the observations recorded in these documents, even though they were not everywhere made according to the same principles. It was noted that the values recorded in different countries often agreed quite well. For example, according to the data communicated by the Administrations of France, the Federal German Republic and Ireland, there are some 2 to 3 interruptions per 100 km. per day observed on carrier circuits.

Comments on part b) *of the Question*

1. The following may be mentioned as the main causes regularly giving rise to breakdowns (leading to series of interruptions and noise pulses), excluding fortuitous causes such as a faulty cord inserted for a reserve repeater :

(i) high resistance and unsoldered connections ;

(ii) microphonicity of valves ;

(iii) transitory saturation of old-fashioned repeaters ;

(iv) for carrier systems, disturbances caused in carrier-frequency generators by abrupt variations in power supplies ;

(v) noise induced by sources external to equipment (for example, fluorescent lighting).

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* Supplements to Arnhem Documents, pages 196 to 199.
** Supplements to Arnhem Documents, pages 194 to 205.

2. In the preamble of C.C.I.T. Recommendation B.41 the most frequent causes of disturbance are also enumerated.

3. The C.C.I.F. Permanent Maintenance Sub-Committee, in October, 1954, took the view that the diagram submitted by the Dutch Administration (C.C.I.T. Drawing No. 19, at the end) was thoroughly representative of the conditions generally encountered.

The way in which transmission interruptions are apportioned at the various times of day, and their apportionment over the various days of the week, show that these interruptions chiefly occur at times when staff is on duty. It is incontrovertibly true that the action taken by the maintenance staff plays a most important part from this point of view. But other causes also play their part, i.e., mechanical faults (for example, vibrations affecting valve holders, defective potentiometers), electrical faults (variations in power supplies, repeater overloading during peak traffic).

4. In October, 1954, the Permanent Sub-Committee on Maintenance has examined whether any correlation can be established between the number of interruptions and the number of repeater sections. It has not appeared possible to draw any conclusion at present on this point. Whereas some administrations believe that such a correlation exists, and that a circuit on a coaxial system is, for example, subject to more interruptions than a circuit on a symmetrical pair system, which is itself subject to more interruptions than a circuit routed entirely on audio plant, some administrations believe, on the other hand, that the meticulous inspection of equipments carried out during the manufacture and installation of modern systems lead to a very considerable reduction of interruptions of transmission due to the equipment itself.

Annex 1

OBSERVATIONS FROM THE UNITED KINGDOM ADMINISTRATION IN 1946/1947

Table summarizing the number of false operations per VFT channel and per day
(1st January 1946 to 3rd February 1947)

V.F.T. system and channel		Length in miles (1 mile = about 1609 m)	Number of false operations (excluding " large batches ")							
			With tone on : level changes > 4.5 db				With tone off : number of false operations of telegraph relay			
			> 12 ms	per 100 km of circuit	> 40 ms	per 100 km of circuit	> 12 ms	per 100 km of circuit	> 40 ms	per 100 km of circuit
BM « A »	4	110	4.7	1.33	3.8	1.07	2.3	0.65	0.9	0.25
	5	110	4.8	1.36	4.0	1.13	4.8	1.36	2.9	0.82
BS « D »	7	122	3.5	0.89	2.1	0.54	6.1	1.55	2.9	0.74
	15	122	3.2	0.82	2.2	0.56	1.8	0.46	0.4	0.10
EH « B »	1	407	26.3	2.01	14.1	1.08	11.2	0.85	3.2	0.24
GW « E »	7	456	13.5	0.92	5.5	0.38	17.7	1.21	10.1	0.69
LS « A »	18	227	7.1	0.97	5.6	0.77	5.3	0.73	2.6	0.36
LS « C »	17	239	4.6	0.60	3.4	0.44	3.9	0.51	1.5	0.20
	18	239	4.7	0.61	3.6	0.47	1.9	0.25	0.3	0.04
LV « D »	10	202	7.5	1.15	4.7	0.72	6.9	1.06	2.2	0.34
	11	202	6.5	1.00	5.0	0.77	7.5	1.15	2.4	0.37
MR « B »	13	230	3.5	0.47	2.2	0.30	8.0	1.08	1.4	0.19
PZ « A »	1	325	9.9	0.95	5.8	0.56	14.0	1.34	2.9	0.28
	16	325	5.7	0.55	3.6	0.34	4.4	0.42	1.1	0.11
	18	325	7.2	0.69	6.3	0.60	7.3	0.70	1.6	0.15
Means				0.95		0.65		0.89		0.33

Annex 2

OBSERVATIONS FROM THE SWEDISH ADMINISTRATION (V.F. channels)

Summary of the number of changes of level greater than about > 0.7 *neper (excluding " large batches ")*

Circuit *	Length in km	Time **	Length of tests in hours	Number of recordings					
				20-150 ms		150-300 ms		> 300 ms	
				Total	Per hour and per 100 km	Total	Per hour and per 100 km	Total	Per hour and per 100 km
A	617	21-5 (night)	560	7	0.0020	6	0.0017	44	0.0128
		5-21 (day)	1120	17	0.0025	8	0.0012	23	0.0033
B	389	21-5 (night)	536	3	0.0015	1	0.0005	4	0.0019
		5-21 (day)	1072	5	0.0012	2	0.0005	10	0.0024
C	1128	21-5 (night)	408	55	0.0119	12	0.0026	29	0.0063
		5-21 (day)	820	438	0.0475	106	0.0116	241	0.0260
D	305	21-5 (night)	466	101	0.0711	4	0.0028	48	0.0338
		5-21 (day)	926	166	0.0588	16	0.0057	65	0.0230

* A. Audio-frequency circuit.
B. Audio-frequency circuit.
C. Carrier-current circuit, 8 + 8 system on symmetrical pairs.
D. Carrier-current circuit, coaxial system.

** Central European Time.

Annex 3

OBSERVATIONS BY THE DUTCH ADMINISTRATION IN 1952/1953

Interruptions on voice-frequency telegraph systems. Systems on low-frequency telephone circuits

Telephone circuit	Number of days	Total breakdowns	Percentage of total breakdowns							Breakdowns per day
			5-30 m/sec	30-50 m/sec	50-70 m/sec	70-90 m/sec	90-110 m/sec	110-300 m/sec	>300 m/sec	
A	69	194	53.5	11.2	6.7	1.5	1.5	2.6	23	2.80
B	69	309	47	14	9	3.8	2.8	9	14.4	4.50
C	15	58	12	5	0	1	4	10	68	3.87
D	15	26	58	7.5	4	0	3.5	0	27	1.74
Total or average	168	587	42.5	9.4	4.9	1.5	3.0	5.4	33.3	3.23

Systems on carrier telephone circuits

E	69	108	19.5	20	17.5	3.0	2.0	12	26	1.56
F	69	104	31	14	5.5	2.0	1.0	4.5	42	1.50
G	69	112	30	11	6.0	2.0	1.0	9	41	1.62
H	15	199	49	8	8	3.5	4.0	7.5	20	13.25
I	15	4	50	0	0	0	0	25	25	0.27
J	15	46	39	6.5	8.5	2	0	2	42	3.00
Total or average	252	573	36.5	10	7.5	2	1.5	10	32.5	3.50

Annex 4

OBSERVATIONS FROM THE FRENCH ADMINISTRATION, IN 1954

Interruptions and disturbances of short duration on telephone circuits (excluding " large batches ") *
Speech-frequency circuits or carrier systems (1 + 2) :

TABLE I

Type of circuit	Length in kilometres	Average interruptions per day								Average number of disturbances per day *							
		8 to 20 ms		20 to 50 ms		50 to 100 ms		> 100 ms		8 to 20 ms		20 to 50 ms		50 to 100 ms		> 100 ms	
		Total circuit	per 100 km	Total circuit	per 100 km	Total circuit	per 100 km	Total circuit	per 100 km	Total circuit	per 100 km	Total circuit	per 100 km	Total circuit	per 100 km	Total circuit	per 100 km
4-wire / A	250	1.5	0.6	0.8	0.32	2.6	1	0	0	1.5	0.6	0.3	0.12	0.3	0.12	0.2	0.08
voice / B	260	2.5	1	1.3	0.5	1.3	0.5	4	1.54	1.1	0.42	0.5	0.2	0.12	0.05	0.	0.
frequencies / C	850	10.2	1.2	4	0.47	0.5	0.06	13	1.5	0.5	0.06	1	0.12	11	1.6	0.8	0.95
1 + 2 system / D	1200	0.4	0.03	1	0.08	2	0.17	5	0.42	4	0.33	4.8	0.4	4.3	0.36	0.95	0.08

N. B. : On circuit **B**, interruptions lasting more than 100 milliseconds are broken down as follows :

Lasting from 100 to 300 ms : 2.6 (1 per 100 km)
Lasting > 300 ms : 1.4 (0.54 per 100 km)

Coaxial-Pair Circuits

TABLE II

A	260	0.2	0.08	0	0	0	0	0.8	0.3								
B	520	8	1.6	1.2	0.23	0	0	1.2	0.23								
C	880	10	1.1	1.2	0.13	0	0	2	0.23	8	0.9	2.2	0.25	0.5	0.06	0.2	0.02
D	840	16	1.9	4.2	0.5	1.5	0.18	3.4	0.4	3.4	4	1	0.12	1	0.12	0.4	0.05

N. B. : On circuit **A**, observations were made on the pilot wave of the coaxial pair carrying the circuits ; on circuits B, C, and D, they were made on loop circuits.

* The " disturbances " mentioned in the right-hand part of the above 2 tables are composed of :
— sudden increases of equivalent equal in amplitude to at least 1 neper,
— spurious disturbances the level of which at the output of a voice-frequency channel filter reached — 4 nepers at a point of zero relative level.

Annex 5

OBSERVATIONS BY THE ADMINISTRATION OF THE FEDERAL GERMAN REPUBLIC IN 1954

(On voice-frequency telegraph circuits on different circuits. Variations in equivalent of amplitude > 0.7 nepers were recorded. "Large batches" of faults are not included in these figures.)

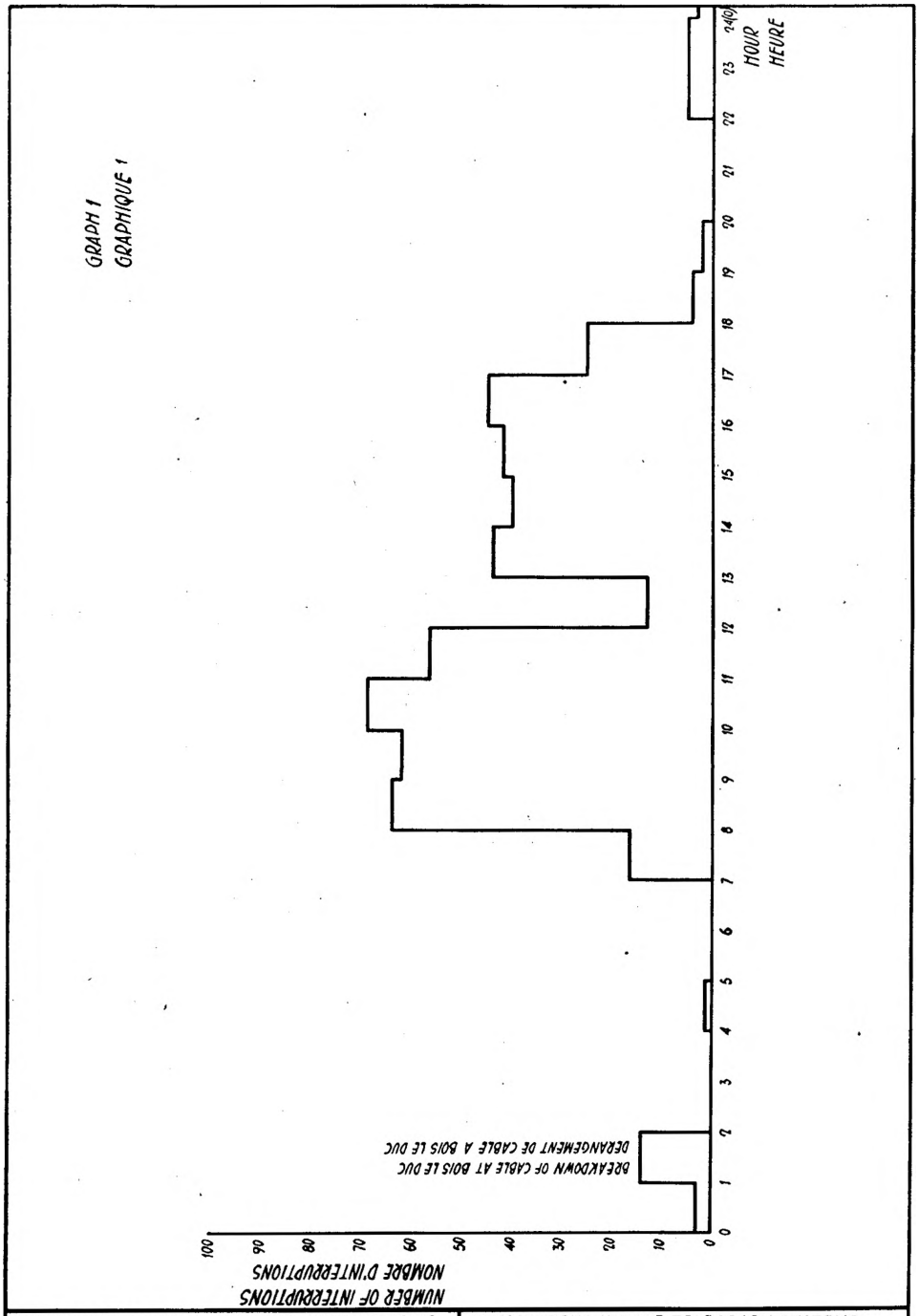
Circuit	Length km	Duration of observation (days)	Average number of interruptions per 100 km per day					
			2 to 8	8 to 20	20 to 100	100 to 300	> 300	Total
A	490	32	0.27	0.31	0.49	0.19	0.36	1.62
B	408	32	0.70	0.10	0.16	0.07	0.46	1.49
C	430	11	1.08	2.90	1.95	0.19	0.87	6.99
D	430	11	0.19	0.11	0.74	0.19	0.36	1.59
E	490	11	1.45	0.61	0.13	0.06	0.43	2.68

Annex 6

OBSERVATIONS BY THE IRISH ADMINISTRATION IN 1954

Interruptions on a telephone channel of a coaxial-pair carrier system.
Duration of observations : 915 hours

Duration of observation	5 ms <	5-20 ms	20-100 ms	100-300 ms	> 30 ms	Total
Number per 100 km and per day	0.074	1.77	3.40	2.47	3.54	11.25



INTERRUPTIONS SUR 35 SYSTEMES DE TELEGRAPHIE HARMONIQUE A AMSTERDAM EN FONCTION DE L'HEURE DE LA JOURNEE (NOVEMBRE 1952)	INTERRUPTIONS ON 35 VF TELEGRAPH SYSTEMS AT AMSTERDAM AS A FUNCTION OF THE HOUR OF THE DAY (NOVEMBER 1952)
	PTT CENTR AFD TG — CCIT Nº 19 E/F AP 7/51 ED.1 MAI 1953

Observations faites par l'Administration suédoise en 1955

Observations sur une voie de télégraphie harmonique.

Dans le tableau 1 on a inscrit les variations brusques d'équivalent $> 0{,}9$ N.

Dans le tableau 2 on a inscrit les perturbations parasites dont le niveau, à la sortie d'un filtre de voie de télégraphie harmonique, atteint — 4,1 N en un point de niveau relatif zéro.

TABLEAU 1

Circuit *	Longueur en kilomètres Length in kilometres	Durée des essais, en heures Length of tests, in hours	Nombre d'interruptions — Number of interruptions									
			> 2 ms		> 5 ms		> 20 ms		> 100 ms		> 300 ms	
			Par jour Per day	Par jour et 100 km Per day per 100 km	Par jour Per day	Par jour et 100 km Per day per 100 km	Par jour Per day	Par jour et 100 km Per day per 100 km	Par jour Per day	Par jour et 100 km Per day per 100 km	Par jour Per day	Par jour et 100 km Per day per 100 km
A	616	10	1.31	0.21	1.21	0.20	1.21	0.20	0.50	0.08	0	0
B	196	15	—	—	2.81	1.43	1.82	0.93	0.60	0.31	0.22	0.11
C	338	14	—	—	11.10	3.29	8.00	2.37	5.88	1.74	3.61	1.07

TABLEAU 2

Circuit *	Longueur en kilomètres Length in kilometres	Durée des essais, en heures Length of tests, in hours	Nombre de perturbations — Number of disturbances									
			> 2 ms		> 5 ms		> 20 ms		> 100 ms		> 300 ms	
			Par jour Per day	Par jour et 100 km Per day per 100 km	Par jour Per day	Par jour et 100 km Per day per 100 km	Par jour Per day	Par jour et 100 km Per day per 100 km	Par jour Per day	Par jour et 100 km Per day per 100 km	Par jour Per day	Par jour et 100 km Per day per 100 km
A	616	10	—	—	65.60	10.62	5.49	0.89	0	0	0	0
B	196	15	9.12	4.65	8.00	4.08	5.17	2.64	0.36	0.18	0.24	0.12
C	338	14	—	—	9.57	2.83	2.02	0.60	0.09	0.03	0	0

* A. Circuit à fréquences vocales.
B. Circuit à courants porteurs, système sur paires coaxiales.
C. Circuit à courants porteurs, système (8 + 8) sur paires symétriques.

Remarque : En étudiant le tableau de la page 21 du document 10/C.C.I.F. (page 6 du document C.C.I.T. SG II/21) il semble que les valeurs par 100 kilomètres et par jour doivent être doublées.

Observations made by the Swedish Administration in 1955

Observations on a voice-frequency telegraph channel.

Table 1 shows abrupt variations in equivalent $> 0{,}9$ N.

Table 2 shows parasitic disturbances the level of which, at the output of a voice-frequency telegraph channel filter, reaches — 4,1 N at a zero relative level point.

TABLE 1

Circuit *	Longueur en kilomètres Length in kilometres	Durée des essais, en heures Length of tests, in hours	Nombre d'interruptions — Number of interruptions									
			> 2 ms		> 5 ms		> 20 ms		> 100 ms		> 300 ms	
			Par jour Per day	Par jour et 100 km Per day per 100 km	Par jour Per day	Par jour et 100 km Per day per 100 km	Par jour Per day	Par jour et 100 km Per day per 100 km	Par jour Per day	Par jour et 100 km Per day per 100 km	Par jour Per day	Par jour et 100 km Per day per 100 km
A	616	10	1.31	0.21	1.21	0.20	1.21	0.20	0.50	0.08	0	0
B	196	15	—	—	2.81	1.43	1.82	0.93	0.60	0.31	0.22	0.11
C	338	14	—	—	11.10	3.29	8.00	2.37	5.88	1.74	3.61	1.07

TABLE 2

Circuit *	Longueur en kilomètres Length in kilometres	Durée des essais, en heures Length of tests, in hours	Nombre de perturbations — Number of disturbances									
			> 2 ms		> 5 ms		> 20 ms		> 100 ms		> 300 ms	
			Par jour Per day	Par jour et 100 km Per day per 100 km	Par jour Per day	Par jour et 100 km Per day per 100 km	Par jour Per day	Par jour et 100 km Per day per 100 km	Par jour Per day	Par jour et 100 km Per day per 100 km	Par jour Per day	Par jour et 100 km Per day per 100 km
A	616	10	—	—	65.60	10.62	5.49	0.89	0	0	0	0
B	196	15	9.12	4.65	8.00	4.08	5.17	2.64	0.36	0.18	0.24	0.12
C	338	14	—	—	9.57	2.83	2.02	0.60	0.09	0.03	0	0

* A. Audio-frequency circuit.
B. Carrier circuit, coaxial-pair system.
C. Carrier circuit (system 8 + 8) on symmetrical pairs.

N.B. : Study of the table on page 21 of Document 10/C.C.I.F. (C.C.I.T. Document SG II/21, page 6) would seem to show that the figures per 100 km per day should be doubled.

TRANSMITTING STATIC RELAYS FOR VOICE-FREQUENCY TELEGRAPHY

(C.C.I.T. Question 18)

FRANCE

Document S.G. II/40
10 February 1956

In its voice-frequency network, the French Administration has taken steps to stop disturbing signals reaching telegraph switching equipment in case of failure in the current controlling the sender static relays. The necessary modifications are being made and the modified static relays are proving satisfactory.

The following is an account of the action taken and the results obtained.

STATIC RELAYS (OR STATIC MODULATORS)

Reduction in the level of the voice-frequency signal in the absence of the direct feed current

The problem

Figure 1 represents a standardized static relay (Drawing 77/1). According to the direction of the voltage applied to the controlling terminals, this organ introduces, or does not introduce, a great attenuation between the voice-frequency channel and the voice-frequency source. No matter what operating method is used (point to point or switching), the static relay is always subject to a continuous voltage which polarizes the cells in the suitable sense.

Should there be a circuit interruption between the telegraph office and the static relay, the attenuation introduced by this latter between the voice-frequency generator and the voice-frequency channel is ill-defined because the static relay cells are not polarized.

In Question 18, the C.C.I.T. asks for study of the action to be taken in order that, in the absence of the direct current coming from the connection to the telegraph office, the attenuation introduced by the static relay should be 2.5 nepers at least.

The aim of this paper is to explain what the French Administration has done and to describe the results obtained.

Action taken (Figure 1 — Drawing 77/1)

The resistance R has been added. One of the extremities of this is connected to the control wire (sending wire), and the other to a direct-current generator with its positive pole earthed (Battery —48).

When a negative voltage is applied in the normal way on the sending wire, cells 1 and 2 act as insulators and cells 3 and 4 as conductors. The attenuation introduced by the static relay exceeds 6 nepers.

When a positive voltage is applied on the sending wire, cells 1 and 2 act as conductors and cells 3 and 4 as insulators, and the attenuation introduced by the static relay is low (a few decinepers).

Should the sending wire break, the slight negative voltage (about $0^{V}.6$) applied to the static relay terminals enables an attenuation exceeding 2.5 nepers to be obtained from this relay.

Results of measurements

Static measurements (Figures 2, 3, 4, 5, and 6) (Drawings 77/2, 3, 4, 5, and 6)

Attenuation curves have been drawn for static relays from various sources, as against current in the negative sense through the static relay. On these curves the resistances R for given attenuations have been noted.

In general, for R = 20 000 ohms, the attenuation introduced by the static relay exceeds 2.5 nepers. Taking R = 15 000 ohms gives us a safety margin.

The figures obtained by these measurements are represented by the curve in Figure 7. Examination of this curve shows that connecting the resistance has an effect on distortion when it is less than 4000 ohms.

RELAIS STATIQUE (FRANCE)

STATIC MODULATOR

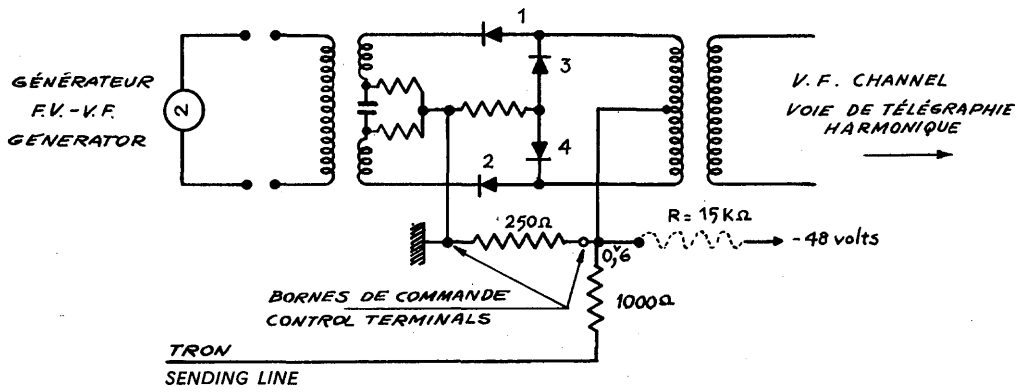
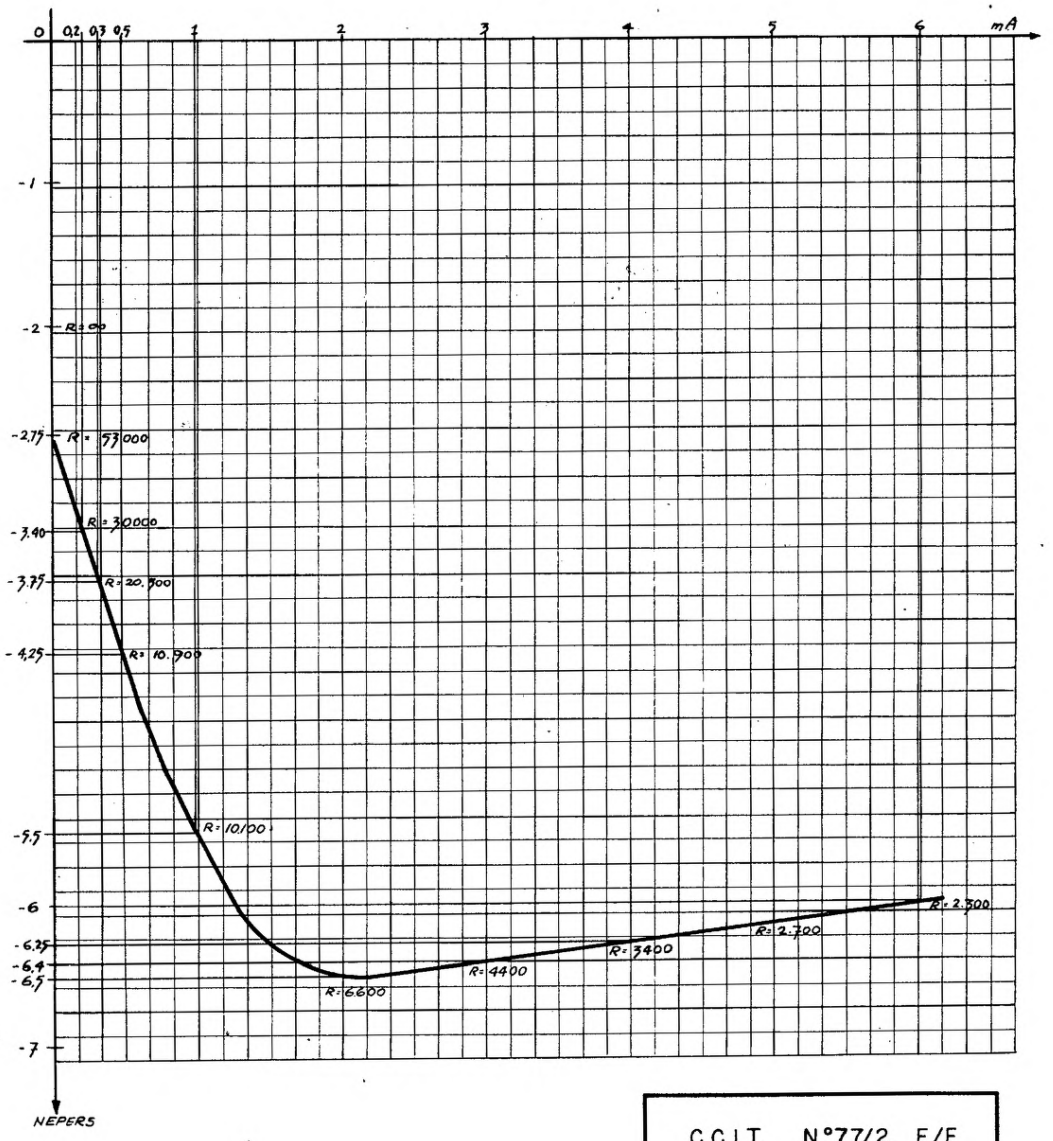


Fig. 1

C.C.I.T. N°77/1 E/F

SG II /40

EDITION 1 FEV, 56



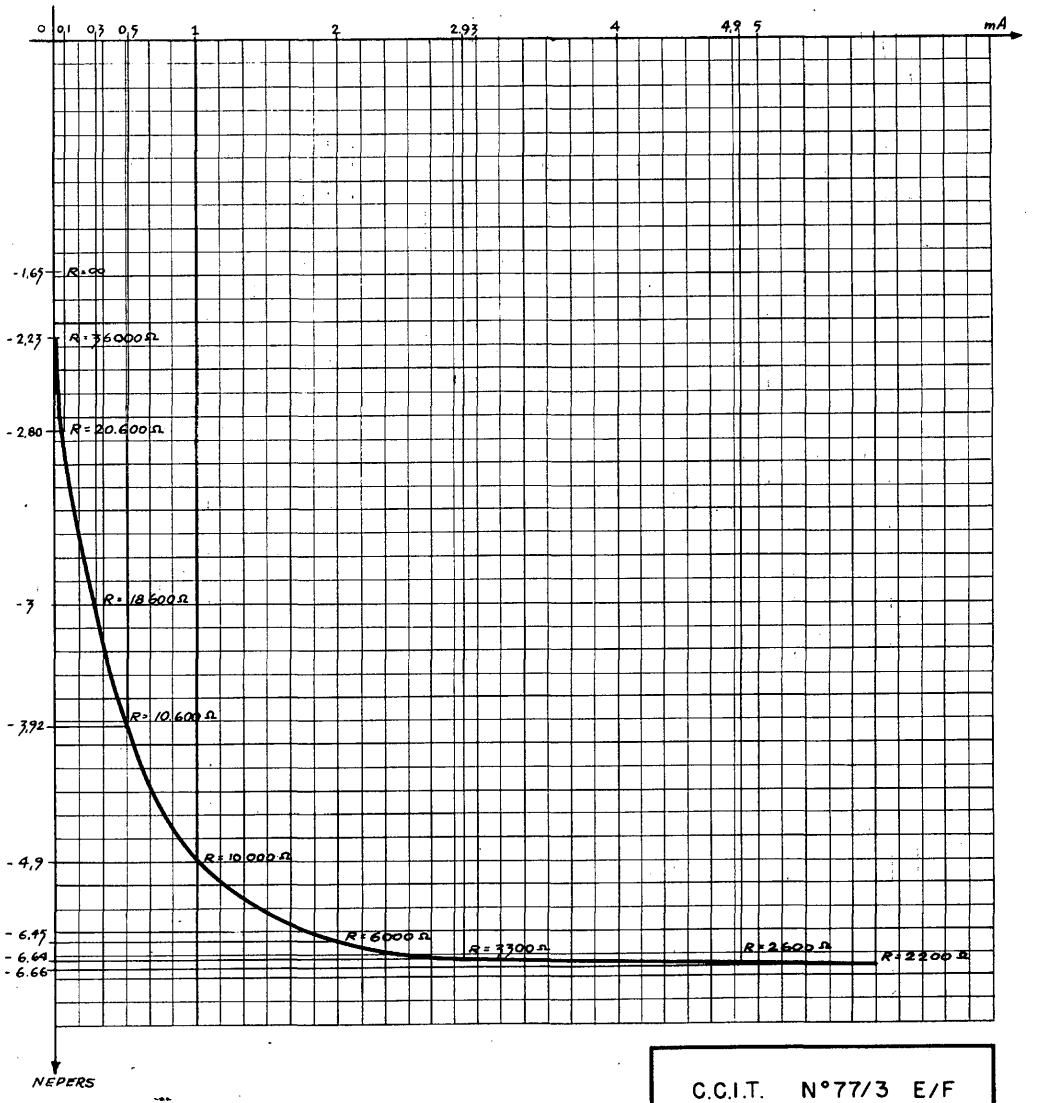
IμA	40	20	10	5	0
N	-2,95	-2,89	-2,8	-2,98	-2,75
RΩ	40000	45.000	48.000	50.000	53.000

C.C.I.T. N°77/2 E/F

SG11/40

EDITION 1 FEV, 56

Fig. 2



IμA	29	15	0
NIVEAUX-LEVELS	-2,4	-2,28	-2,23
RenΩ	30000	34000	36000

Fig. 3.

C.C.I.T. N°77/3 E/F

SG II /40

EDITION 1 FEV.56

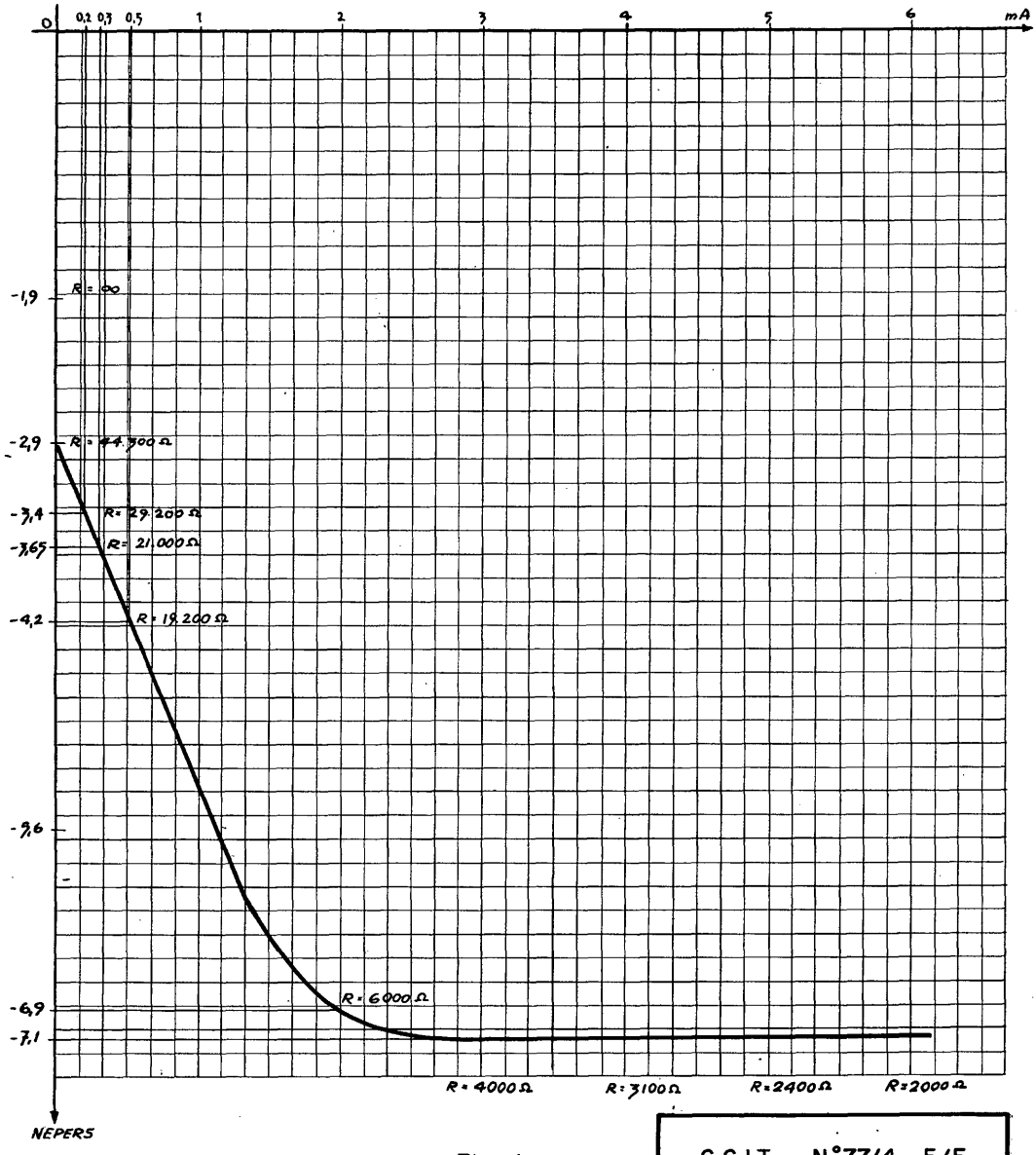


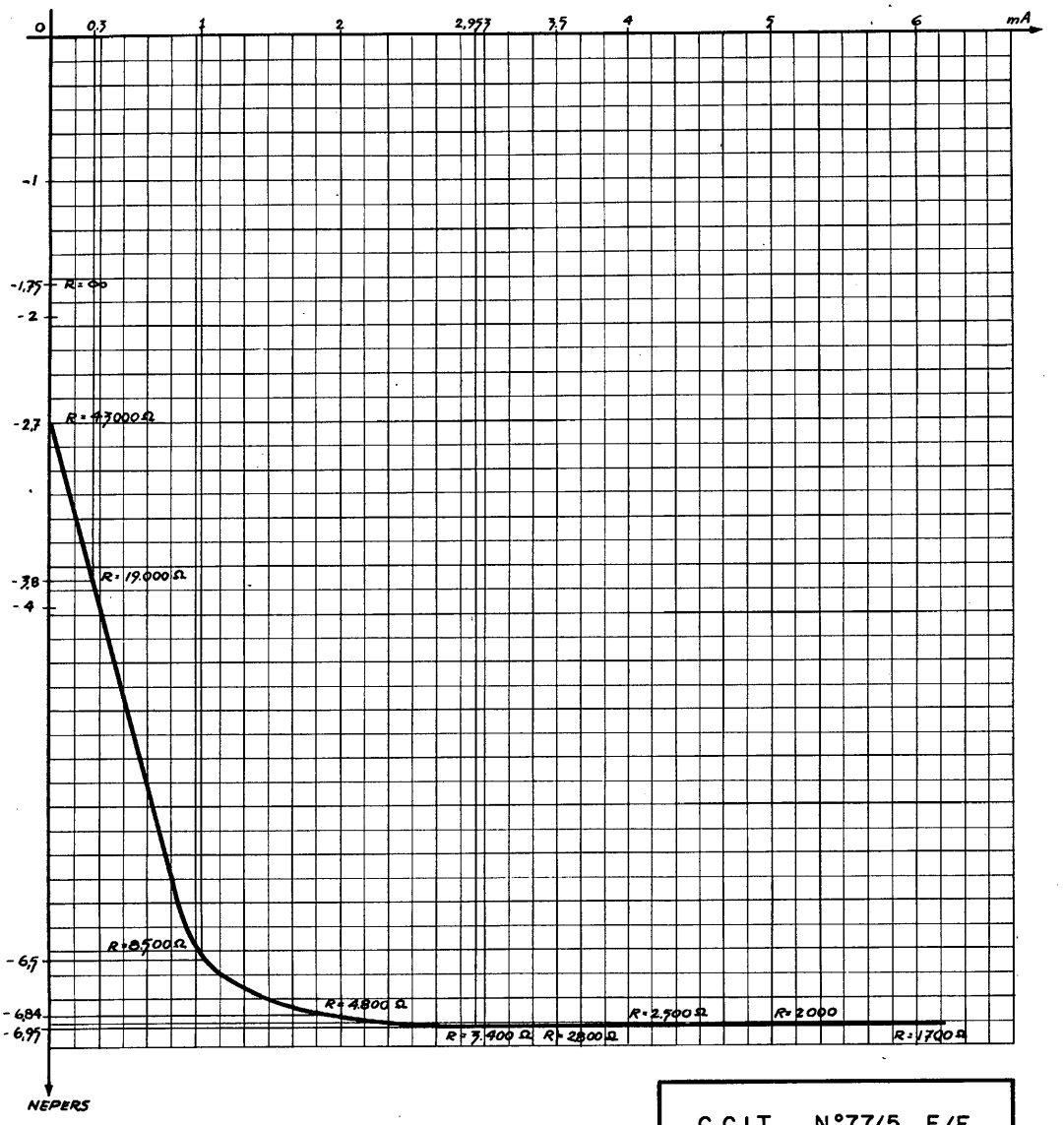
Fig. 4

IμA	52	30	10	0
N	-3,2	-3,1	-2,95	-2,9
R	30000	33000	37000	44300

C.C.I.T. N°77/4 E/F

SG II /40

EDITION 1 FEV,56



IμA	35	20	10	0
NIVEAUX-LEVELS	-3	-2,8	-2,75	-2,7
Ren Ω	3×10^4	31.100	34.000	47.000

Fig. 5

C.C.I.T. N°77/5 E/F

SG II /40

EDITION 1 FEV.56

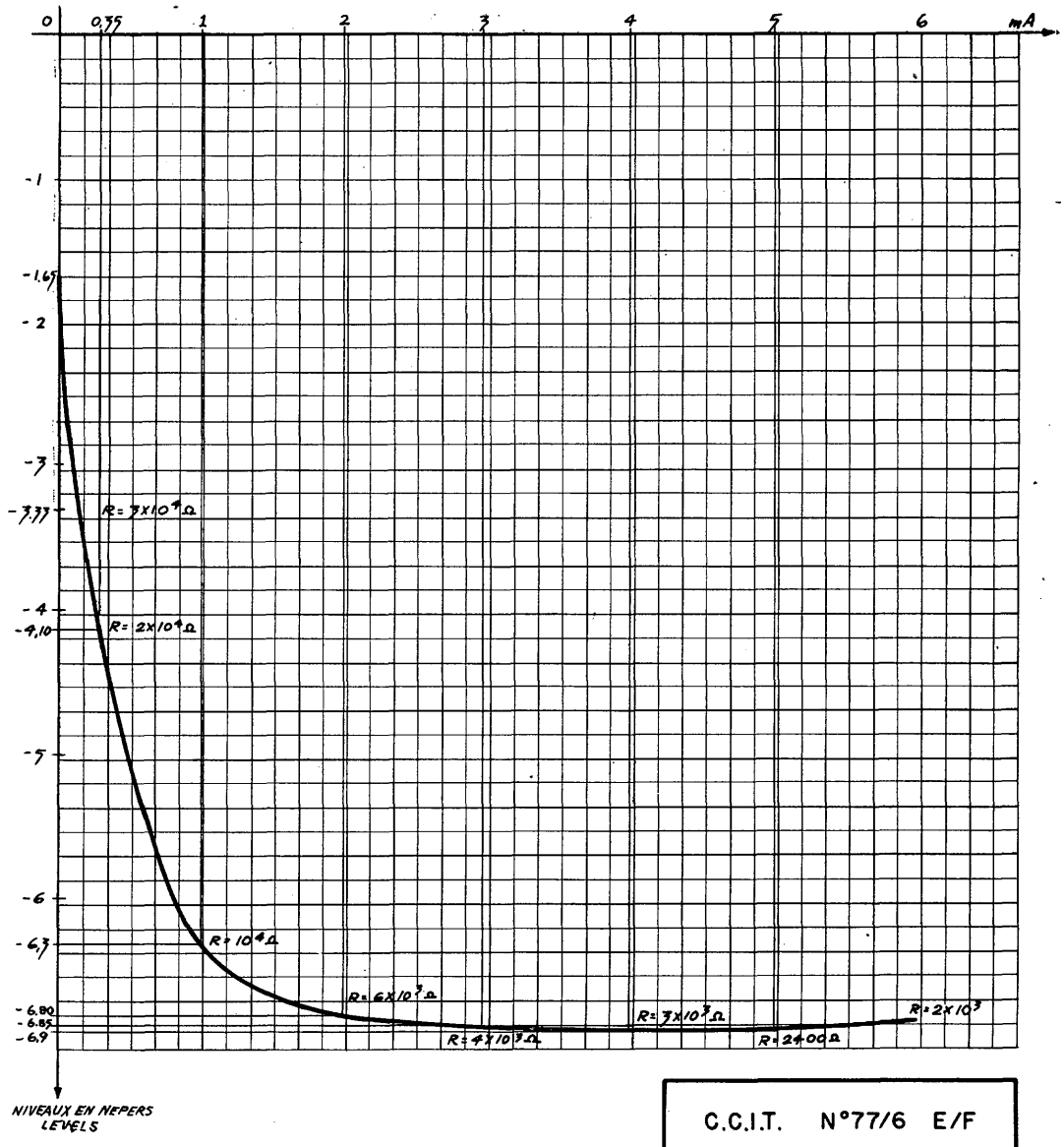


Fig. 6

C.C.I.T. N°77/6 E/F

SG II/40

EDITION 1 FEV,56

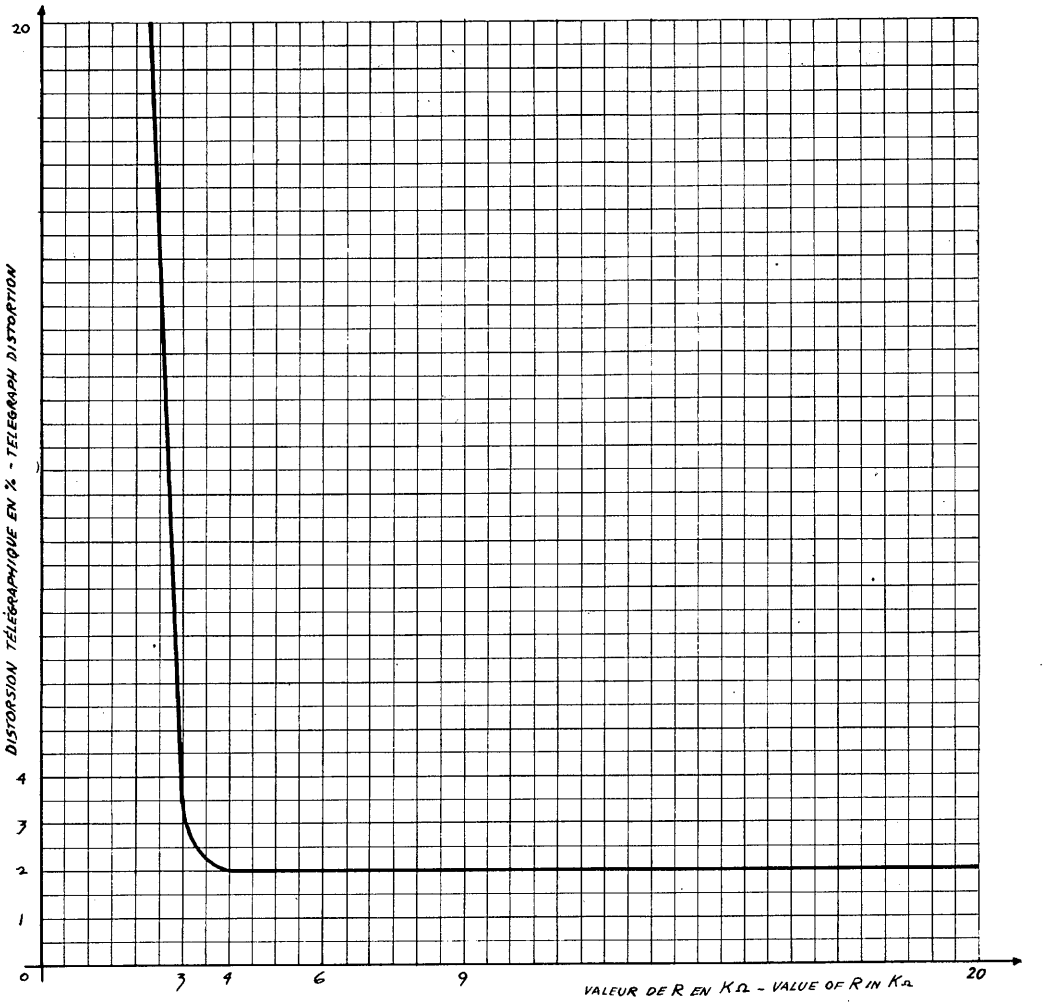


Fig. 7

C.C.I.T. N°77/7 E/F

SG II/40

EDITION 1 FEV. 56

VOICE-FREQUENCY TELEGRAPHY BY FREQUENCY MODULATION

(C.C.I.T. Question 23 — C.C.I.T.T. Question 16/9)

ITALY

Document S.G. II/62
5 October 1956

Standardization of voice-frequency telegraphy by frequency modulation

Question No. 23

1. Is there need to introduce for international service frequency modulation telegraph systems ?

2. If so, what characteristics of these systems should be standardized ?

As was already stated in its reply to Question V, 1 c, at the Arnhem meeting, the Italian Administration is in favour of introducing, for the international service, frequency-modulation VF telegraph systems, especially in circuits which may form part of a Telex liaison, for such systems involve low degrees of telegraph distortion, even when the signals level is subject to appreciable, and especially sudden variations. Moreover, the increase in the distortion of telegraph signals caused by noise is smaller in FM systems than in systems using amplitude modulation.

In FM equipment in service in Italy, admissible variations in the level of the reception of telegraph signals, keeping the distortion of the C.C.I.T. text below 10 %, are ± 8 db.

A series of measurements was carried out to determine the influence of noise due to telegraph signals transmitted on other channels or over other telephone circuits. In particular, the influence of a disturbing current on the distortion of the received signals was determined by measuring the relative level, in relation to the signal, of a noise capable of producing an increase in distortion of up to 10 %, 15 % and 20 %, in a channel whose own distortion, in the absence of noise, was 5 % or 6 %.

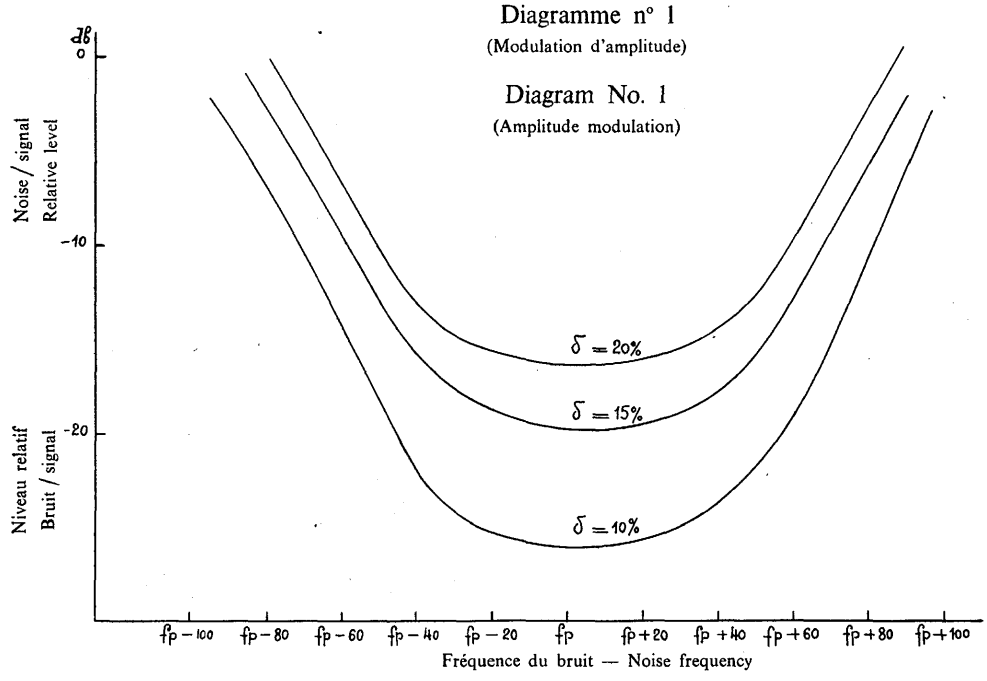
The average results of measurements made on several channels are summarized in the diagrams below (No. 1 for AM systems and No. 2 for FM systems) in which the relative noise/signal level is represented as a function of the fundamental frequency of the noise (current not modulated, or modulated by 1/1 50-baud signals).

It is to be noted that, the increase in telegraph distortion being equal, a greater volume of noise in the filter transmission band of a channel can be tolerated in the case of FM than in the case of AM ; the noise tolerated can be greater by 9 db or by 6 db according to whether a distortion below 10 % or 15 % is desired.

The noise level in relation to that of the " mark " current, capable of determining the passage of the reception relay in the " space " position, was also measured.

Diagramme n° 1
(Modulation d'amplitude)

Diagram No. 1
(Amplitude modulation)



The average results of the measurements carried out on several channels are summarized in diagrams 3 and 4, for AM and FM systems respectively. The relative noise/" mark " current level is given in terms of the fundamental noise frequency (current not modulated or modulated by 1/1 50-baud signals).

It is to be observed that the tolerable noise in the case of FM is greater by 2 or 3 db to the noise tolerated in the case of AM, and that for this latter type of modulation the extension of the non-modulated disturbing frequencies which can determine the untimely passage of the relay over the " space " position, is greater ($\sim$ 120 c/s in AM and $\sim$ 70 c/s in FM).

On the other hand, FM systems using circuits made up of a telephone carrier-current channel usually impose more limiting conditions for such circuits than do AM systems with regard to frequency variations introduced by modulations and demodulations to which the signals are subject in the transmission channel.

The increased distortion caused by a variation in frequency in the carrier current is on the average 2 % for each c/s of variation in equipment in service in Italy.

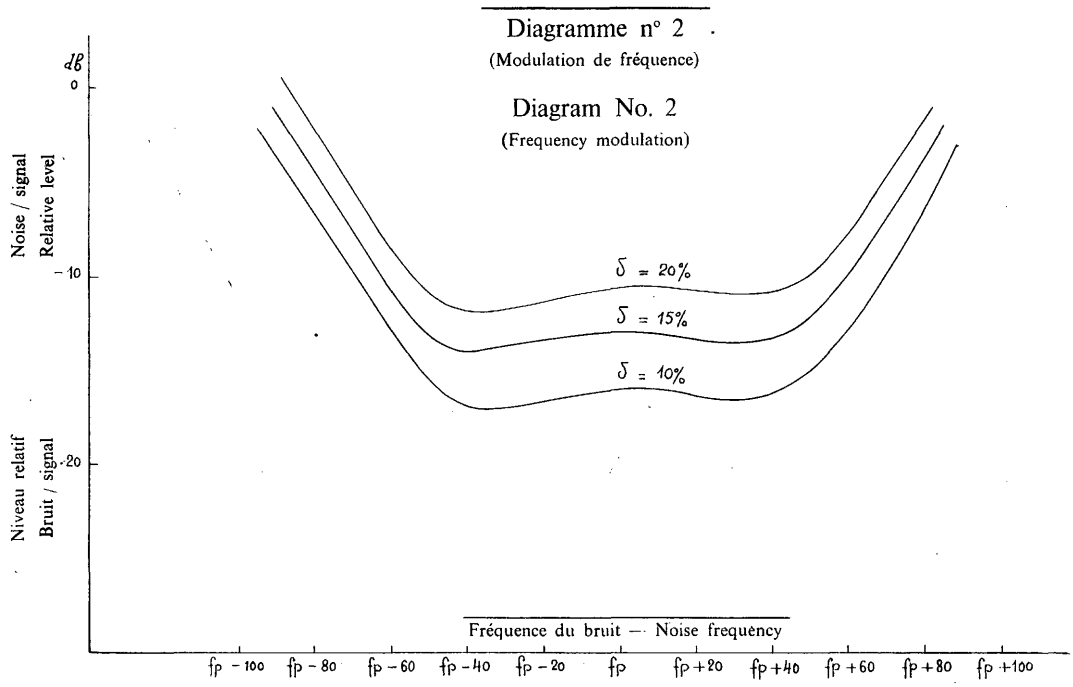
For the maximum variations admitted by the C.C.I.F. in carrier-frequency telephone channels, the increased distortion would be 4 %. In view of the fact that the average distortion for the C.C.I.T. text is 5 % in normal conditions, total distortion would be 9 % ; this is below the maximum laid down by the C.C.I.T. in Recommendation B.24 for each section of a transmission channel.

The Italian Administration agrees to the characteristics to be standardized in FM voice-frequency systems indicated in the proposal by S.G. II (Document C.C.I.T. A.P. VIII-1-E).

The Italian Administration proposes the following values for these characteristics :

1. The nominal frequencies of the channels should be uneven multiples of 60 c/s starting from 420 c/s, as in the case of AM voice-frequency telegraphy.

These frequencies should not vary by more than 1.5 c/s from their nominal value.



2. The maximum modulation speed should be 50 bauds.

3. The most frequently adopted frequency deviations are ± 30 c/s and ± 35 c/s.

With the former value (± 30 c/s) the modulation band passing through normal-type filters (with a filter transmission band of about 80 c/s) is wider, and therefore the telegraph signals are, at least in theory, less impaired by noises.

In practice it has been noted that differences between increases in distortion caused by noises (which are normally very small increases), measured in the two cases of frequency deviation (± 30 c/s or ± 35 c/s), are negligible.

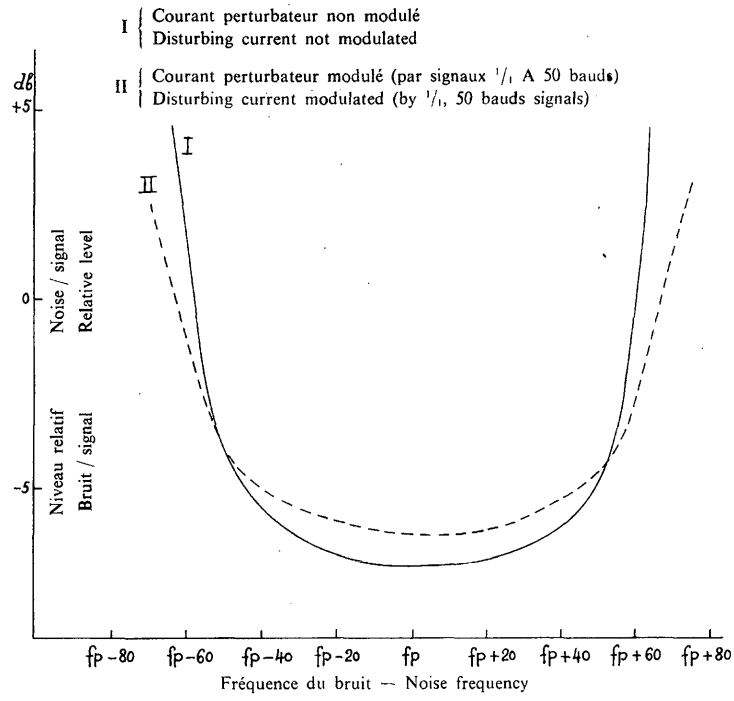
With the second value (± 35 c/s), the increase in distortion due to variations in the carrier frequencies is less. In view of the fact that frequency variations may occur either at the output or, above all, in the transmission channel, if this channel is part of a carrier-frequency (particularly on coaxial cable) telephone circuit and that the influence of such variations on the increase of distortion is considerable, we have preferred, in Italy, to adopt for modulation frequency deviations of ± 35 c/s.

For the above-mentioned reasons we propose that standardization should be according to the values given.

4. The frequency spectrum of the signals emitted could be fixed for 1 : 1 signals on the basis of the frequency spectrum at the output of a standardized emission filter, when the above-mentioned signals are sent at the input at the average frequency of the filter and with rectangular modulation.

5. The same values for the emission levels (Recommendation B.13) and the same tolerances for variations in these levels (Recommendation B.11) established for AM systems could be adopted for FM systems, if transmission is over audio telephone circuits.

Diagramme n° 3
(Modulation d'amplitude)
Diagram No. 3
(Amplitude modulation)



If carrier-current telephone channels having the same group amplifiers are used, these amplifiers are, on the average, more loaded in the case of FM voice-frequency telegraphy, since the total power transmitted over the telephone channel is greater, owing to the fact that there is always some current (marking or spacing) on all the telegraph channels.

This might counsel the establishment of emission levels lower than those already established for AM voice-frequency telegraphy.

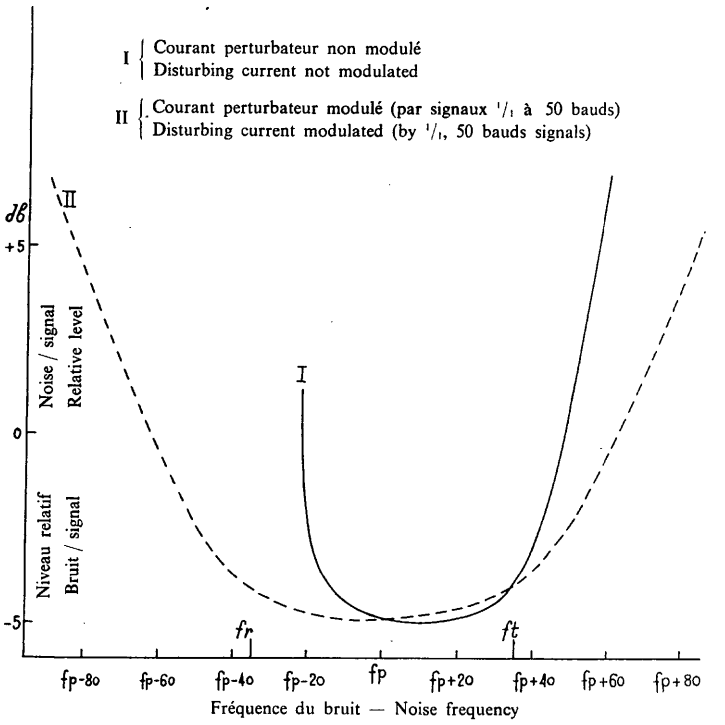
6. The significant " mark " condition (stop element) and " space " condition (start element) should correspond to the lowest and highest frequencies respectively.

7. The frequency to be used for a possible pilot channel should be chosen preferably below the band used for voice-frequency telegraphy. By using a low frequency (e.g. 300 c/s) the relative variation of the frequency received would be greater and a greater sensitivity of the frequency drift compensation device could be obtained.

8. The threshold level for the signals received, beneath which receiving equipment would give the alarm, should be $\sim$ 30 db below the normal level of the signals, taking into account that FM systems can still work with a tolerable degree of distortion in the case of a decrease in the level of 20-25 db.

9. Other significant conditions do not appear to be necessary.

Diagramme n° 4
(Modulation de fréquence)
Diagram No. 4
(Frequency modulation)



10. The maximum degrees of tolerable distortion in the channels should be respectively:

in case *a)* : 6 %
in case *b)* : 8 %
in case *c)* : 10 %
in case *d)* : 10 %
in case *e)* : 16 %

This last value could be reduced to about 10 % or 12 % for equipment embodying automatic frequency drift compensation devices.

U.S.S.R.

Document S.G. II/66-E
30 October 1956

Standardization of frequency-shift voice-frequency telegraphy

Question No. 23

1. Is there need to introduce for international service frequency-modulation telegraph systems ?

2. If so, what characteristics of these systems should be standardized ?

1. *Speed of telegraph transmission and mid-frequencies of channels*

Two types of F.M. voice-frequency telegraph systems are in general use in the U.S.S.R. ; they are the 18-channel systems (with possibility of providing 24 channels) intended for the standardized transmission speed of 50 bauds, at intervals of 120 c/s between mid-frequencies starting from 420 c/s, and the 16-channel systems intended for a transmission speed of 70 bauds, at intervals of 180 c/s between mid-frequencies, starting from 450 c/s.

Taking into account the general use in the European international network of voice-frequency telegraph systems having intervals of 120 c/s between mid-frequencies, starting from 420 c/s, for the transmission of messages at the standardized speed of 50 bauds, the Administration of the U.S.S.R. feels that it is possible to recommend these standards provisionally also for F.M. channels. At the same time, taking into account the tendency to increase the keying speed of start-stop apparatus in order to raise the operator's efficiency, the Administration of the U.S.S.R. considers that the following new question might be profitably studied by the C.C.I.T. :

" Is it desirable to use voice frequency telegraph channels designed for the high transmission speed of 70-80 bauds on international circuits ?

If so, what conditions should they satisfy ? "

2. *The frequency spectrum of the signals emitted*

The passband of a telegraph channel should not be less than ± 40 c/s (at a level of 0.5 N with respect to attenuation at the mid-frequency).

3. *Frequency shift (tolerances)*

At the meeting of C.C.I.T. Study Group II, in February 1956, it was evident that in their voice-frequency telegraph equipment with intervals of 120 c/s between mid-frequencies, many Administrations use a channel frequency shift of ± 30 c/s, while quite a few Administrations use a frequency shift of ± 35 c/s.

The Administration of the U.S.S.R. feels that a channel frequency shift of ± 30 c/s should be accepted, firstly, because for such a shift the signal/noise ratio in a channel with a given filter frequency characteristic is highest (Figure 1).

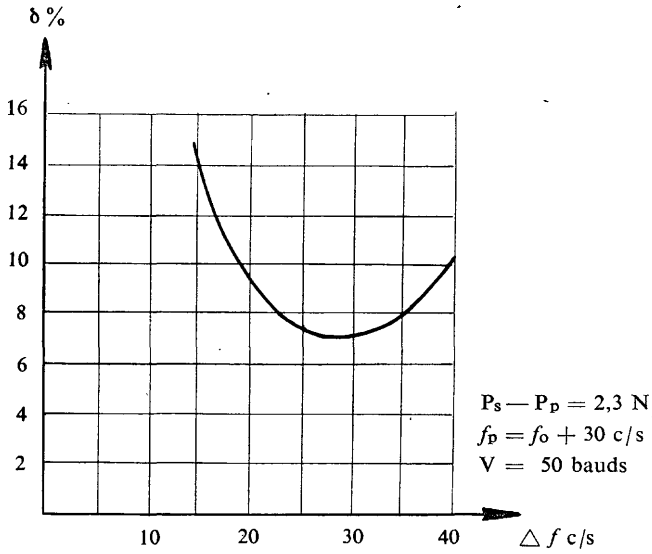


Fig. 1

And secondly, because the condition that the frequency shift should be equal to a quarter of the interval between the mid-frequencies of neighbouring channels is satisfied

$$\frac{\Delta f}{f_{n+1} - f_n} = \frac{30}{120} = \frac{1}{4}$$

Consequently, the influence of the second harmonics of the oscillations for " voltage + " and " voltage — ", $2(f_o \pm \Delta f)$ is lessened for these harmonics fall in the middle of the channel passband, i.e., at the point where the discriminators are least sensitive. However, since the signal/noise ratio of a channel with a shift of 35 c/s differs only little from the signal/noise ratio of a channel with a shift of 30 c/s, and since the systems of voice-frequency telegraphy having shifts of 30 to 35 c/s, established at the ends of a circuit, coincide between themselves, the Administration of the U.S.S.R. has no objection to the use of equipment with frequency shifts of ± 30 c/s of ± 35 c/s for international circuits.

The recommendations by the C.C.I.T. should indicate the advantage of channels with a shift of ± 30 c/s over those with a shift of ± 35 c/s.

The admissible frequency shift f_o and $f_o \pm \Delta f$ in relation to its nominal values should not exceed 1 c/s and should satisfy the condition :

$$|+\Delta f| - |-\Delta f| \leq 2 \text{ c/s}$$

4. *Channel frequencies corresponding to the start and stop element of start-stop apparatus*

It is desirable that, by analogy with the C.C.I.R. recommendation, the higher frequency $f_o + \Delta f$ should correspond to the start (A) condition and the lower $f_o - \Delta f$ to the stop (Z) condition.

With double-current working, the higher frequency should correspond to the positive polarity and the lower to the negative.

5. *Transmission levels (and their tolerances)*

According to the regulations of the Ministry of Posts and Communications of the U.S.S.R., transmission levels in A.M. and F.M. voice-frequency telegraphy channels have the same value expressed by

$$W_1 = \frac{5000}{N^2} \mu W \qquad (1)$$

or, according to the absolute level, by

$$P_1 = 0.8 - \log_n N$$

where N is the number of channels.

5000 μ W is the maximum instantaneous power of all the telegraph signals transmitted simultaneously over a telephone channel at a point of zero relative level.

In the 18-channel system $W_1 = 15 \mu W$; $P_1 = -2.1 N$; in the 24-channel system $W_1 = 9 \mu W$; $P_1 = -2.35 N$.

For these systems the mean resultant power at the output of the equipment

$$W_m = W_1 N \mu W \quad \text{or}$$

$$P_m = P_1 + {}^1/_2 \log_n N \text{ nepers}$$

is equal to

$$W_m = 270 \mu W ; P_m = -0.66 \text{ nepers} ;$$

for the 18-channel system, and to

$$W_m = 216 \mu W ; P_m = -0.77 \text{ nepers},$$

for the 24-channel system.

For the present, the Administration of the U.S.S.R. does not consider it desirable to reduce transmission levels on F.M. channels in relation to transmission levels on A.M. channels, as proposed by the C.C.I.F., for the following reasons :

a) Observations made in the U.S.S.R. on the mean power of the whole of the output of telegraph channels with A.M. equipment, have shown that during the transmission of telegraph messages the mean power of the 18-channel systems is reduced, not by 50 % in relation to the mean power during continuous transmission of the carrier current on all the channels (this 50 % would correspond to the transmission of telegraph dots), but by only 18 % ; however, during the busy hour of the telephone channel, this reduction is on the average 23 %. In 24-channel voice-frequency telegraphy systems, the reduction in mean power is even smaller.

Thus, the reduction of the resultant mean power in F.M. systems by 50 %, as proposed in the draft reply by the 3rd Study Group of the C.C.I.F., is not justified.

b) Voice-frequency telegraphy over long-distance carrier-current channels (especially by overhead line), with several retransmissions on low frequencies, is affected by intense interference of varying origin ; this is why the U.S.S.R. is interested in maximum protection of voice-frequency telegraph channels.

c) In the 24-channel equipment of A.M. voice-frequency telegraphy systems used on carrier-current telephone channels, the mean power at the output is less than 216 μ W, i.e., it is 20 % below the maximum of 270 μ W for 18-channel systems.

d) In each 12-channel group of carrier-current systems, the number of channels provided for voice-frequency telegraphy is generally less than the number of channels used for the transmission of telephone calls.

However, taking into account the draft reply to Question 6 by the 3rd Study Group of the C.C.I.F., the Administration of the U.S.S.R. feels that it is possible to reduce the average transmission power in F.M. voice-frequency telegraph systems to 135 μ W in cases where more than two telephone channels, in a group of 12 channels, are used simultaneously for voice-frequency telegraphy.

Moreover, with the aim of eliminating the possibility that the maximum admissible average power may be exceeded, the Administration of the U.S.S.R. proposes to determine the maximum admissible power on voice-frequency telegraph channels for A.M. systems with a number of channels $N < 18$, as for F.M. systems, not on the basis of expression (1), but according to formula (2):

$$W_1 = \frac{5000}{N^2} \mu W \qquad (1)$$

$$W_1 = \frac{\text{mean } W}{N} = 270 \mu W$$

or

$$P_1 = -0.66 - \frac{1}{2} \log_n N \qquad (2)$$

$$(N = 1, 2, 3 \ldots 17).$$

In view of the above, the Observation in Recommendation B.15 (Documents of the VIIth Plenary Assembly, Arnhem, page 75) should be amended.

6. *Frequency and transmission level of a pilot channel*

In the U.S.S.R. pilot waves are not used for automatic correction of frequency drift on a telephone circuit. Frequency stabilization in the telephone channels used for voice-frequency telegraphy is crystal-controlled.

7. *The minimum threshold for signals received, beneath which the receiving equipment would give the alarm and return to the position for receiving the start element in more or less clear cases of a break in the telephone circuit*

Two types of equipment are in use in the U.S.S.R.; in one type, when there is a reduction of 2 N in the reception level, the receivers give the alarm and return to the position corresponding to the start element, while in the other type there is no such device.

The Administration of the U.S.S.R. considers the use of an alarm and of a return device in receiving equipment to be reasonable. The threshold should be at least 2 N below the normal threshold.

8. *Tolerable distortion in channels*

In F.M. voice-frequency telegraph equipment, intended for installation in international circuits, distortion in looped channels should not exceed:

a) 5 % for the nominal levels and frequencies transmitted;

b) 7 % when there is a variation of 1 neper above, or 2 nepers below the normal level at reception;

c) 10 % for 90 % of the total number of jumps in cases of sudden variations in the reception level, by jumps of ± 1 neper, in relation to the nominal value;

d) 10 % in cases where the frequencies transmitted in channel deviate by ± 3 c/s from their nominal values;

e) 10 % where the channel is being protected against a harmonic disturbance 2.3 N at frequencies corresponding to positive and negative polarities.

FRANCE

Document S.G. II/70-E
19 November 1956

Standardization of frequency-modulation voice-frequency telegraphy

The French Administration considers that it would be advisable to introduce frequency-modulation voice-frequency systems for international traffic, even for normal operation.

The expansion of Telex makes it more and more necessary to set up a very great number of high-quality channels that are not sensitive to sudden changes in level or noise peaks. On existing circuits, complying with C.C.I.F. recommendations, however, experience has shown that the most disturbing factors in operation are sudden variations in equivalent and noise, arising from cross modulation between channels, even if it lasts only a very short time.

Frequency-modulation systems have a considerable advantage over amplitude-modulation systems, when the carrier circuits show these defects, but they are more sensitive to any frequency drift that might occur in the channel, when it is part of a carrier telephone system. In actual fact, the C.C.I.F. recommendations on frequency stability (*Green Book*, Vol. III, page 45) are observed by modern equipment much more satisfactorily than those concerning variations in equivalent and noise. It can therefore be concluded that frequency-modulation systems are superior even in the case of circuits possessing the characteristics recommended by the C.C.I.F.

The characteristics to be standardized for these voice-frequency telegraph systems might be the following:

1. *Channel centre frequencies and tolerances*

On an international circuit, it is exceedingly desirable to obtain as many telegraph channels as possible from each telephone circuit and for this reason the French Administration considers that, for frequency-modulation systems, the carrier frequencies standardized for amplitude-modulation in Recommendation B.11, revised at Arnhem in 1953, should be retained. For frequency-modulation systems, it is the centre frequency, defined as the arithmetic mean of the two frequencies $f1$ and $f2$ corresponding to space and mark, which should not differ from the nominal frequency fo of the channel by more than the specified value. The French Administration proposes 1.5 c/s for this value.

$$\left| \frac{f1 + f2}{2} - fo \right| < 1.5$$

2. *Maximum modulation rate*

With the exception of cases of special use, the maximum modulation rate should be that specified in Recommendation C.4, i.e., 50 bauds.

The French systems type 1951 L, described in document 25, nevertheless provide the possibility of transmitting at a slightly higher modulation rate.

3. *Frequency deviation and tolerance*

The choice of this characteristic will depend on the choice of the above two characteristics. The deviation adopted by the French Administration is 35 c/s. The theoretical and experimental reasons for this choice are described in an article by Mr. Gardère, entitled " Deux nouveaux systèmes de télégraphie harmonique " published in the July 1951 and July 1952 numbers of *Câbles et Transmission*.

A compromise must be reached between :

— high modulation indices which require costly filters, if the 120 c/s interchannel spacing is to be maintained ;

— low modulation indices which give transmissions more sensitive to frequency drifts.

In France, the following modulation index has been chosen

$$1.4 = \frac{70}{2 \times 25}$$

as it gives the lowest distortion, making allowance for the choice of the above-mentioned characteristics (centre frequency, modulation rate). The proposed frequency deviation is thus 70 c/s with a tolerance of ± 3 c/s.

With this value of m, it can be shown that the band of frequencies limited by the second order components of the signals spectrum ($f_o - 2f$ to $f_o + 2f$) carries almost 99 % of the total power.

4. *Frequency spectrum of the signals emitted*

For a correct definition of the operation of a frequency-modulated telegraph transmitter, it is not enough to give the characteristics of the transmission filter, since the filtering can be divided between the modulation signals and the signals transmitted.

The operation of the transmitter, characterized by the variation in the instantaneous frequency of the signal emitted, can be determined, for instance, by the discrete spectrum corresponding to a 1/1 modulation signal at a modulation rate of 50 bauds.

For a definition of the behaviour of this transmitter outside its allocated band, it is necessary to know the maximum amplitude of the spectrum for each frequency, whatever may be the shape of the modulating signal, provided the shortest modulating signal be no longer than 20 ms.

Assuming that a rectangular modulating current is supplied to the oscillator, the latter will give a signal whose instantaneous frequency passes in zero time from one frequency to the other. The Fourier analysis is given by a classical formula quoted by Mr. Gardère in his article in *Câbles et Transmission* mentioned above.

We have made the requisite calculations for rectangular modulating signals with a repetition frequency varying between 0 and 25 c/s.

Curve No. I in drawing INST. 12462 (C.C.I.T. No. 101/1) gives, for each frequency around the centre frequency of the transmitter, the maximum amplitude that can be obtained by varying the repetition rate of the modulating signals from 0 to 25 c/s. It will be seen that, if the frequency deviation is called ΔF (35 c/s in the system standardized by the French Administration) for all frequencies $fo \pm \frac{\Delta F}{2n+1}$ where n can be any whole number from 1, there can be no terms in the decomposition. Thus there are infinite discontinuities between fo and $fo \pm \frac{\Delta F}{3}$ which are not represented on curve I.

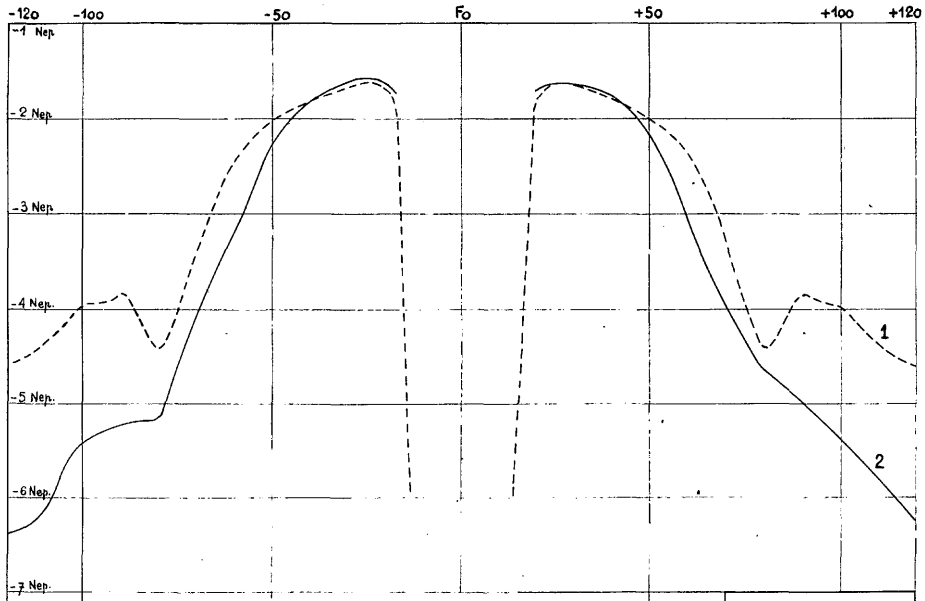


Fig. 1

Spectre de fréquence des signaux émis
Frequency spectrum of signals

At frequency *fo*, the maximum amplitude corresponds to the maximum modulation rate of 50 bauds. Curve I is plotted for relative amplitudes, supposing that a permanent emission of frequency $fo \pm \Delta F$ is at — 1 neper level.

In these circumstances, the spectrum corresponding to 1/1 signals at a rate of 50 bauds, when F = 35 c/s, has the following amplitudes :

fo : — 2 N
$fo \pm 25$ c/s : — 1.61
$fo \pm 50$ c/s : — 2.04
$fo \pm 75$ c/s : — 3.61

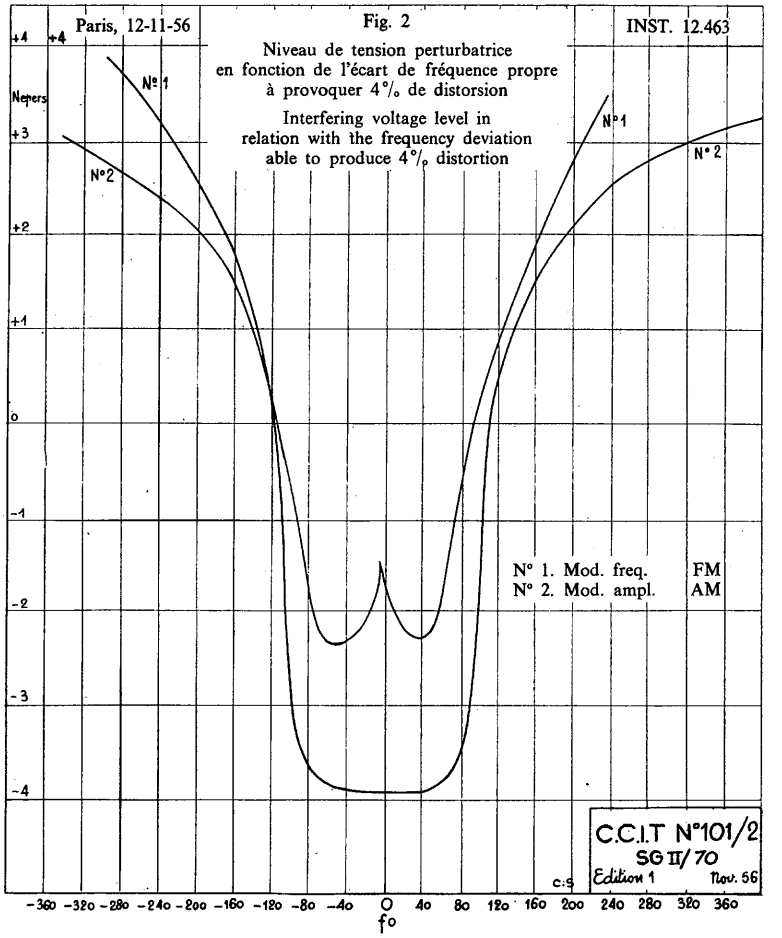
Tests have been made on transmitters standardized by the French P.T.T. Administration, type 51 L. The spectrum components were measured with a selective apparatus of 2 c/s bandwidth.

For each frequency for which it was desired to know the amplitude, the repetition rate of the rectangular signals modulating the transmitters was varied between 0 and 25 c/s, so as to obtain the maximum amplitude.

The results of the measurements are summarized in curve II of drawing INST. 12462 for one of the transmitters tested (channel 10 in the range 7 to 12) (C.C.I.T. No. 101/2).

5. *Transmission levels and tolerances*

On low-frequency telephone circuits the same levels as for amplitude modulation could be adopted. On carrier telephone circuits, 5.6 μ W is given as the permissible limit for a 24-channel group. Actually, in the French network, the same power is transmitted on these circuits as for



amplitude-modulated V.F. systems and so far no trouble has been encountered. The tolerable power limits depend on the design of the amplifiers of the telephone carrier systems. Thus, we should favour adoption of the powers shown in Table 2 of the above-mentioned document by direct arrangement between Administrations, whenever these levels do not appear to disturb telephone transmission.

6. *Correspondence between the significant conditions and the outside frequencies*

The C.C.I.R. had recommended the correspondence

marking frequency = higher frequency
spacing frequency = lower frequency

only for circuits using Morse.

Hence, we propose that the opposite correspondence should be used. It has given satisfaction for several years in the French network.

7 and 8. *Pilot channel and alarm for breaks in the telephone circuit*

The French Administration does not think that it is necessary to make systematic use of a pilot channel on carrier telephone circuits in F.M. V.F. telegraph systems, in view of the size

of the level variations that can be admitted by such systems. Neither does it think necessary to use a pilot channel to control frequency drift on the telephone channel or to offset such drift, since such a provision is not required for telephone circuits fulfilling the C.C.I.F. recommendations and the risk of oscillator fault is very low, as we have observed in France.

Thus, the French Administration has no views to express on the characteristics considered.

9. *Additional significant conditions*

It does not appear necessary to sanction the transmission of significant conditions other than marking and spacing, as transmission of modulations of this kind (with more than two conditions) in any case requires specially designed channels.

10. *Limits of maximum distortion in the following cases*

a) Normal transmission level of the telephone circuit, without frequency drift :

$$d \leq 8\,\%$$

b) Slow variations in level from 1 neper above to 2 nepers below the normal level :

$$d \leq 10\,\%$$

c) In the case of sudden variations in the reception level, by steps of 1 neper in the range from + 1 neper to — 2 nepers.

The maximum degree of distortion depends on the original level of reference for the sudden variation. In any case

$$d \leq 12\,\%.$$

d) In presence of a pure unwanted frequency of level 2 to 2.3 nepers below the signal level and with frequency equal either to the nominal centre frequency or to the marking or spacing frequencies of the channel under test.

The tests made by the French Administration show that the upper limit of this degree of distortion can be fixed at 12 %.

Fuller tests were made to find out what noise level could create 4 % distortion, the noise frequency varying over all the transmitted band of a telegraph channel. The result of these measurements is summed up in the diagram in Fig. 2 INST. 12463.

e) In cases where the frequencies are altered by approximately 3 to 5 c/s after transmission by the telephone circuit.

It the difference of the frequencies before and after transmission by the telephone circuit, referred to the A.F. frequency deviation of the system, be ϵ, the distortion introduced is :

$$\delta = \frac{\epsilon}{2}\frac{M}{B}$$

M being the telegraph modulation rate and 2 B the transmitted bandwidth, at any rate when ϵ remains low ($\epsilon \leq 0.15$).

Thus, in the case considered, the following might be established

$$\epsilon \leq \frac{5}{35}$$

$$\delta \leq 10\,\%$$

a figure verified by experience and possible to obtain without any special device for compensating frequency drift.

BASSOLE.

POLAND

Document S.G. II/73-E
24 November 1956

Contribution to the choice of frequencies in FM VF telegraph systems

The operation of a telephone circuit with the object of forming several telegraph channels is not possible unless there is adequate guarantee against interaction.

Each of the telegraph channels occupies its own frequency band, the minimum width of which depends primarily on the modulation rate. Among the factors that may influence the occupied bandwidth are the requirements concerning telegraph distortion arising in the circuits and the characteristics of the transmitter and receiver, such as the frequency stability of the voltage produced in the transmitter, the constancy of the filter elements and the discriminator, the design of the discriminator and the use of correctors. The characteristics of the transmission channel such as variations in the transmission level, stability of the transmitted frequencies, phase variations and the knowledge of the speed of these fluctuations are not without importance. In a very simplified procedure we use the formula:

$$F_k = 1.6\,\nu \qquad (1)$$

where F_k = frequency bandwidth of one telegraph channel,

ν = modulation rate in bauds.

Assuming a modulation rate of 50 bauds (the usual practice) expression (1) gives a bandwidth of 80 c/s.

It is not the author's intention to expatiate on the relations between the bandwidth occupied by a telegraph channel and the factors listed above, which would require a separate article. Let us assume for our purposes that the bandwidth has been fixed.

To avoid interaction, the respective frequency bands should not interfere with each other, i.e., they should be placed side by side in the telephone circuit band. In theory, the telephone channel could be divided into a number of telegraph channels given by dividing the telephone bandwidth by the width of the telegraph frequency band. But, unfortunately, there must be some spacing between channels, since the attenuation/frequency characteristic of the filters that can be achieved in practice has not a steep enough slope.

In standard V.F. telegraphy systems, the smallest spacing is 40 c/s.

The separation between adjacent channels, defined as the differences between the centre frequencies of the channels, is given by the following expression:

$$f_n - f_{n-1} = F_k + F_s = F_r$$

where f_n, f_{n-1} = centre frequencies of channels n, $n-1$;

n, $n-1$ = whole numbers corresponding to the successive numbers of the channels, in this case index showing the channel with centre frequency f;

F_s = width of the band between channels;

F_r = channel spacing.

The arrangement of the telegraph channels can be represented as in Figure 1.

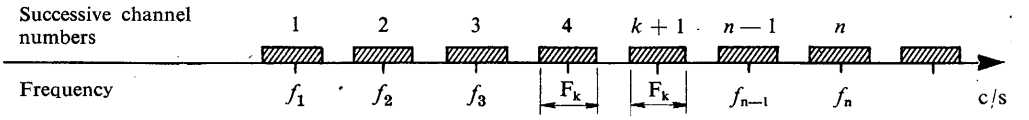


Fig. 1

Using expression (2), most of the European systems have adopted an inter-channel separation of 120 c/s.

Each circuit functions independently as transmission is kept in its own channel. This means that :

1. The signals leaving the transmitter of the circuit cannot contain component voltages of frequencies outside the channel. In practice it is enough if these voltages do not appear, beyond the neighbouring separation bands, at a level capable of giving distortion. This can be obtained by connecting, at the transmitter output, filters restricting the transmitted frequency band, the simplified characteristic of which is given in Figure 2.

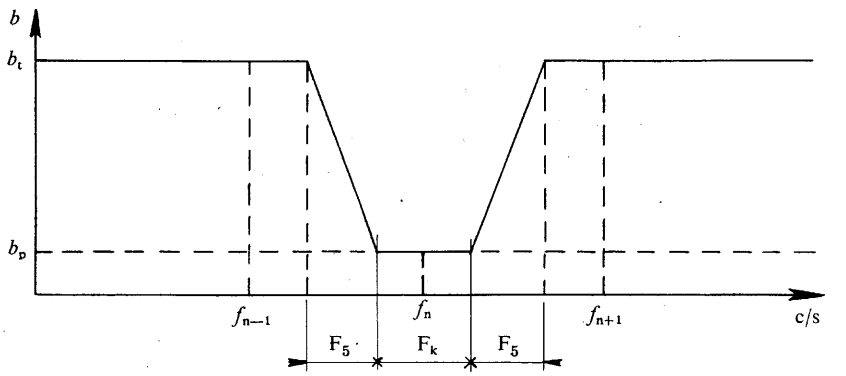


Fig. 2

We assume that a filter of this type should satisfy the following conditions :

$$b_t - b_p > b_{min} \qquad (3)$$

where b_t — attenuation in the limits of the other channels ;

b_p — attenuation in the limits of the channel considered ;

b_{min} — minimum attenuation depending on the maximum admissible interference power in the co-operating channels defined, *inter alia*, by the sensitivity of the circuit receivers to interference and depending on the power of the component frequencies of the signals produced.

2. The circuit receiver should possess the faculty of reacting selectively to the voltages of the frequencies in the limits of their own channel. For this purpose suitable filters are connected at the receiver inputs. According to the simplified curves of these filters, as in Figure 2, they should also comply with the inequality (3). In this case, the value b_{min} is influenced by the number of telegraph channels working together in the telephone circuit, the relation between the power of the signals proper and those coming from the other channels and the sensitivity of the receiver to interference.

3. The transmission channel should not be a source of voltage at the frequencies inside a channel on account of signals being transmitted on other channels.

We shall analyse these latter conditions a little more closely. As is known, the non-linearity of the elements of the transmission channel, such as receivers, limiters, level regulators, modulators and demodulators, filter windings, may cause :

a) the appearance of the upper harmonics of the frequencies of the voltages transmitted, for example, the second or the third harmonic ;

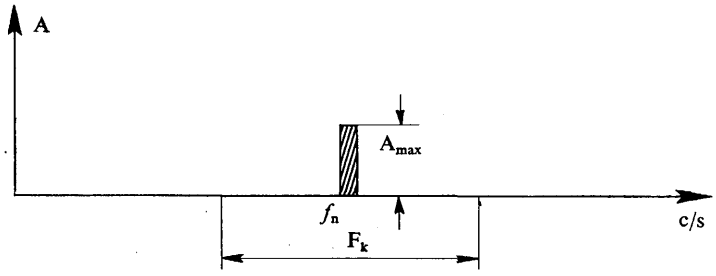
b) the appearance of voltages at frequencies which are the sum or the difference of the fundamental frequencies or their harmonics.

The appearance of upper harmonics, or sums or differences, occurring on account of non-linearity in the elements of a channel, may cause difficulties in the simultaneous working of several channels varying according to the positioning of these frequencies. If, for instance, they are in the band separating two particular channels, their influence may be very slight. However, if these unwanted frequencies are in the channel bands, their seriousness will vary with their position, the system of modulation and the overall properties of the receiver. In F.M. systems in particular, the influence of the unwanted voltage depends on its frequency.

In the general case, decomposition of the telegraph signals transmitted into component voltages gives a continuous function of the amplitude of these voltages with frequency. This function depends on the signals, but at the same time it shows regularities in all cases.

The amplitudes of the component voltages have different values in the channel. The function showing the amplitude of the component voltages appearing in the channel has one or two maxima, the position of which depends, *inter alia*, on the modulation system employed.

With amplitude modulation, the greatest amplitudes correspond to the component voltages of a frequency equal to the carrier frequency (i.e., the frequency of the voltage of the generator, the amplitude of which is subjected to modulation). Usually, the carrier frequency is the same as the channel centre frequency, at least in theory. Thus, in A.M. telegraphy we can represent the positions of the component amplitude maxima of the transmitted signals as in Figure 3.



A = amplitude of component voltages

Fig. 3

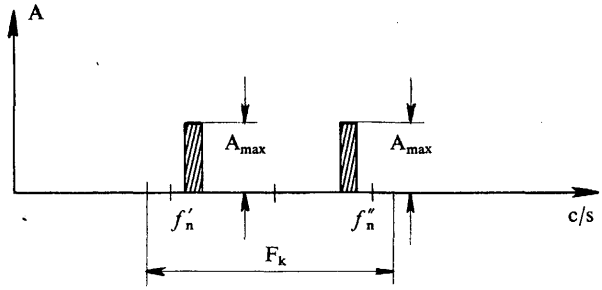
With frequency modulation, this function has quite a different character. Modulation is obtained by varying the frequency, and not the amplitude, of the carrier. One of the significant conditions of the modulation is defined by the significant frequency f'_n and the other by the significant frequency f''_n. In general the following relations are valid :

$$f'_n = f_n - \Delta F \tag{4}$$

$$f''_n = f_n + \Delta F \tag{5}$$

where ΔF is called the frequency deviation. We assume as a basis for the rest of our analysis that the biggest amplitudes of the component voltages are produced in the neighbourhood of the significant frequencies f'_n and f''_n: which of them will preponderate depends on the signals transmitted and on the operating methods.

The example given in Figure 4 is analogous to Figure 3 for F.M. telegraphy.



A = amplitude of component voltages

Fig. 4

The upper harmonics and the sum and difference frequencies of greatest length and power are the most dangerous, because the unwanted voltages produced cause the greatest distortion.

Without in any way affecting the principle of regular distribution of the telegraph channels, a slight displacement higher or lower in the interchannel bands will provide a more or less certain guarantee against the effects of non-linearity in the elements of the transmission channel.

For this purpose, in A.M. telegraphy systems, we choose the channel centre frequencies in such a way that the second harmonics and the sums and differences of the centre frequencies fall well inside the inter-channel bands.

This is obtained when the centre frequencies are equal to the odd multiples of half the inter-channel space using the equation:

$$f_n = \frac{F_R}{2} \cdot (a + 2n) \text{ c/s} \tag{6}$$

in which a is an uneven whole number, the value of which depends on the lowest frequency we can admit for the first channel. For example, in A.M. telegraphy systems, we adopt $a = 5$ and then the centre frequency of the first channel is 420 c/s (for $f_n - f_{n-1} = 120$ c/s).

The second harmonic of f_n is, in these conditions, defined by the equation:

$$2f_n = \frac{F_R}{2} (2a + 4n) \text{ c/s} \tag{7}$$

Substituting as follows:

$$k = 2n + 0.5a - 0.5 \tag{8}$$

expression (7) can be replaced by the following:

$$2f_n = \left[\frac{F_R}{2}(a + 2k) + \frac{F_R}{2}\right] \text{ c/s} \tag{9}$$

The first term in brackets on the right-hand side of equation (9) gives, from formula (6), the centre frequency of the channel k, where k, defined by equation (8), is a whole number greater than n. The second term in brackets represents half the inter-channel space. The result is that the second harmonic is in the middle of the band separating channel k and channel $k - 1$.

Let us find the position of the sum of the centre frequencies of channel n and a certain channel l. From equation (6)

$$f_n + f_l = \left[\frac{F_R}{2}(a + 2n) + \frac{F_R}{2}(a + 2l)\right] = \frac{F_R}{2}(2a + 2n + 2l) \text{ c/s} \tag{10}$$

After the following substitution:

$$k = n + l + 0.5a - 0.5 \tag{11}$$

we get

$$f_n + f_l = \left[\frac{F_R}{2}(a + 2k) + \frac{F_R}{2}\right] \text{ c/s} \tag{12}$$

Like the second harmonic, the sum of the centre frequencies of two different channels, for channel positioning as in (6), is found to be in the middle of the band separating channels k and $k - 1$, where k is defined in this case by equation (11).

In the same way it can be shown that the difference between the centre frequencies lies in the middle of the inter-channel bands, if these frequencies are chosen in accordance with equation (6).

The above considerations concern harmonics, centre frequency sums and differences in the frequency band occupied by the channels of V.F. telegraphy. The equations are also applicable to other cases, but the k obtained may be greater than the number of channels, or it can be negative for the calculation of the difference.

If we accept rule (6) for the choice of the centre frequencies, we shall not be free from the influence of the third harmonic, since:

$$3f_n = \frac{F_R}{2}(3a + 6n) = \frac{F_R}{2}\left[a + 2(3n + a)\right] \text{ c/s} \tag{13}$$

From this formula it will be seen that the third harmonic lies in the middle of the channels k, where $k = 3n + a$. In the practical case where $a = 5$, the third harmonic of the centre frequency of the first channels will be in the 8th channel, that of the second channel in the 11th channel and we must expect the appearance of third harmonics in channels 14, 17, 20 and 23. Thus, in the case of 24-channel telegraphy, there will be six channels exposed to the third harmonics of the centre frequencies of the first six channels.

The limitation of the effects of the non-linearity of the elements of the transmission channel to the case of the influence of the third harmonic in six channels only and the harmonics or interaction products of certain side frequencies resulting from the telegraph modulation, is regarded as the best solution under existing conditions.

On the other hand, as we shall see later, the choice of equally favourable working frequencies is much more complicated for F.M. telegraphy and does not give the required results to the same degree. This is because, as figure 4 shows, there appear two maxima for the amplitudes of the component voltages in each channel and therefore in studying the effects of the non-linearity of the elements of the transmission channel, account must be taken of doubling, tripling, adding and subtracting twice as many frequencies.

Since the channel width can be kept the same in F.M. as in A.M. systems, it seems quite natural to wish to keep the same channels in both cases and, hence, to calculate the centre frequencies from formula (6). Let us look at the result.

The second harmonics of the significant frequencies, in the light of expressions (4), (5) and (6) are given by :

$$\text{I.} \qquad 2f'_n = 2f_n - 2\,\Delta f = \left[\frac{F_R}{2}(2a + 4n) - 2\,\Delta F\right] \text{ c/s} \tag{14}$$

$$\text{II.} \qquad 2f''_n = 2f_n + 2\,\Delta f = \left[\frac{F_R}{2}(2a + 4n) + 2\,\Delta F\right] \text{ c/s} \tag{15}$$

substituting

$$k - 0.5a + 2n - 0.5$$

we obtain

$$\text{I.} \qquad 2f'_n = \left[f_k + \frac{F_R}{2} - 2\,\Delta F\right] \text{ c/s} \tag{16}$$

$$\text{II.} \qquad 2f''_n = \left[f_k + \frac{F_R}{2} + 2\,\Delta F\right] \text{ c/s} \tag{17}$$

It will be seen that the deviation adopted influences the frequencies of the second harmonics of the significant frequencies.

For these second harmonics to fall within the inter-channel space, the expression $\frac{F_R}{2} - 2\,\Delta F$ and $\frac{F_R}{2} + 2\,\Delta F$ must be equal to the odd multiple of half the distance between the channels F_R. This condition is fulfilled when $\Delta F = 0$, $\Delta F = \frac{F_R}{2}$, $\Delta F = F_R$.

All these deviations are not obtainable in practice, because the first case implies that modulation is not achieved and the following cases assume a deviation such that it would be impossible to separate the signals by means of filters on account of channel spread.

Thus, by calculating centre frequencies from formula (6), we cannot ensure that the second harmonics of the significant frequencies will fall in the middle of the inter-channel spaces by a suitable choice of deviation.

If, for certain reasons, we still wished to use formula (6), in order to obtain the same circuit distribution for A.M. and for F.M., then it would seem advisable to rely on making the second harmonics equal to the channel centre frequencies.

Most F.M. telegraph receivers are not sensitive to the appearance of voltages at these frequencies. We can achieve this condition when, in formulae (16) and (17) the expressions $\frac{F_R}{2} - 2\,\Delta F$ and $\frac{F_R}{2} + 2\,\Delta F$ are whole multiples of the inter-channel space.

A theoretical solution can be obtained with different deviations, but for practical reasons only the smallest of these can be considered, defined by the formula :

$$\Delta F = \frac{F_R}{4} \tag{18}$$

If, then, in the choice of f_n we base ourselves on formula (6), we obtain the second harmonic of the significant frequencies in the middle of a telegraph channel when the deviation is equal to a quarter of the inter-channel space. In this case, from formulae (16) and (17), $2f'_n = f_k$ and $2f''_n = f_{k+1}$.

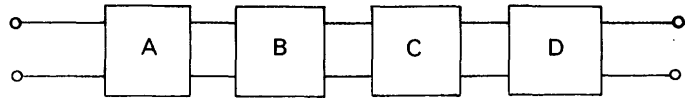
In Europe, F.M. V.F. systems with a 120 c/s spacing are used. These systems have the same centre frequencies as the standard A.M. telegraphy systems, but the deviations used are different. In some, $\Delta F = 30$ c/s, in others $\Delta F = 35$ c/s.

The above considerations speak in favour of 30 c/s.

However, the fact that the greater the deviation, the more constant the operation and the more reliable the discrimination, speaks in favour of a larger deviation. In principle, for a larger deviation, the influence of errors in f'_n and f''_n is smaller, but at the same time there is a greater risk that these frequencies will be outside the channel band.

Application of a provision that the second harmonics should always fall in the middle of the channels would protect the receiver only partially from their influence.

The guarantee of more or less constant working conditions for the discriminator of the receiver requires the use of an automatic gain control before the discriminator (Fig. 5).



A = filter B = AGC
C = discriminator D = relay

Fig. 5

The appearance of the second harmonic does not depend on the operation of the channel in which it falls but on the signals of the channels producing it. Its passage through the automatic gain control lowers the gain and its disappearance increases it.

Thus the power of the wanted signals will vary according to the appearance and disappearance of the second harmonic of the signals in the interfering channel.

If we give up the principle of the same spacing for A.M. and F.M., we could more easily protect the significant frequencies against second harmonic interference from another channel. For this purpose, the centre frequencies should be selected in such a way that they are the even multiple of half the inter-channel space. The following formula should be used :

$$f_n = \frac{F_R}{2}(b + 2n) \quad \text{c/s} \tag{19}$$

where b is a whole number depending, like a in formula (6), on the smallest frequency of the channel that can be admitted. Keeping the channel spacing at 120 c/s, a solution must be found, with the help of appropriate study, to the question whether b can be equal to 4, which corresponds to $f_1 = 360$ c/s, or to 6, which corresponds to $f_1 = 480$ c/s.

Substituting b for a in formulae (14) and (15) we obtain second harmonic formulae from expression (19). For the choice of the number k, defining the channel in the neighbourhood of which we expect to find the second harmonic, we can admit that b is an even number. Consequently, we admit:

$$k = 0.5a + 2n$$

and we finally obtain formulae similar to expressions (16) and (17)

I. $$2f'_n = [f_k - 2\Delta F] \quad \text{c/s} \tag{20}$$

II. $$2f''_n = [f_k + 2\Delta F] \quad \text{c/s} \tag{21}$$

It will be seen from these formulae that, assuming the deviation $F = \frac{F_R}{4}$, the second harmonics of the significant frequencies will fall in the middle of the inter-channel bands, which is the desired result.

It is not difficult to prove that for a deviation given by formula (18) calculation from formulae (6) and (19) reveals that one half of the possible sums and differences of the significant frequencies of different channels are in the middle of the inter-channel bands and that the second half is in the middle of the channels. For example, when f_n and f_1 of the channels n and l are the uneven multiple of half the channel space (formula 6), then:

$$f'_n + f'_1 = f_k \qquad f''_n + f''_1 = f_k + 1$$

$$f'_n + f''_1 = f''_n + f'_1 = f_k + \frac{F_R}{2}.$$

The first two sums are in the middle of two neighbouring channels and the other two in the middle of an inter-channel band.

If f'_n and f'_1 were chosen equal to the even multiples of half the inter-channel space (formula 19), the position would be slightly different, but the results would be similar, since:

$$f'_n + f'_1 = f_k - \frac{F_R}{2} \qquad f''_n + f''_1 = f_k + \frac{F_R}{2}$$

$$f'_n + f''_1 = f''_n + f'_1 = f_k$$

We can conclude from the above reasoning that:

1. The choice of a deviation equal to a quarter of the inter-channel space in F.M. V.F. telegraphy gives the most satisfactory results as regards protection against the effects of non-linearity.

2. If we select the centre frequencies of F.M. telegraphy channels in such a way that they are the even multiple of the inter-channel space, we obtain a partial guarantee against non-linearity of the elements of the transmission channel, consisting of the elimination of the influence of the second harmonic. However, we must put up with the fact that the F.M. V.F. telegraph channels must be shifted by half the inter-channel spacing in respect of A.M. V.F. telegraph channels.

Study of the influence of the non-linearity of the elements of the transmission channel on the increase of telegraph distortion in V.F. telegraph circuits might solve the following question: Does the advantage obtained from this method decidedly overweigh the certain drawback of different spacing of V.F. telegraph channels?

As far as the author is aware, no such study has as yet been made or published.

SWITZERLAND

Extracts from Document S.G. II/75-E
27 November 1956

Frequency deviations on telephone circuits — Observations made by the Swiss Administration

Some results of measurements of frequency deviations on carrier telephone circuits are given below and have been obtained from measurements on the Swiss network.

To determine these deviations, a daily comparison was made (with the exception of Sundays) of the frequency of ten master oscillators for telephone systems on coaxial pairs with:

a) the 200 kc/s carrier frequency of the Droitwich transmitter (taking account of the monthly corrections);

b) the standard frequency from the Neuchâtel observatory.

Excluding short-time variations, it was noticed that there was a regular increase of the frequency due to the ageing of the quartz.

This increase was on the average 8.9×10^{-5} c/s per day for an oscillator frequency of 100,000 c/s or 8.9×10^{-10} c/s per day per cycle. The least stable of the oscillators observed gave a value of 26×10^{-10} c/s and the better ones a value of 4×10^{-10} c/s. One oscillator showed a slight and regular decrease of frequency of 2.4×10^{-10} c/s per day per cycle.

Taking as a basis the value of $\pm 1 \times 10^{-7}$ for the stability, as recommended by the C.C.I.F. on page 85 of Volume III of the *Green Book*, and neglecting the short-term variations, it is possible to determine the theoretical maximum period during which there is no need to readjust the oscillator. It is sufficient to divide the maximum variation admitted by the value of the daily variation. In this particular case we have:

$$\frac{2 \times 10^{-7}}{8.9 \times 10^{-10}} = 225 \text{ days}$$

for the average of the oscillators. For the extreme cases we have 77 and 830 days respectively.

However, to these regular variations due to the ageing of the quartz, there are to be added irregular variations arising from such factors as temperature change, variations of supply voltage, measuring errors, etc. The curves of frequency variation as a function of time thus have an irregular form and the theoretical period between two successive adjustments is reduced.

The average of this reduced period for the 10 oscillators is 141 days, while for the extreme cases we have approximately 60 and 360 days.

It can, then, be concluded that if the interval between adjustments is less than the period determined above, the stability of $\pm 1 \times 10^{-7}$ recommended by the C.C.I.F. may be satisfied.

Observations carried out on master oscillators for carrier systems on balanced pairs, but over a shorter period, have given similar results.

No information can at present be given on sudden changes of phase.

TRANSMISSION STANDARDS

(C.C.I.T. Question 25 — C.C.I.T.T. Question 22/9)

FEDERAL GERMAN REPUBLIC

Document S.G. II/67
6 November 1956

Telex Transmission Standards

Question 25 (1953/1956)

What are the telegraph transmission standards which should be adopted for teleprinter switching networks :

a) between a user's station and an international Line-Head Office ?

b) between international Line-Head Offices ?

Reply

1. *Some general information about the Telex network we operate*

It is entirely automatic, but there are manual Telex positions in the international terminal exchanges to handle international traffic. A part only of international traffic passes through these Telex positions, since the traffic to several countries is already routed by direct automatic selection.

Figure 1 is a diagram of the Telex network as a whole. The network includes a number of offices which, according to their position in the network, are designated as central office (ZA), main office (HA), terminal office (EA), and " partial " office (EAT). The central offices constitute the high level of the plan, which covers the whole of the Federal Republic. They are connected by direct lines. Every central office serves a particular area, designated as a ZA area and including a number of main offices (HA), which are star-connected to their particular central offices. Similarly each main office serves an HA area, which has a number of terminal offices (EA), which in their turn are star-connected to their particular main offices. In addition, the terminal offices are directly connected to the central offices of the areas in which they are situated. Communications established within an HA area go through the appropriate main office. Communications established to other main offices in the ZA area and those going beyond the limits of the area are directed from the terminal office to the central one, over direct lines. The " partial " offices (EAT) are switching offices connected to the nearest office, i.e., according as to where they are, to a central office, a main office, or a terminal office. From the technical viewpoint, they represent a constituent part of this office.

If there is enough traffic, direct lines are established between the main offices or between a main office (or terminal office) and the central office of another ZA area.

Plan d'ensemble du réseau Télex de l'Administration fédérale allemande des postes et télécommunications

General plan of the Federal German Administration Telex network

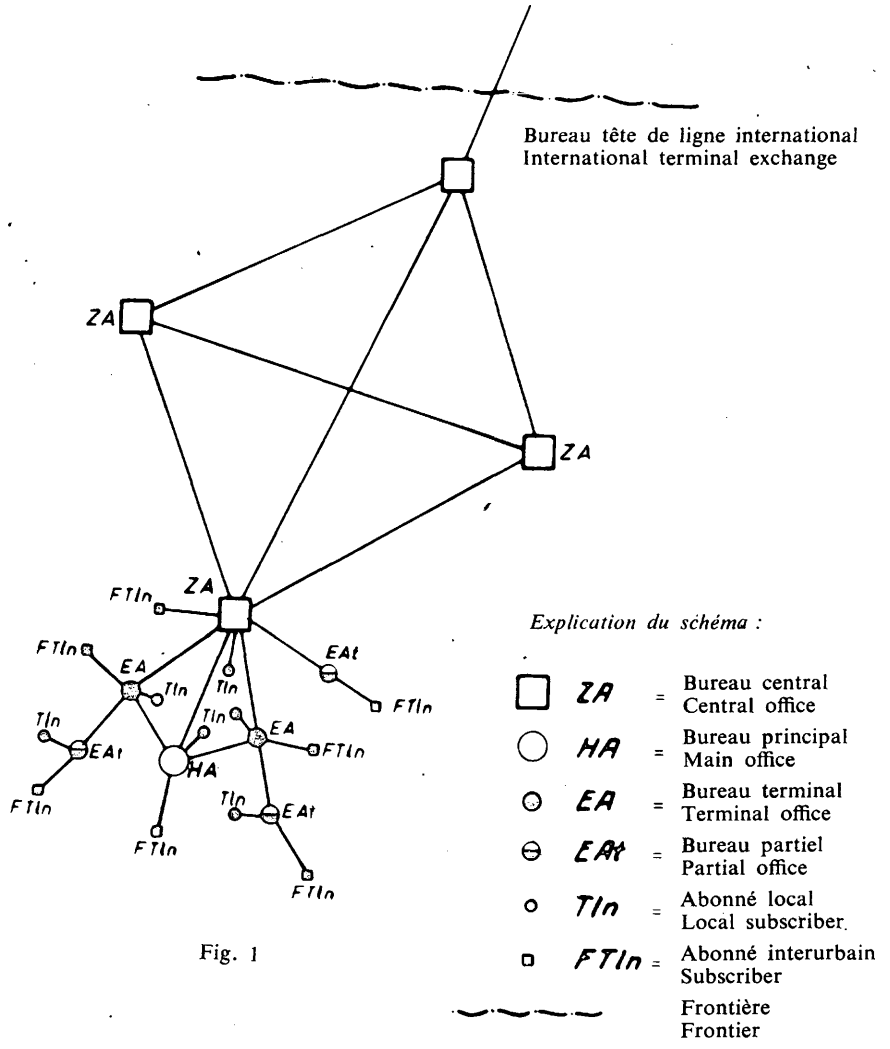


Fig. 1

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S.G. II / 67
Novembre 1956

The Telex subscribers are connected to the switching offices (central offices, main offices, terminal offices, " partial " offices) by single-current two-wire circuits for twenty miles or so, and by voice-frequency or direct-current telegraph circuits in the case of greater distance.

The present Telex network comprises, with West Berlin, eight central offices, of which two (Frankfurt-on-Main and Hamburg) are international terminal exchanges with Telex positions

for outgoing traffic. For automatic traffic proper, provision has been made for three international terminal exchanges (Düsseldorf, Frankfurt-on-Main, and Hamburg). Other offices can be added in case of need. Besides the eight central offices, there are fifty-four main offices, forty-one terminal offices, and twenty-seven " partial " ones.

Figure 1 shows that international communications may be routed through as many as four voice-frequency telegraph links in the German Telex network between a subscriber and the international terminal exchange. But the international terminal exchanges are more often reached via less than four such links, because subscribers in considerable number are connected directly to the central and main offices and because groups of circuits for international traffic can be directly connected from concentration points, should the volume of traffic so warrant.

2. *Routing of a communication in the German Telex network between a trunk subscriber connected to a " partial " office and the international terminal exchange, and computation of the admissible start-stop distortion that may be expected at the points where the sections join.*

Figure 2 shows how we route a communication between a subscriber connected to a " partial " office and the international terminal exchange; the most unfavourable case is considered, i.e., when the " partial " office is connected to a terminal or main office. The distortion arising at the ends of the various transmission links has been assessed from the formula, to wit:

$$\delta_{text} = \sum_{1}^{n} \delta_c + \sqrt{\delta_t^2 + \delta_v^2 + \sum_{1}^{n} (\delta_{1:1} + \delta_{irreg.})^2} \qquad (n > 1)$$

The following characteristic values have been laid down for the teleprinters and voice-frequency telegraph equipments used in the Federal network:

For distortion at the output of the teleprinter:

$$\sqrt{\delta_t^2 + \delta_v^2} = 10\,\%$$

For circuits: subscriber's telegraph repeater — " partial " office and " partial " office — terminal office, operated by voice-frequency telegraphy with frequency modulation (WT 51):

$$\delta_c = 0\,\% \qquad \delta_{1:1} + \delta_{irreg.} = 6\,\%$$

For circuits: terminal office — central office and central office — international terminal exchange, operated with voice-frequency telegraphy with amplitude modulation (WT 53):

$$\delta_c = 3\,\% \qquad \delta_{1:1} + \delta_{irreg.} = 6\,\%.$$

Figure 2 shows the degrees of distortion at the ends of the various transmission links. For traffic leaving international terminal exchanges for foreign countries, we get a distortion of approximately 22 %.

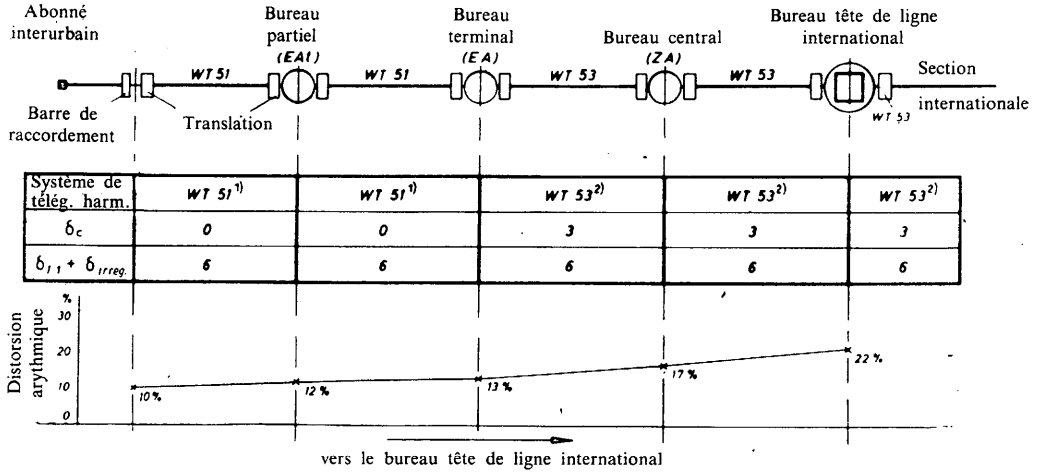


Fig. 2

[1]) WT 51 = Système de télégraphie harmonique avec modulation de fréquence.
[2]) WT 53 = Système de télégraphie harmonique avec modulation d'amplitude.

Plan d'acheminement d'une communication Télex, dans le réseau Télex allemand, entre un abonné interurbain raccordé à un bureau partiel et un bureau tête de ligne international, avec indication des valeurs de distorsion arythmique tolérées aux points de jonction des sections de transmission pour le sens de communication allant de l'abonné vers le bureau tête de ligne international.

How a Telex call is routed in the German Federal network, between a subscriber connected to a " partial " office and an international terminal exchange, showing how much start-stop distortion is admissible at the junction points of the transmission links, when the call goes from the subscriber to the international terminal exchange.

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S.G. II / 67
Novembre 1956

In the opposite direction, i.e., from abroad, the gross distortion appearing at the input to the subscriber's telegraph repeater may be computed for the complete communication, if we know the conditions governing the routing of the call in the foreign country and on the international section, as shown in Figure 2. When the start-stop distortion, calculated at the input to the subscriber's repeater, exceeds the maximum, 30 %, laid down in Recommendation B.25, the Administrations concerned have to see what can be done to reduce it to this figure.

3. *The switching network for the general service*

The switching network for the general service is made up, technically speaking, in the same fashion as the Telex network, but comprises only central and main offices. A communication established between a terminal telegraph office connected as a subscriber and the international terminal exchange can comprise not more than three line sections at most (see figure 3).

For the direction telegraph station — international terminal exchange, we make provision for about 20 % of start-stop distortion at the entry to the international section.

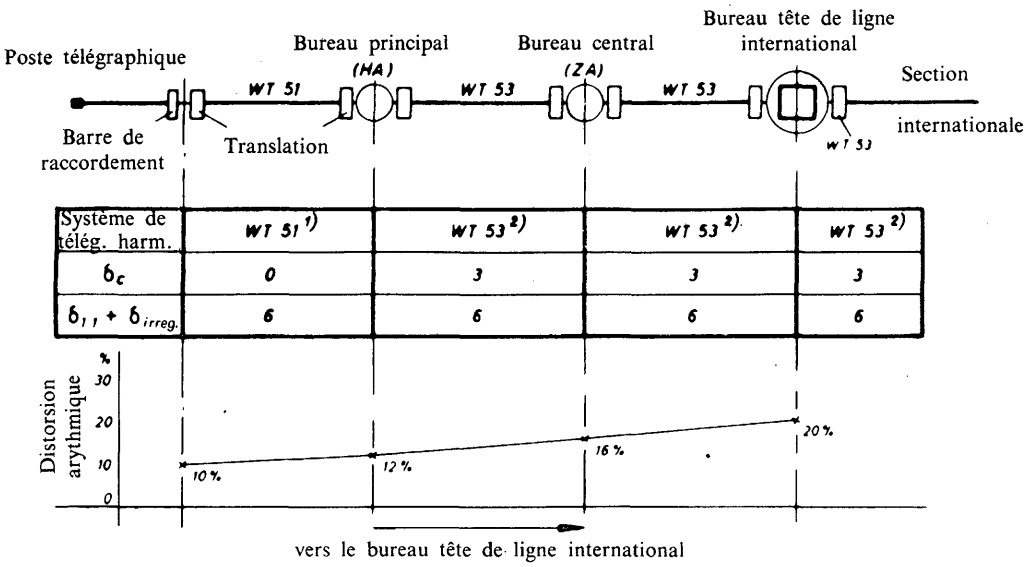


Fig. 3

[1]) WT 51 = Système de télégraphie harmonique avec modulation de fréquence.
[2]) WT 53 = Système de télégraphie harmonique avec modulation d'amplitude.

Plan d'acheminement d'une communication dans le réseau avec commutation pour le service télégraphique général, entre un poste télégraphique raccordé à un bureau principal comme abonné interurbain et un bureau tête de ligne international, avec indication des valeurs de distorsion arythmique tolérées aux points de jonction des sections de transmission pour le sens de communication allant du poste télégraphique vers le bureau tête de ligne international.

How a call is routed in the switching network for general service betwen a telegraph station connected to a main office as a subscriber and an international terminal exchange, and how much start-stop distortion is admissible at the junction points of the transmission links for a call going from the telegraph station towards the international terminal exchange.

C.C.I.T. 95 / 3
S.G. II / 67
Novembre 1956

UNITED KINGDOM

Extracts from Document S.G. II/36
23 January 1956

Observations on the study of C.C.I.T. question 25

Question 25

What are the telegraph transmission standards which should be adopted for teleprinter switching networks :

a) between a user station and the international Line-head Office ?

b) between international Line-head Offices (see recommendations B.25 and B.36).

Reply

In the United Kingdom the transmission plan of the national Telex network is based upon the use of a maximum of 5 voice-frequency (V.F.) telegraph channels in tandem in any established connection. Regenerative repeaters are not required for purely national calls. The network consists basically of a number of zone switching centres, all of which are interconnected by single V.F. telegraph channels. Each zone centre serves a number of area switching centres and automatic Telex sub-centres to which subscribers lines are connected. Some subscribers are directly connected to zone centres. Calls from a subscriber which require to be connected via its parent zone centre never require more than 2 V.F. telegraph channels in tandem in the connection to its parent zone centre. For international service one zone centre only, namely London, has trunk circuits to the international Telex exchanges in other countries and thus the maximum number of V.F. telegraph channels between a Telex subscriber in the U.K. and the London international Telex exchange is 3 and more commonly 2, as direct trunk circuits are provided in most cases from the area switching centres to the London international switchboard.

Approximately 50 % of the Telex subscribers in the U.K. are located in London and the majority of international Telex traffic is to and from London subscribers, all of whom have exchange lines of negligible distortion. To cater for the greater distortion which may be received on international calls from provincial subscribers, it will be necessary, in order to ensure satisfactory transmission to subscribers in other countries who are similarly remote from their international Telex exchange, to provide regeneration of the signals into the sending side at each end of the international Telex circuit, in conformity with recommendation B.26. Regenerative repeaters are therefore being installed in London and for economic reasons it is proposed to connect them in the receiving ends of the trunk circuits from provincial Telex exchanges to the London international Telex exchange. The repeaters are expected to be in service early in 1956 and thereafter the distortion in signals transmitted over international Telex trunk circuits from London will be negligible on calls from provincial subscribers. The gross start-stop distortion from London subscribers will, as at present, also be small (not greater than 12 %), being mainly the transmitter distortion of the subscriber's instrument, the line distortion being almost negligible.

It should be noted that the foregoing action to improve transmission on international calls between provincial subscribers, will only be effective if other Administrations provide regenerative repeaters in their countries, fitted in the sending side of international switched circuits of the type described.

C.C.I.T. recommendation B.25 (Arnhem) gives provisional standards for use in planning point-to-point telegraph communications and switching networks using start-stop apparatus. The recommendation envisages that a switched connection or point-to-point circuit shall not include more than 4 V.F. telegraph channels in tandem and presupposes that the distortion introduced by the local ends of the circuit is negligible. Furthermore, the standards recommended take no account of the possibility of including regenerative repeaters in circuits, although some advice regarding the siting of such repeaters in international Telex circuits is given in recommendation B.26 (Arnhem).

Despite the foregoing, international Telex calls are being set up at the present time over switched connections requiring as many as 6 V.F. telegraph channels in tandem and without, as far as is known, the use of regenerative repeaters. This practice is considered to be very undesirable, as experience in the United Kingdom, both in the operation of the Telex Service and also from the results of extensive tests using a telegraph distortion analyser on switched telegraph channels, has indicated that for satisfactory transmission without regenerative repeaters, and without the need for an increase in the normal maintenance attention, the maximum number of V.F. telegraph channels in tandem should be limited to 5, assuming the physical ends have negligible distortion. Any increase beyond 5 channels causes a significant increase in the probability of errors on some calls.

In view of the rapid expansion of the international Telex service, the number of calls requiring more than 4 or 5 links in tandem is increasing and it therefore seems desirable to give greater clarity and precision to the C.C.I.T. recommendations relating to transmission standards for switching service, in order that the future growth of the service can proceed on the basis of a sound transmission plan. It is therefore proposed that recommendation B.25 should be revised accordingly and in so doing it is suggested that the recommendations relating to switching service should be separated from those appertaining to point-to-point circuits. For point-to-point circuits, the present recommendations in B.25 are considered to be adequate.

For switching service, it is suggested that when regenerative repeaters are not employed in a connection, not more than 5 V.F. telegraph channels in tandem, with physical ends of negligible distortion, should be permitted in any international call. Beyond this limit, it is recommended that regenerative repeaters should always be inserted at appropriate points in the circuit unless special V.F. telegraph channels of low distortion can be employed in the connection. In either case the standardized test isochronous distortion of the whole trunk section of the connection, including national and international sections of the circuit, should not exceed 28 %.

The adoption of 5 V.F. telegraph channels as the maximum transmission limit, without using regenerative repeaters, would in general only permit the use of 2 V.F. telegraph channels in tandem between each subscriber and his international exchange and only one V.F. telegraph channel between the 2 international exchanges. Since in many cases these limits will need to be exceeded, it seems preferable to specify in the international recommendation:

a) the distortion of signals entering an international Telex trunk circuit from a subscriber;

b) the distortion in the trunk circuit between the international Telex exchange in the country of origin of the call and the international exchange in the destination country.

Administrations would then be free to determine the measures to be taken to conform with these limits in the light of the characteristics of their national networks. It is suggested that the limits for *(a)* should be 12 % and for *(b)* 10 % when the international trunk circuit consists of one V.F. telegraph channel, and 18 % when the international trunk consists of 2 V.F. telegraph channels or when transit switching is necessary.

Ultimately it is considered that the distortion limits quoted in the recommendation will need to be quoted in terms of probability values, but insufficient test results are so far available in the United Kingdom for this purpose.

Document S.G. II/72-E
21 November 1956

Further information concerning question 25

C.C.I.T. Document S.G. II/36 contains some observations of the United Kingdom on this question and gives details of the trunking plan and transmission standards at present employed; it also describes the action being taken to provide start-stop regenerative repeaters in international Telex connections from provincial subscribers in the United Kingdom.

From a transmission viewpoint, no changes are contemplated at present which will affect the trunking arrangements described in our previous reply, apart from some change in the utilization of regenerative repeaters which may become desirable in the light of further C.C.I.T. discussions regarding their use in international networks.

The following supplementary information concerning transmission standards is given in response to the inquiry which Study Group II, at its meeting in February 1956, proposed to be made by Administrations :

1. The maximum value of the conventional degree of gross start-stop distortion which may be expected to be transmitted from the United Kingdom international exchange (i.e. London) into any international trunk circuit, assuming regenerative repeaters are not employed, is as follows :

a) *For subscribers in London :* 12 %. These subscribers constitute approximately 50 % of Telex subscribers in the United Kingdom and more than half of the total international Telex traffic of the United Kingdom is to and from London subscribers.

b) *For subscribers in the Provinces :* 15 % to 20 %, depending whether the connection to London involves one or two voice-frequency telegraph channels in tandem. (If regenerative repeaters are employed in the manner so far proposed by the United Kingdom, then the value of distortion transmitted will be 5 %).

2. The maximum value of the conventional degree of gross start-stop distortion which can be tolerated at the international exchange in London for transmission to a subscriber in the United Kingdom is :

a) *For subscribers in London :* 30 %.

b) *For subscribers in the Provinces :* 24 % to 26 %.

DESIGNATION OF THE DIFFERENT TYPES OF CHANNELS

(C.C.I.T.T. Question 3/7)

Mr ALBANESE,
Chairman, Study Group I

Extract from C.C.I.T. Document A.P. VIII/14
7 August 1956

My personal opinion is that the confusion referred to in the afore-mentioned new question [1] had its origin in the definition itself of " channel " (" voie de transmission ", in French). When this term was introduced into telecommunications, some people gave it the meaning of the English word " channel ", subsequently investing it with a meaning which would justify the application of the adjectival noun " transmission ".

In this respect, I would recall that one of the questions discussed by the C.C.I.F. Vocabulary Committee was whether a channel should be considered a channel allowing *single transmission* [2] in one direction, as was subsequently indicated in the definition in the new C.C.I.F. Glossary, which was contrary to the impression given by the " International Six-Language Telephone Vocabulary " [3]; it was this discussion which revealed that the French term " voie de transmission " was to mean " channel " in English.

Moreover it should be stressed that even the English word " channel " gives rise to some confusion. This term is, for example, used without discrimination in voice-frequency telegraphy for what would now be called " channel " or " circuit ".

The following solution might be adopted to clear up this muddle:

a) A word might be introduced into French to denote what in English is called " channel ", i.e. " canal ", reserving it exclusively for multiplex systems [4]. The French term " canal " should have practical connotations and not be associated with transmission questions.

b) To give " voie de transmission " the meaning of all the media allowing the transmission of signals in a given direction, whether the signals pass over one channel or over several different channels.

In this way, in the case of voice-frequency telegraphy, the " voie de transmission " would be constituted by those elements of the telephone circuit which make transmission in one direction possible: the channels obtained by frequency splitting would be termed " canaux " and those obtained from each of them by time-division might be called " sous-canaux ". We could, too, use the term " voie de transmission " for each of the " canaux " obtained by frequency splitting, especially if this " canal " was not used for a single transmission; in this case there would be no need to introduce the term (" sous-canal ").

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[1] C.C.I.T.T. question 3/7.

[2] In telegraphy the term " single transmission " should be taken to mean the successive transmission of signals forming a message without the interleaving of other signals.

[3] In this Vocabulary, the following definition is given for a " two-wire " circuit: " A circuit made up of one channel used for bothway traffic ".

[4] It should be decided at the same time whether or not the French term " canal " includes transmission in both directions; it would be possible to use the French terms " semi-canal " (or " demi-canal ") and " canal bilatéral " to differentiate between the two cases.

MARGIN AND OUTPUT DISTORTION OF START-STOP TELEPRINTERS

(C.C.I.T. Questions 34, 37 and 38 — C.C.I.T.T. Questions 1/8, 2/8 and 3/8)

FRANCE

Document S.G. II/37
S.G. III/22
25 January 1956
(Extracts)

Statistical study of the margin of teleprinters

The object of the measurement should be to establish a relation between the error rate of the translation by the start-stop apparatus and the measured margin.

The French Administration has already made an investigation of this method, the results of which are given below:

Tests were made on 5 S.A.G.E.M. sets of apparatus, in order to find the relation between the margin of a given apparatus during a rapid measurement and the margin corresponding to a given error probability.

1. *Methods used for the tests*

The tests lasted more than six weeks.

They were made under the following conditions:

1. The receiving electromagnet was fed with double current at 20 mA, its two windings being connected in series. The circuit of the telegraph current, apart from the electromagnet, was purely resistive.

2. The modulation came from a type 53 transmitter of calibrated telegraph signals. This apparatus provides signals of which the start-stop distortion, adjustable in 2 % steps, differs from its nominal value by not more than 1 %. As with all apparatus of this type, the signals succeed each other as closely as possible, according to the length of the cycle. The distortion is obtained by lengthening or shortening the stop element of the signal, the code elements retaining their nominal theoretical length.

3. The signals comprising the modulation formed the French sentence standardized by the C.C.I.T. The transmission cycle was 7.5 units.

4. The frequency of occurrences of translation errors for degrees of " early " distortion (shortening of the start element) and " late " distortion (lengthening of the start element), equal to 44, 42, 40, 38 and 36 %, was determined. In the modulation used only one out of two characters in the international sentence was distorted. The modulation rate of the transmitter was taken as equal, by a stroboscopic method, to the average speed of the teleprinter during the reception of the sentence.

To obtain these frequencies of occurrence, the number of characters required to produce 10 errors was determined. This measurement was repeated 6 times in succession. However, when the rate of occurrence was low enough for 100,000 characters to be received without error, the test was stopped.

2. *Results obtained*

Only equipments Nos. 4460 and 4503 gave a sufficiently narrow margin to provide useful results. The other equipments showed a sufficiently high margin to have an error occurrence frequency of 0/100,000 for distortions of 42 and even 44 %.

Tables I and II summarize the results obtained for equipments Nos. 4460 and 4503. The curves in diagrams 71/1 and 71/2 are a graphic representation of these tables. These figures show the curve of the mean frequency and the dispersion area around this curve. The bottom part of the curve was obtained by a justifiable extrapolation.

These curves show that the frequency of occurrences of errors increases very rapidly when the limiting area of the margin of the apparatus is attained. For a distortion variation of some 6 %, the occurrence frequency of errors passes from less than 10^{-5} to more than 10^{-2}.

3. *Definition of a margin measuring method*

It is natural to assume that an apparatus can be regarded as providing satisfactory service if the probability of a translation error is small as compared with the probability of an operator's typing error. It seems reasonable to assume that this is so when the first probability does not exceed a tenth of the second.

The " gross " probability of a typing error may be regarded as approximately 1/1,000, but allowance must be made for the operator's correction possibility, especially in perforated tape transmission, when it can be assumed that the corrected probability can easily fall to 1/10,000.

The tolerable probability for a translation error is thus 1/100,000.

But this does not mean that the permissible figure for the margin of an apparatus is the smallest distortion which under test conditions gives an error frequency of 1/100,000.

During the tests, 85 characters are transmitted per sentence. Of these, 34 or 40 % are distorted, whereas on a *real channel*, the probability of reaching a 35 % distortion corresponding to the minimum effective margin of the apparatus is less than 1/100,000.

If several channels are joined end to end, the probability very rapidly increases. For example, if four similar channels are placed end to end, this probability becomes about 1/100, which still corresponds to an occurrence rate forty times smaller than in the test.

Thus it is quite safe to admit, as a practical value for the margin, the distortion which, under test conditions, gives an error probability of the order of 1/10,000.

The curves in figures 1 and 2 show that this distortion is 4 % less than that which gives an error probability of the order of 1 per sentence (probability a little higher than 1 %).

If, then, a single test is made to determine the apparent margin of an apparatus (highest value of distortion giving at most one error per sentence), the practical margin of the apparatus is 4 % less. This margin effectively corresponds to a translation error probability of less than 1/100,000 under the most unfavourable conditions.

4. *Conclusions*

The above tests, although they entailed a great deal of work, should be regarded as a first indication only. They should be taken up again with apparatus more appropriate for the aim in view.

TABLE I

Apparatus No. 4460

Distortion	Frequency of occurrences of errors
Late 44 %	1.49 - 1.21 - 0.74 - 0.74 - 0.66 - 0.64, average 0.91
Late 42 %	0.022 - 0.020 - 0.020 - 0.020 - 0.013 - 0.013, average 0.018
Late 40 %	0
Early 44 %	3.57 - 2.94 - 2.74 - 2.70 - 2.70 - 2.70, average 2.89
Early 42 %	0.098 - 0.097 - 0.065 - 0.059 - 0.054 - 0.038, average 0.069
Early 40 %	0.01 - 0.0067 - 0, average 0.0056
Early 38 %	0

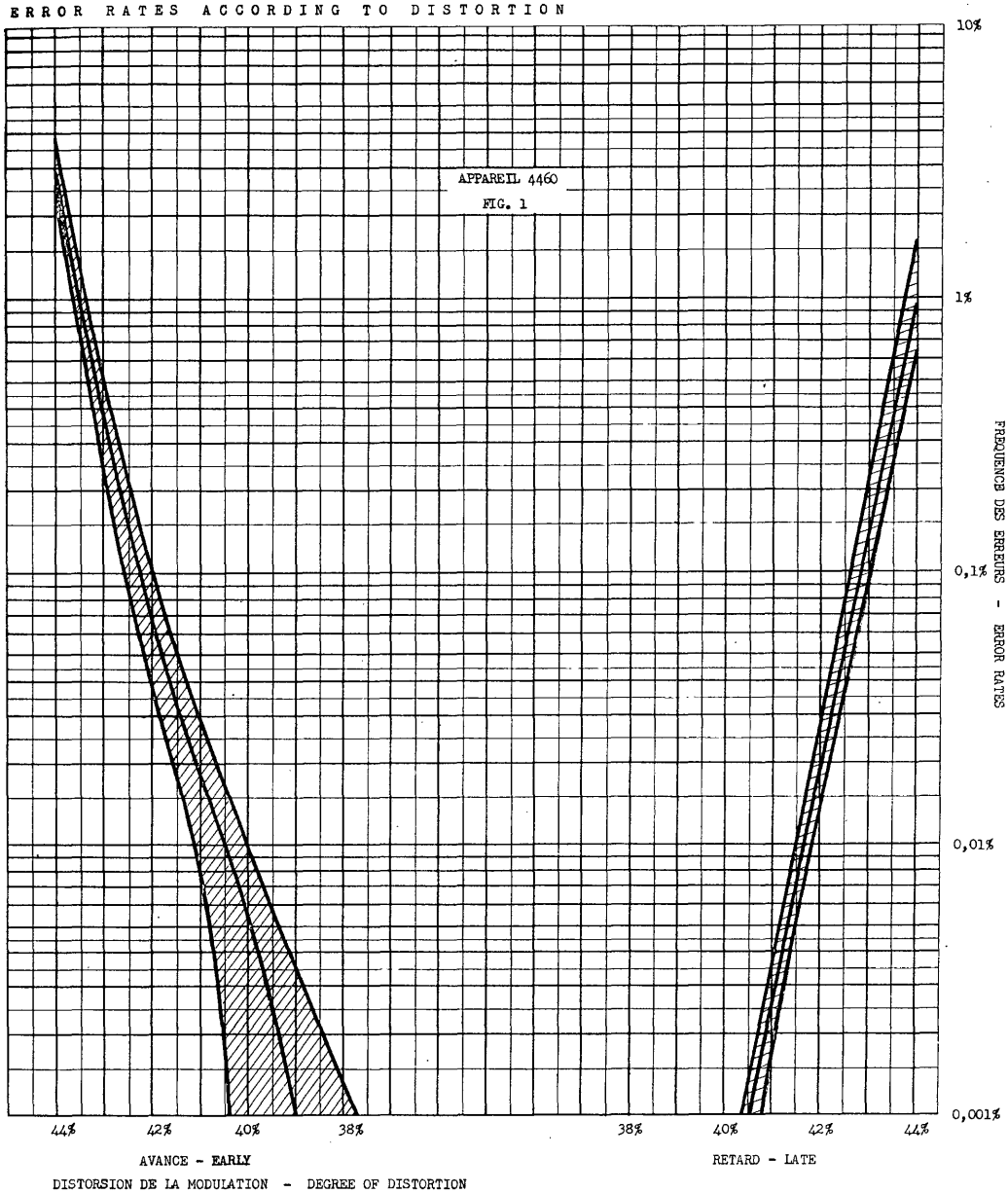
TABLE II

Apparatus No. 4503

Distortion	Frequency of occurrences of errors
Late 44 %	0.93 - 2.86 - 2.08 - 2.22 - 3.13 - 1.82 average 2.17
Late 42 %	0.17 - 0.14 - 0.092 - 0.091 - 0.086 - 0.076 average 0.11
Late 40 %	0.033 - 0.044 - 0.030 - 0.016 - 0.063 - 0.020 average 0.034
Late 38 %	0
Early 44 %	0.059 - 0.28 - 0.32 - 0.37 - 0.084 - 0.33 average 0.24
Early 42 %	0.015 - 0.023 - 0.024 - 0.021 - 0.025 - 0.033 average 0.024
Early 40 %	0

ETUDE STATISTIQUE DE LA MARGE DU TELEIMPRIMEUR
FREQUENCE DES ERREURS EN FONCTION DE LA DISTORSION

STATISTICAL STUDY OF TELEPRINTERS MARGIN
ERROR RATES ACCORDING TO DISTORTION



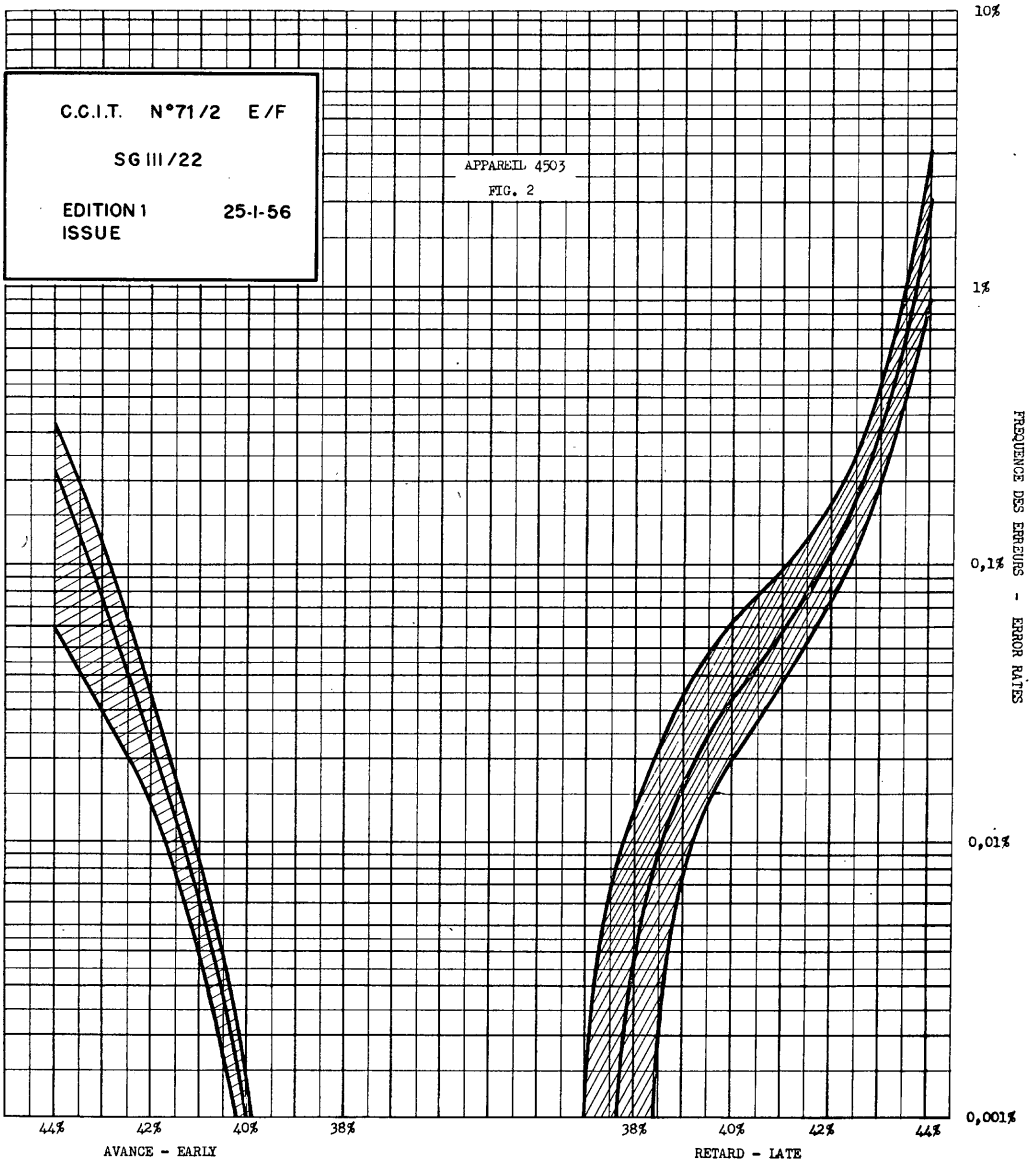
C.C.I.T. N°71/1 E/F

SG III/22

EDITION 1 25-1-56
ISSUE

ETUDE STATISTIQUE DE LA MARGE DU TELEIMPRIMEUR
FREQUENCE DES ERREURS EN FONCTION DE LA DISTORSION

STATISTICAL STUDY OF TELEPRINTERS MARGIN
ERROR RATES ACCORDING TO DISTORTION



FRANCE

Extracts from Document S.G. II/37-E
S.G. III/22-E

25 January 1956

Telemargin and teledistortion

Question 37

In attempting to measure the margin of a receiving apparatus from a distant point, through the intermediary of a transmission channel, what relation is there between the result of this measurement, the true margin of the apparatus and the degree of inherent distortion in the transmission channel ?

Should such measurements be recommended ?

Question 38

In measuring the degree of distortion at the output of a transmission channel associated with a transmitting apparatus, what relation is there between the result of the measurement, the degree of distortion at the transmitting point and the degree of inherent distortion of the channel ?

For the further study of these questions it is agreed that the portion of the communication section metallically connected to the apparatus (from the last point at which the signals are repeated) should be regarded as part of the apparatus.

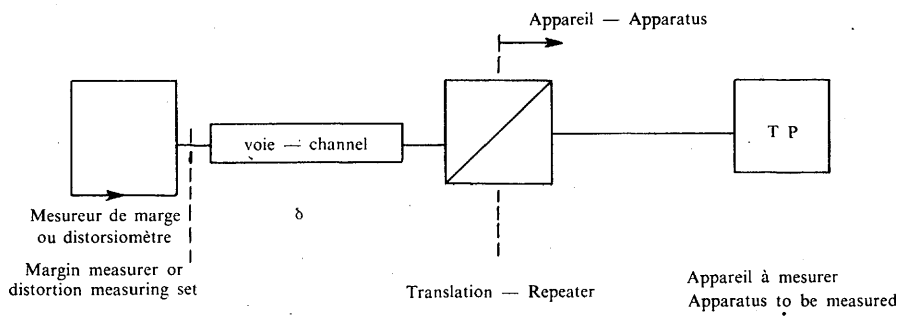


Diagram 1

The transmission channel referred to in the Questions 37 and 38 is the channel included between the measuring set and the last point at which the signals are repeated.

The inherent distortion of this channel in the direction under consideration will be represented as δ (Diagram 1).

Measurements will be made by Administrations according to their own method of working (single or double current).

Question 37

The aim of the measurements shall be to establish a relationship between the result of measurements of telemargin and the probability that the receiving apparatus will show an error rate lower than a given value. This value will have to be fixed later, in the light of the recommendations of Study Group IX, the results of measurements carried out by Administrations within the framework of Questions 34, 37 and 38 and the limits already indicated in Recommendation B.25.

The measurements of telemargin should be made with measuring sets conforming to the annexed Draft Recommendation III/1. Any Administration making measurements with another type of measuring apparatus should clearly define the characteristics of that apparatus.

The measurements should consist of:

a) a margin measurement (M) (telemargin) towards the receiving apparatus from the end of the transmission channel remote from the receiving apparatus (1 in Diagram 2);

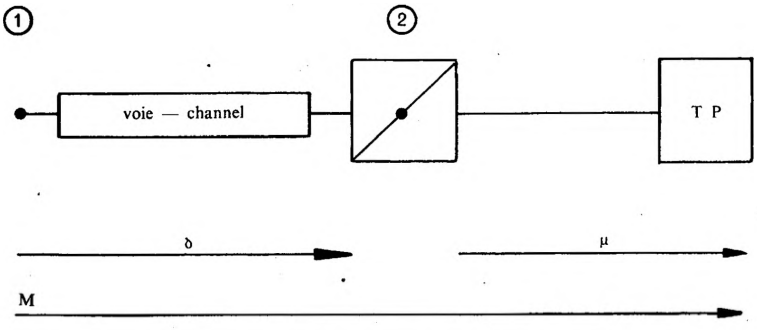


Diagram 2

b) a margin measurement (μ) towards the receiving apparatus from the last point at which the signals are repeated (2 in Diagram 2);

c) a measurement of the inherent distortion (δ) of the transmission channel between points 1 and 2.

In the case of the margin measurements M and μ, it would be useful to prepare the curve showing the frequency of occurrence of errors for each degree of applied distortion. In the case of measurements of inherent distortion (δ) it would be useful to prepare the curve showing the frequency with which the measured degree of distortion is exceeded.

The French Administration has already made an investigation using this method, the results of which are given below:

Measurement of the telemargin of start-stop apparatus from testing stations

It is current practice to determine the margin of start-stop apparatus as seen through the channel which links it to a testing station and the value of such a measurement is very questionable (Question 37).

The present paper is intended to provide material for a reply to this question.

1. *The problem set out*

The idea behind the measurements was to determine the relation between the nominal distortion of the signals transmitted by a margin measuring set and the restitution distortion at the receiving end of a channel, making allowance for the channel inherent distortion.

It was quite obvious beforehand that this relation was essentially of a statistical nature. It was therefore necessary, at the receiving end, to plot the distribution density curve of the restitution distortion for a given distortion at the transmitting end.

2. *Organization of the measurements*

To achieve the end in view, it was first necessary to have telegraph loops available of such a nature as to be able to reproduce the conditions obtaining in channels connecting subscribers to the measurement centres.

The long distance lines department provided us with :

2 metallic circuit loops Paris - St Amand - Paris Bourse ;

2 double phantom loops Paris - St Amand - Paris Bourse ;

2 V.F. telegraphy loops on LF circuit Paris - Dijon ;

2 V.M. V.F. telegraph loops Paris - Fontainebleau ;

2 V.F. telegraph loops on coaxial circuits Paris - Longuyon.

We admitted that a subscriber's station line could comprise :

1. a metallic circuit only ;
2. a metallic circuit and a double phantom circuit end to end ;
3. a metallic circuit, a double phantom circuit and a V.F. telegraph circuit end to end.

A type 53 transmitter of calibrated telegraph signals was used, transmitting the international start-stop text in the 7.5-unit code at the theoretical speed of 50 bauds. The distortion was of the alternating type affecting only one character out of two and the start element. The degrees of transmission distortion were taken as equal to 34, 38 and 42 % in each direction : this choice was due to the fact that the effective net margin of the start-stop apparatus should always be more than 35 % (Recommendation C.4) and that in practice it seldom goes beyond 42 %.

The receiver was a type 53 start-stop distortion measuring set associated with a metering group. If a given degree of distortion is displayed on the start-stop distortion measuring set, the metering group counts the number of characteristic instants suffering from a degree of distortion higher than the degree displayed. The metering group also counts the characteristic instants received. For a given transmission distortion and a given distortion displayed on the measuring set, we prolonged the measurements during the reception of 10,000 characteristic instants, of which about 5,000 showed distortion. The length of a measurement was about 10 minutes.

For a given transmission distortion, each of the measurements corresponded to the recording of a point on the distribution function.

3. *Use made of the measurements*

The double entry tables I and II show the results obtained in two cases given as examples.

The abscissae show the transmission distortion and the ordinates show the distortion rate displayed on the start stop distortion measuring set.

The squares in the table contain the number of characteristic instants suffering from distortion greater than the degree of distortion displayed on the measuring set.

To turn these numbers into percentages, we divided them by 10,000, which is the number of characteristic instants received. If we had directly entered on the abscissae the numbers in the first column of a table and on the ordinates the corresponding numbers of another column, we should have obtained the curve of the distribution function relative to the distribution of the distortion of the restituted characteristic instants.

TABLE I

Inherent Distortion of the Channel < 4 % Perfect

Circuit : Paris Corbeil 1 + Paris Bourse 1

Distortion displayed at receiver	Transmitter/Distortion					
	34 % Early	34 % Late	38 % Early	38 % Late	42 % Early	42 % Late
30 %	4680	4970				
32 %	3090	4120				
34 %	2010	2610				
36 %	444	1190				
38 %	0	68	2570	2700	4940	4940
40 %		0	914	790	3840	4540
42 %			28	26	2456	2530
44 %			0	0	850	890
46 %					46	24
48 %					2	1

TABLE II

Inherent Distortion of the Channel < 8 % Perfect

Circuit : Paris Fontainebleau D + Paris Corbeil 2 + Paris Bourse 1

Distortion displayed at receiver	Transmitter/Distortion					
	34 % Early	34 % Late	38 % Early	38 % Late	42 % Early	42 % Late
30 %	5120	4460				
32 %	4100	3100				
34 %	2828	1274	4940	4540		
36 %	1820	131	4300	3840		
38 %	1043	1	3190	2400	4340	4400
40 %	1071		1350	275	3680	3840
42 %	366		1019	35	3020	2620
44 %	5		777	7	2634	566
46 %			479	3	1724	43
48 %			25		700	0

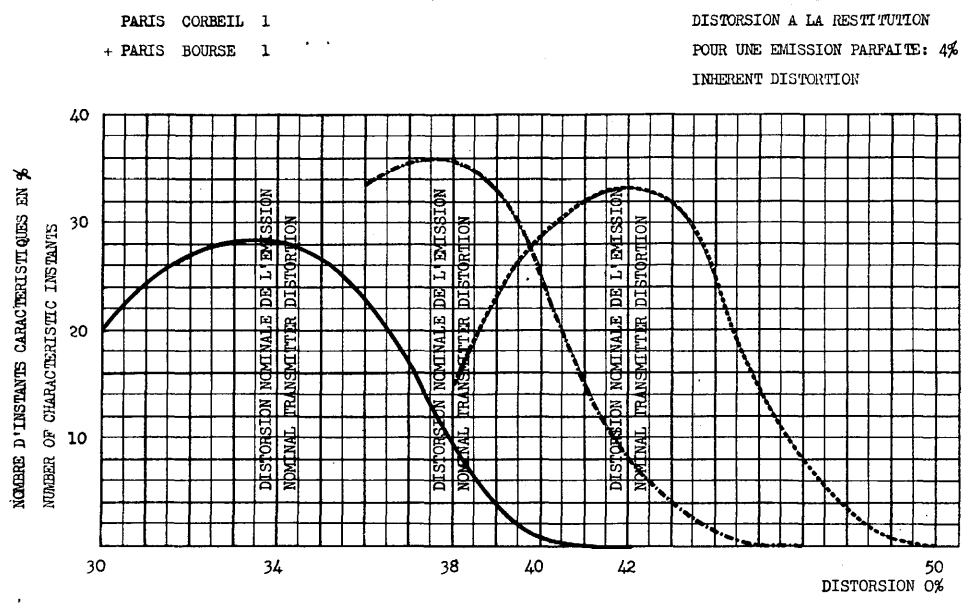
To deduce from these results the curve for the frequency density of the distribution of the distortion, we found a numerical derivative by entering along the abscissae the arithmetical averages of two consecutive numbers in the first column of the table and along the ordinates the differences in the corresponding numbers in another column, naturally turned into percentages.

In this way, we obtained curves like those in diagrams 71/1 and 71/2 corresponding respectively to tables I and II. It will be seen that for the six columns of a table there are only three curves. That is because we averaged the results corresponding to one degree of distortion displayed at the receiving end for transmission distortion differing only as regards direction (early or late).

In addition to those measurements, we measured the channel inherent distortion in the following way : as the transmitter of calibrated signals provided a perfect emission, we determined the degree of distortion to be displayed on the start-stop distortion measuring set in such a way that the number of characteristic instants with a higher degree of distortion than that displayed should be less than 5 for 10,000 characteristic instants received.

DISTRIBUTION DES DISTORSIONS (COURBE DE DENSITE DE FREQUENCES)

DISTORTIONS DISTRIBUTION (FREQUENCY DENSITY CURVES)



C.C.I.T. N°72/1 E/F

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4. *Remarks on the measurements*

When plotting the occurrence density curves, we noted a very marked dispersion of the measurement results which compelled us to make a very broad interpolation between the points in order to obtain a sufficiently smooth curve.

After all, apart from the irregular results due to accidental faults in the apparatus—the apparatus used was in the design stage—this dispersion was only to be expected, in view of the magnitude of the phenomena involved.

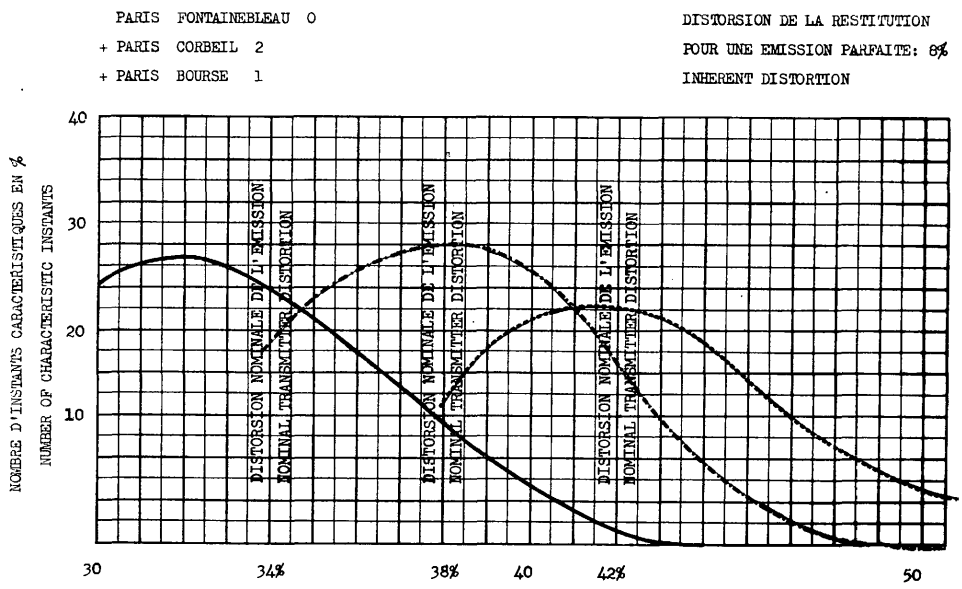
First, the relays in the circuit—including measurement apparatus—have bias distortion which is slight but capable of small variations.

And then, a small relative variation in speed of the transmitter or the distorsion measuring set may, in unfavourable cases, be sufficient to cause a great variation in the degree to which a given distortion displayed on the start stop measuring set is exceeded.

Lastly random variations in channel characteristics produce effects similar to the above.

DISTRIBUTION DES DISTORSIONS (COURBE DE DENSITE DE FREQUENCES)

DISTORTIONS DISTRIBUTION (FREQUENCY DENSITY CURVES)



C.C.I.T. N°72/2 E/F

SG III/22

EDITION 1 JANV. 56
ISSUE

5. *Conclusions*

From the above it will be seen that no extremely accurate conclusion can be drawn from the whole set of measurements made.

As a matter of mere common sense, it will be seen that the effect of the channel is to disperse the distortion of the modulation emitted around its value at the output of the transmitter and to a degree which is greater as the inherent distortion of the channel connecting the apparatus under examination to the transmitter is higher (see drawing 73).

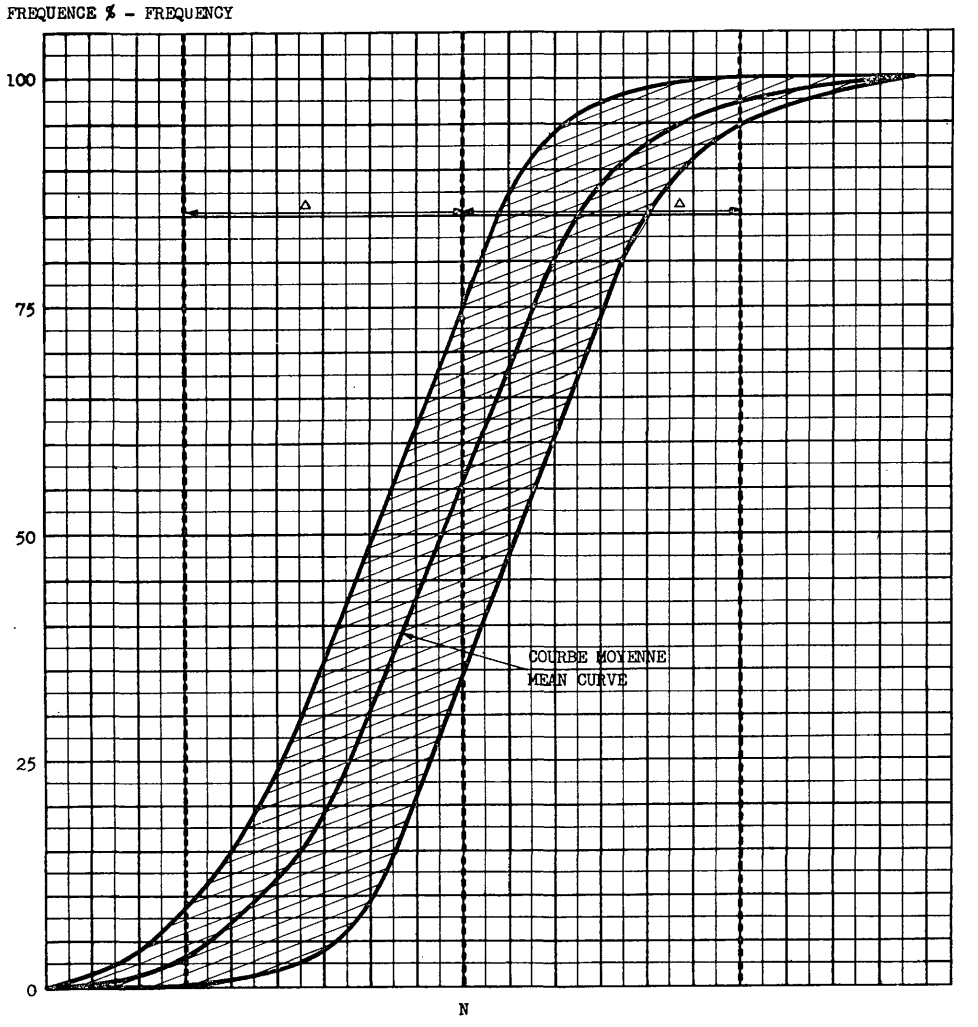
It would also seem possible to state that this dispersion is appreciably equal to the channel distortion, quite apart from the distortion of the modulation transmitted.

This latter conclusion is, incidentally, very approximate as the dispersion seems to increase with the degree of this distortion.

Margin measurements carried out at a distance are thus systematic understatements.

DISPERSION DES COURBES REDUITES DE REPARTITION DE LA FREQUENCE DES DISTORSIONS REÇUES

CUMULATIVE DISTRIBUTION FUNCTION OF THE FREQUENCIES OF THE RECEIVED DISTORTIONS



C.C.I.T. N°73 E/F

SG III/22

EDITION 1 JANV.56
ISSUE

N = DISTORSION NOMINALE A L'EMISSION

N = NOMINAL TRANSMITTER DISTORTION

Δ = DISTORSION PROPRE DE LA VOIE QUI N'EST DEPASSEE QU'AVEC UNE PROBABILITE DE 0.05%

Δ = INHERENT DISTORTION OF THE CHANNEL (TO BE EXCEEDED WITH A PROBABILITY OF 0,05% ONLY)

Question 38

It is required to establish a relationship between the results of a measurement of teledistortion and the probability that this result will be exceeded.

The measurements should consist of:

a) a measurement of transmitter distortion (D) of the signals transmitted by the apparatus and received at the extremity of the transmission channel (1 in Diagram 3);

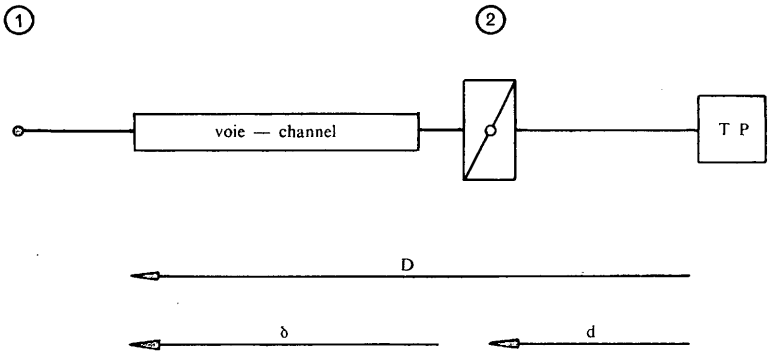


Diagram 3

b) a measurement of the distortion *(d)* of the signals transmitted by the transmitting apparatus measured at the first point at which the signals are repeated after transmission;

c) a measurement of the inherent distortion (δ) of the channel between points 2 and 1.

For these measurements (D, *d* and δ), it would be useful to prepare a curve showing the frequency with which each degree of measured distortion is exceeded.

The French Administration has already made an investigation which seems to imply that the distribution of transmitter distortion *(d)* is Gaussian and can consequently be assimilated to the inherent distortion of a transmission channel the distribution of which is also Gaussian. The teledistortion could then apparently be calculated from the standard deviations of the distribution of *d* and δ.

The curve in diagram 74 and the following extracts from a paper by the French Administration show the results obtained:

DRAFT RECOMMENDATION III/1

Standardization of certain characteristics of measuring apparatus

The C.C.I.T.,

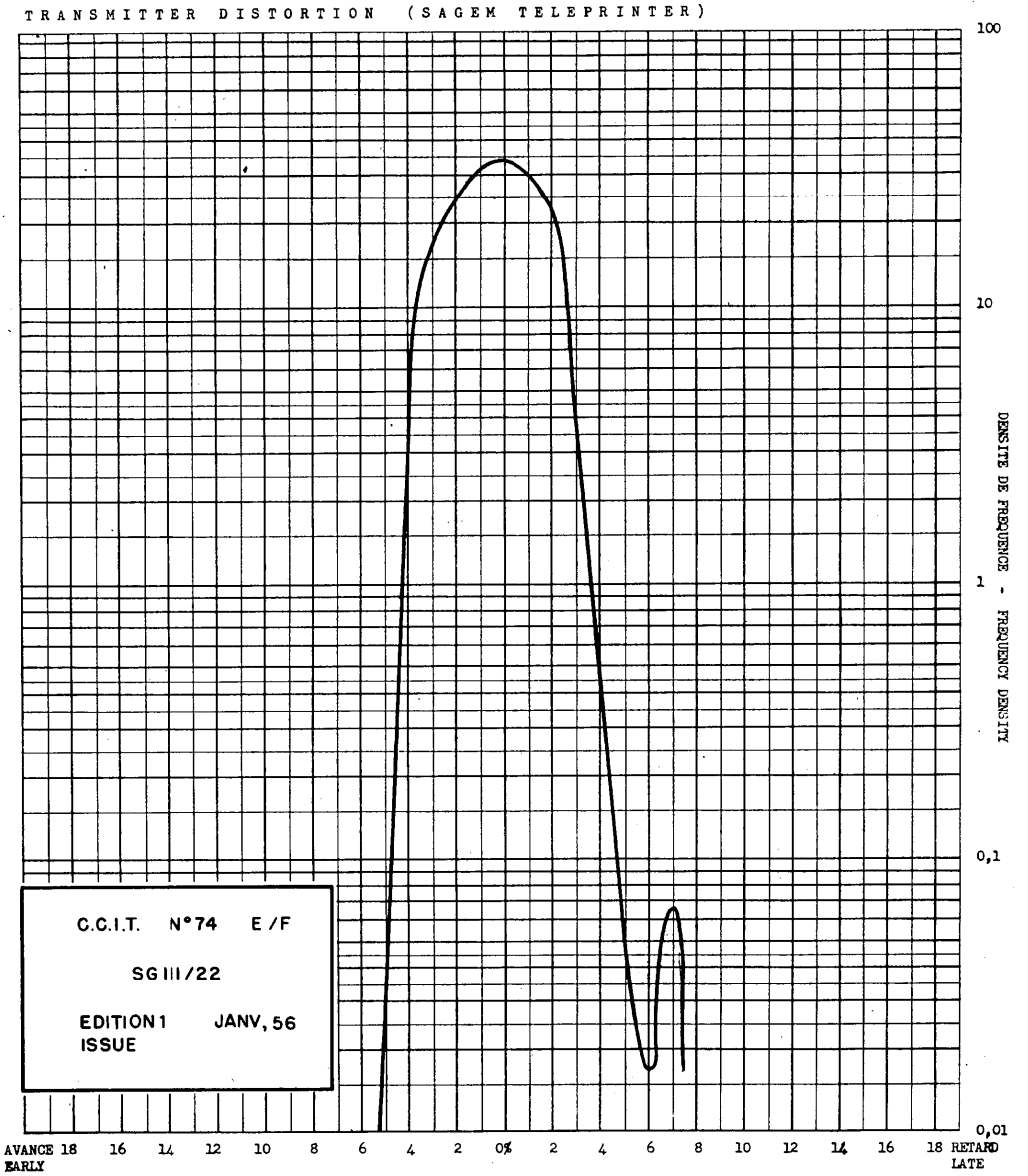
considering

that it is necessary to make statistical measurements for the study of the margin and the transmitter distortion of standardized start-stop apparatus;

that comparison between the results supplied by the different Administrations can be made only if there are uniform measurement conditions;

COURBE DE REPARTITION DES DENSITES DE FREQUENCE DE LA DISTORSION A L'EMISSION D'UN TELEIMPRIMEUR "SAGEM"

REPARTITION CURVE OF THE FREQUENCY DENSITIES OF TRANSMITTER DISTORTION (SAGEM TELEPRINTER)



... declares the view

I. that *margin measuring apparatus* should comply with the following requirements :

a) the mean speed accuracy should be ± 0.1 %. The apparatus, if necessary, can be calibrated before each measurement or series of measurements ;

b) the transmission cycle should be 7 or 7.5 units according to the custom of the Administration concerned ;

c) the distortion should be produced by lengthening the " start " signals (" late " distortion) or shortening the " start " signals (" early " distortion), the code elements retaining their nominal theoretical length ;

d) the distortion should be introduced in alternate characters [1] ;

e) the international text referred to in Recommendation B.33 should be used.

II. that *start-stop distortion measuring sets* should meet the following requirements :

a) the mean speed accuracy should be ± 0.1 %. The apparatus, if necessary, can be calibrated before each measurement or series of measurements ;

b) the accuracy of reading should be ± 1.0 %.

FEDERAL GERMAN REPUBLIC

Document S.G. III/21-E
24 January, 1956

A contribution to the study of questions 34, 37, and 38

Question 34 (1953/1956)

What measurement methods can be recommended to ensure that start-stop telegraph apparatus satisfies the conditions laid down in Recommendation III/1 ?

Reply

What follows is divided into three main sections. The first sets forth our views on paragraphs 1 to 6 of Recommendation C.4. The second deals with other technical matters of importance for the construction of apparatus and the drawing-up of reception specifications. The corresponding figures should, we think, be embodied in Recommendation C.4. In Section III, we sum up our position in relation to Question 34 and submit proposals for amendment to Recommendation C.4.

I. Recommendation C.4 deals with measurements to be performed on start-stop apparatus in service. The aim of these measurements is to ensure that, despite variations in the local voltage and in temperatures, correct transmission is maintained on the most unfavourable Telex circuits. Service measurements can usefully be carried out from the office, and as far as possible in such a way that no service representative need be present with the subscriber. The measurements may then, to a large extent, be performed automatically.

Recommendation C.4 contains a number of points which are individually discussed hereinafter.

1. The decision that the nominal modulation rate shall be 50 bauds represents a principle governing the construction of teleprinters. Hence this rate does not need to be measured in service.

---

[1] *Note :* In the view of some Administrations, this condition is more severe than the instruction of distortion on all cycles. Administrations are requested to study the results obtained with these two methods and to assess whether they justify any change in measuring apparatus.

2. The maximum difference between the actual modulation rate and the standardized rate can be ± 0.75 %. The difference is that between the average values of the modulation rate. It is recommended that an indication be embodied to this effect in Recommendation C.4.

Measurement of the difference in speed cannot be effected on different start-stop signals because a shift in characteristic instants may be due to causes other than variations in rotation speed, as, for example, distortion in the subscriber's line or distortion peculiar to the transmitter. Hence, for these measurements, a fairly large number of continuously emitted signals will have to be observed, or the rotation speed of the motor itself will have to be measured.

The following is a method already much used for remote measurement of emission speed.

The subscriber's answer-back device is operated from the centre. Signals arriving in the centre are measured or recorded by special apparatus. For example, the Siemens and Halske device for measuring errors in rotation speed might be used ; this automatically indicates the difference in rotation speed in the light of the spacing between the stop elements. Or we might use the device for recording discrepancies in rotation speed, produced by the same firm ; this records the signals and enables the discrepancy to be read off.

If this method be used, the drift of the start element is determined from a 19 signals interval. When the measurement is made from the office nearest to the subscriber, the limit for start-stop distortion may, according to Recommendation B.25, *a)* 1, be 12 %. But in theory, in extreme cases, the first start element might be shifted ± 24 % in relation to the twentieth. Since the measurement is effected on 19 × 7.5 elements, the possible measurement error will be

$$\pm \frac{24\,\%}{19 \times 7.5} = 0.17\,\%.$$

In reality, there is no possibility of such a large discrepancy appearing, because in the tolerated 12 % distortion the greatest rotation speed discrepancies and distortions, not perceived in measurement are also covered. The measurement apparatus in the offices must be continually calibrated and adjusted, so that allowance does not have to be made for an additional measurement error, and so that the error in measurement may be expected to be less than 0.1 %.

3. The duration of an emission cycle must be at least 7.4 units (preferably 7.5 units), the stop element lasting at least 1.4 units (preferably 1.5 units).

The duration of a cycle of emission is, in general, fixed by the form of the transmitter components. Hence the contents of this paragraph constitute a principle governing the construction of transmitters, and measurement is unnecessary.

For transmitters operating by electrical or electronic means, prolongation of the duration of the stop element must be obtained by special auxiliary electrical devices. In such cases, a check should be made that all is in good working order. The stop element cannot be separately determined in the office, because the distortion, the difference in rotation speed and variations in the duration of the stop element intervene in each measurement. For service purposes, it will suffice to measure service distortion as described in Recommendation B.25 *a)*, 1 and to determine the average duration of signals by the method set forth under 2 above.

In reality, this method would elicit neither the duration of the stop element nor the average discrepancy in rotation speed separately. It would nevertheless ensure that the signals emitted fulfilled, for subsequent transmission and reception, the conditions to be met under points 2 and 3 of Recommendation C.4.

4. Point 4 of Recommendation C.4 lays down two conditions which ought to be separately considered :

a) Start-stop synchronous distortion of the signals emitted must not exceed ± 5 %.

Each measurement of distortion effected from the office will be influenced by the subscriber's line, and possibly by a lengthy trunk circuit, and other constructional features. Hence we cannot possibly determine, in the office, exactly what the distortion of the transmitter really is. The 5 % limit laid down in the Recommendation is too small for such influences to be neglected.

Accurately to measure start-stop synchronous distortion of the signals transmitted, we should make the measurement at the subscriber's, and the teleprinter should be separated from the line. Now this cannot be what we mean by service measurement. Besides, the electronic distortion measurement devices which would have to be employed (there are several models) are too bulky, too heavy, and too complicated to be used for periodical maintenance at the subscriber's.

Hence a measurement under service conditions, performed in accordance with Recommendation C.4 is, we feel, impossible. Nor do we think it is necessary. In service conditions, it is not so much the state of the teleprinter properly so called which is all-important, as the distortion transmitted by the subscriber to the office and to the other trunk circuits. The figure of 12 % is laid down for this in Recommendation B.25, *a)* 1.

For this reason, then, we propose that this part of Recommendation C.4 should be deleted.

It would seem well to lay down limiting figures for the distortion of signals emitted by new teleprinters.

b) The overall distortion of the start-stop transmitter under service conditions, i.e., the sum of the start-stop synchronous distortion of the signals emitted by the apparatus, and of the discrepancy in rotation speed, must be less than ± 10 %.

For the reasons set forth under *a)*, the overall distortion of the teleprinter cannot be determined from the office. The indications relating to this should be deleted, too, in Recommendation C.4 and replaced by the indication given under *a)*, 1, in Recommendation B.25.

5. In service conditions, the receiver must be able to translate, correctly, the signals from a transmitter having a nominal emission cycle of 7 units.

This will follow from the form of the receiver components. A check under service conditions will be unnecessary.

6. The effective net margin must never be less than 35 %.

In the case of measurements carried out by the office, for the same reasons as those given under 4 *a)* for synchronous start-stop distortion of the signals transmitted by the apparatus, the margin cannot be exactly determined. Only at the subscriber's could anybody decide whether the teleprinter is receiving correctly. Hence a measurement under service conditions, as set forth in Recommendation C.4, is impossible.

In discussion of point 2, it has already been proposed that the subscriber's answer-back be used for the measurement effected by the office. It would then seem advisable to operate the answer-back by means of pre-distorted signals. Emission of the answer-back then proves that the figure-shift and " d " signals have been correctly received. The test must always be made twice, once with distortion induced by advancing the signal elements and once with distortion induced by delaying them. Obviously, this test, made for two emissions only, each of which takes place once with a different distortion, cannot be exactly equivalent to a test of all signals. Nevertheless, it has been shewn that from the point of view of margin, start-stop apparatus do not depend on the combination of signals, i.e., there is no substantial variation in margin for the various signals. Whereas Recommendation B.25 *a)* 3 lays down that a 30 % distortion is

to be tolerated at the end of transmission sections, Recommendation C.4, paragraph 6, would propose that the shortcomings of a measurement made only with the figure-shift and " who is that ? " signals should be made good by using a figure of 35 % for distortion.

II. 1. For the manufacture of apparatus and for possible reception specifications, it is essential that the C.C.I.T. should prescribe, besides the construction principles set forth in Recommendation C.4 (paragraphs 1, 2, and 3) for the distortion of the signals emitted, the reception margin and accuracy of rotation speed, the conditions in which measurements are to be made. We would make the following proposals :

a) Variations in the local voltage of ± 10 % must be considered as normal. Administrations expecting greater variations in their equipment must say so in specifying delivery conditions, and must take the necessary local action to keep within the limit laid down.

b) A temperature tolerance of ± 10°C in relation to the ambiant air, but within the range 0° to 35°C at which the apparatus is tested and at which, for example, the rotation speed is measured, must be allowed for in these specifications.

c) For measurement of discrepancies in the rotation speed, a continuous emission must be used, with any apparatus that may be linked to the start-stop apparatus connected and disconnected, for example, a perforated-tape transmitter or receiver-perforator. The most unfavourable values must not exceed ± 0.75 %.

d) In measuring the distortion of signals, the working of the transmitter contacts must be directly measured, for example, with a reference-distortion measurement electronic device, without a reception organ being interposed, and without relays. This method we consider necessary because both the reception organ of a teleprinter and an interposed relay have a notable effect on the measurement. And also because, with engineering technique being what it is, and in view of the limits for transmitted signal distortion required by Administrations, any additional influence affecting the measurement would be inadmissible.

During the measurement, the teleprinter receiver must be fed by a separate circuit, with a text containing all the signals and all the various shifts.

There are available electronic reference-distortion measurement devices which are sufficiently accurate and are suitable for the measurement procedure proposed. These apparatus, and this procedure, have been proved thoroughly satisfactory.

2. *a)* Although there is no imperative reason why a limit for transmitter distortion should be internationally specified, it would be advisable to draw up clear and uniform specifications for all manufacturers and users, and hence to decide on a figure for transmitter distortion.

We propose that 5 % should be adopted for this distortion, as indicated in Recommendation C.4, paragraph 4. In the circumstances outlined in II. 1 above, not the synchronous distortion is concerned, but the overall distortion of the start-stop transmitter.

b) Obviously, the same will apply to the margin. Since the C.C.I.T. originally laid down a figure of 35 % for the effective net margin, and since the figure for reception on new equipment must be a little higher, 38 % is a suitable figure for this margin.

III. In short then, we make the following proposals in connection with Question 34 :

1. Recommendation C.4 should be replaced by a new Recommendation.

2. The new Recommendation C.4 could usefully be divided into three parts, to wit:

a) *Manufacturing specifications*

This would contain the specifications for manufacture of teleprinters set forth in paragraphs 1, 3, and 5 of the present Recommendation C.4. In addition, a few of the conditions described under II above should be included. If that were done, paragraphs 4 and 6 of the present Recommendation C.4 could be deleted.

b) *Conditions for international cooperation*
(Conditions for the upkeep of start-stop apparatus)

The requisite tests or measurements should be divided into:

1.1 Measurements by offices at regular intervals, using fully automatic test equipment, and

1.2 Measurements by maintenance staff from the subscriber's station, by calling or dialling test equipment.

First of all, this section *b)* should include paragraph 2 of the present Recommendation C.4, bearing in mind what was said under I, 2, and drawing attention to the figures given in Recommendation B.25 *a)*, 1, and *a)*, 3.

Start-stop apparatus should be tested under service conditions. Information about this is given, more especially, under I, paragraph 6. Measurements should be made in such a way that the figure-shift and " who are you ? " signals are emitted twice, with 35 % distortion, by advancing the signal elements, and 35 % distortion by retarding them. The answer-back would be used as criterion of correct reception, while discrepancies in the rotation speed and distortion in the signals emitted would be measured in the light of the signals received from the answer-back.

c) *Conditions for reception, and possible specifications*

Proposals for measurement of the distortion of signals emitted, the accuracy of rotation speed, and the margin are made in Sections II 1 *a)* and *d)*, and in Section II, 2 *a)* and *b)* above.

Question 37

In attempting to measure the margin of a receiving apparatus from a distant point through the intermediary of a transmission channel, what relation is there between the result of this measurement, the true margin of the apparatus, and the degree of inherent distortion in the transmission channel ?

Should such measurements be recommended ?

Reply

According to the question, the points for consideration relate to the receiver of a teleprinter and to the subscriber's line connecting him to the office. In the existing C.C.I.T. Recommendations, the station line of the start-stop apparatus is covered by the information given about distortion, etc., in Recommendation B.25, *c)*, and is assumed to be negligible. The station line may differ in type. It may be, for example, a 2 or 4-wire circuit, a phantom, a super-phantom, a section of infra-acoustic telegraphy, or a voice-frequency telegraph channel, and may vary

in length a good deal. Hence it is impossible separately to determine the distortion of the subscriber's line, including the repeater devices for single-current/double-current operation, because the electrical values of the receiver (electro-magnet) relative to inductance, operating value, etc., are largely included in it. In addition, there has hitherto been no apparatus for measuring signal distortion in a single-current circuit which could be used in service conditions and is easy to handle. When the subscriber's line is assembled, the distortion peculiar to that line is mostly corrected by varying the adjustment of the receiver (tension in the armature spring, orientation) included therein. That, of course, is possible only as long as the duration of the transient phenomena is less than the shortest duration of an element (distorted). Replacement of the receiver by a measurement apparatus would give very different conditions and would not make it possible to measure the inherent distortion of the line.

Hence it seems impossible to make the measurements as set forth in the Question.

Subscriber's line assemblies are used both in single-current and in double-current operation. Moreover, as already said, they are operated on cables or phantom circuits of various types. Hence it would be well if Administrations could decide, for the subscriber line assemblies used, how far such assemblies ensure full use of the teleprinter margin, from the shortest to the longest distances, or what loss of margin is to be expected.

The measurements in this connection should be so made that a teleprinter would be linked to the subscriber's assembly and to the repeater, and in each case the receiver would be brought into circuit in the normal manner for various lengths of subscriber line and for various types of line. Thereafter, by means of an irregular-distortion distortion meter, the greatest admissible distortion at the input to the subscriber's assembly would be measured, and also, separately, the margin of the apparatus.

Question 38

In measuring the degree of distortion at the output of a transmission channel associated with a transmitting apparatus, what relation is there between the result of the measurement, the degree of distortion at the transmitting point, and the degree of inherent distortion of the channel ?

Reply

Here again, we must assume that the Question deals with a transmitter associated with a subscriber's line, and the connecting assembly in the office. In such circumstances, it is normal for the transmitter to possess a spark quench and that the teleprinter electro-magnet is also to be brought into circuit. The electrical values of these additional constructional elements influence line transmission phenomena in different ways, depending on whether, for example, the line is short and of low capacity, or long, or is a high-capacity phantom. Hence we can no longer speak of the distortion inherent in the teleprinter (transmitter + receiver + spark quench) and in a subscriber's line distortion. Accordingly, it would not seem well to determine such a separation by tests. The distortion inherent in the subscriber's line is compensated for when the circuit is adjusted in the office. It would be interesting to ascertain to what extent such compensation is possible for the various types of terminal assembly and the various electrical characteristics of start-stop apparatus, and what supplement should be added to the distortion inherent in the transmitter contacts, without spark quench, behind the subscriber's line.

FEDERAL GERMAN REPUBLIC

Document S.G. III/26-E
22 February 1956

Transmitter for measurement purposes

The measurements made by the French Administration and described in Document S.G. III/22 were carried out with a transmitter in which distortion was produced by the difference in length of the start and stop elements. One character in two was distorted, in order to modify the cycle of the receiver at the same time.

By this very simple method all the signalling elements are of nominal length, except for the start and stop elements. The danger arises that the measurements may not be quite exact where there is a telegraph channel between the transmitter affected by distortion and the receiver. Below we describe a measurement transmitter in which all the elements are variable.

If the distortion of an uninterrupted transmission is measured with a rhythmic distortion meter, the significant instants are distributed along a certain range, and the value represents total distortion (see Fig. 1, Sketch 81). The least favourable case is when all the significant instants are distributed on limits *a* and *b*. When a teleprinter is used, certain start significant instants are at point *a*, and the significant instants of the same character are on points *b* and *a*. The distortion of these signals is a late distortion. Other start significant instants are on point *b*, and the significant instants of these signals have an " early " distortion.

The transmitter suggested could send out signals, the significant instants of which are on points *a* and *b* in an irregular flow, but the total of significant instants is distributed equally between *a* and *b*. The distance between *a* and *b*, i.e., distortion *d*, may be adjusted. The transmitter will then emit either shortened elements or elements of a nominal length.

This transmitter may comprise the following:

A transmitting shaft revolving at the normal speed of a teleprinter transmitter, controls a series of 7 contacts (S_{dq}, S_{1q}, S_{2q}, S_{3q}, S_{4q}, S_{5q}, S_{aq}) (Fig. 2 of Sketch 81), the first being for the start impulse, the five following for the code impulses, and the seventh for the stop impulse. There is a second series of contacts (S_{dr}, S_{1r}, S_{2r}, S_{3r}, S_{4r}, S_{5r}, S_{ar}) controlled by the same shaft. This second complete series may be adjusted in such a manner that the distance between the first and the second series will correspond to the desired degree of distortion. Contacts *a*, *b*, *c*, *d*, *e*, *f*, *g* control a contact in either the first or the second series, for every signal element.

The text to be transmitted is on a perforated band which controls contacts $F_1 — F_5$. The impulses of all the contacts control relay R, the armature of which transmits the signals in the line.

Contacts *a*—*g* change position in an irregular sequence but in such a way, that over a long period of time the number of impulses emitted on both sides will be equal. This is made possible by the use of a perforated tape indicated by a contact H which was obtained by a generator supplying a random law. As the perforated band has only 5 perforation rows, two times two of these rows may be superposed in order to control the sixth and seventh contacts.

It could possibly be practicable to control these contacts *a*—*g* by a previously determined programme.

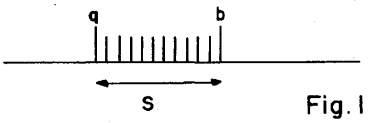


Fig. I

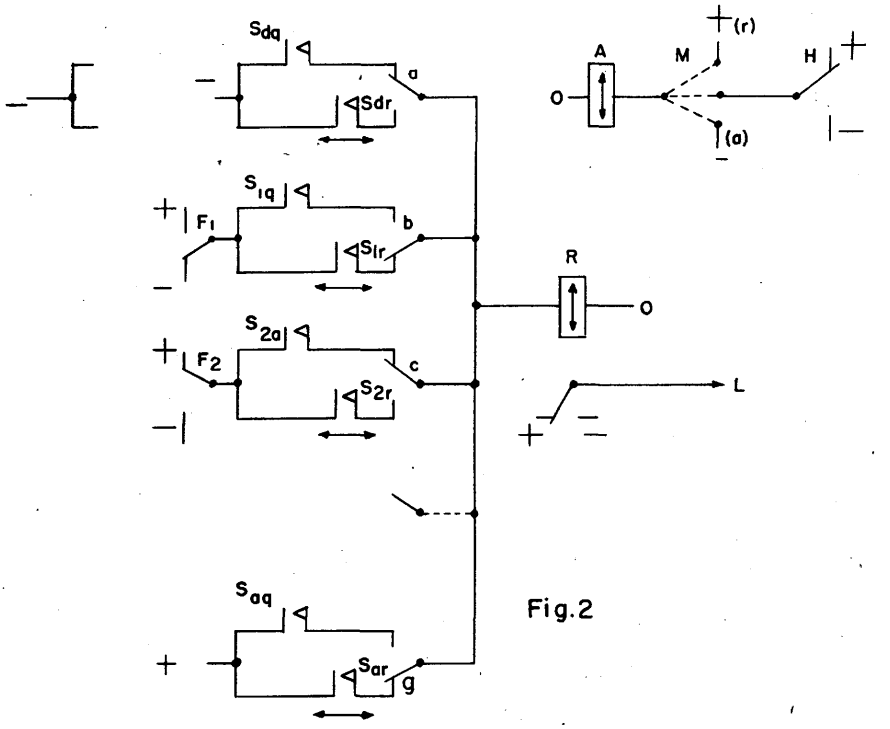


Fig.2

EMETTEUR POUR MESURES TELEGRAPHIQUES
SENDER FOR TELEGRAPH MEASUREMENTS

C.C.I.T. N°81 F/E

SG III/26

EDITION I 22-II-56

As has already been mentioned, signal distortions in this transmitter are early or late in the case of successive characters. To carry out measurements with an early distortion alone or a late distortion alone, manual switch M will have to be introduced on position + or position —.

We have chosen a mechanical apparatus as an example, but it would be equally possible to build it up with electronic elements.

The description given above does not apply to a transmitter that has already been built and on which experiments may have been carried out.

SIEMENS HALSKE
(Federal German Republic)

Document S.G. III/33-E
5 November 1956

Teleprinter signal distortion generator

In C.C.I.T. Document S.G. III/26, the German Administration has proposed a new principle for a Teleprinter Signal Distortion Generator which may be employed especially for measurements according to Questions 34, 37 and 38. The Siemens & Halske A. G. has developed such a transmitter on electronic base. The following description contains information on the operation and construction of this transmitter.

ELECTRONIC TELEPRINTER SIGNAL DISTORTION GENERATOR

General Operating Characteristics

Summary

For the determination of the operating quality of teleprinters and transmission systems, an electronic signal generator has been developed which produces irregularly distorted teleprinter signals. The characteristic feature of this signal generator is the fact that the amount and sense of distortion of each signal can be made a controlled function of the preceding test code. In this way, early and late start-stop distortion is being introduced alternately. Moreover, the length of the signal is also alternately shortened and prolonged.

The following description of the operating principle should be read with the aid of a block diagram (Figure 2):

The output of a 20 kc oscillator (crystal-controlled) is applied to a delay network, a ring counter and several other system components containing bi-stable transistor circuits. The test code signals are derived from the perforated tape of a mechanical transmitter (5-wire simultaneous output). The degree of distortion is adjustable within the range between 0 % and 50 % in steps calibrated down to 0.25 %. The accuracy of the signals is better than 10^{-4}. An electronic output switch supplies the signals in the form of ± 20 mA double current or + 40 mA single current to a terminal equipment having an input impedance of 3000 ohms.

The versatility of this equipment is further increased by provision of special adjusting options, such as a stop element of 20, 30 or 40 ms length.

Scope

Most of the commercially available signal distortion generators achieve the distortion of the teleprinter signals by varying the length of the start element. In this case, the length of the other element of the code combination remains unchanged at 20 ms, and the overall length of the signal is kept constant at 150 ms (50 %-prolonged stop element) or 140 ms, respectively. Depending on the setting, the signal will thus merely be affected by an early or by a late distortion. Normally, this type of controlled signal distortion will be satisfactory for the *direct testing of teleprinter apparatus*.

However, if *distortion measurements over telegraph lines* are to produce conclusive results, both the length of the individual elements within the code combination and the signal length should be varied. For this purpose, a device producing irregularly distorted signals is suggested, whose characteristic features should be largely determined by a number of desirable and, partly, also necessary fundamental postulates :

a) The characteristic instants should exhibit, in an irregularly varying sequence, either a displacement corresponding to the preset distortion factor or *no* displacement. This is to say that the irregularity feature of the distortion should not consist in an alternate introduction of distortion factors of different magnitude ϵ_1, ϵ_2, ϵ_3 and so on.

b) The different possible displacements I through IV of the characteristic instants according to Figure 1 (see [1], [2]) should appear with equal probability. Provision should, however, be made to prevent two consecutive characteristic instants from being affected by a displacement according to II and III or IV and I because, otherwise, the result might be an unpermissible shortening of elements to the point where line transmission is no longer feasible.

c) The nominal length of the teleprinter signals should be 150 ms (50 %-prolonged stop elements), and means should be provided to permit a variation of this amount by $\pm \epsilon$.

d) The irregular distortion should not be of a purely statistical character, but should be programmed. This " controlled irregularity " offers the advantage that, when a wrong signal has been recorded by the teleprinter, it will be easy to find out the type and degree of distortion of each individual element of the respective signal transmitted. Furthermore, it should be possible to apply the customary preset distortion in an early and/or late sense.

Principle of Operation

Block Diagram Figure 2 illustrates the interoperation of the various functional elements of the signal distortion generator.

The " core " of the equipment is a 20 kc/s crystal-controlled oscillator which applies a pattern of impulses, spaced at 1/20 ms (equalling 0.25 % of an element length) to the input of the delay network. The determination of the required accuracy of the oscillator was based on the condition that the maximum permissible departure of the total signal length from the nominal 150 ms should be smaller by at least one order of magnitude than the 1/20 ms interval which constitutes the smallest defined amount of signal prolongation or reduction. The accuracy thus established is $1/3.10,^{-4}$ and this value can be readily maintained in the field.

The *delay network* has been designed on the principle of the frequency divider employing bi-stable circuits. Corresponding to a division ratio of 1 : 400, this network supplies impulses spaced at 20 ms (50 c/s) to the *ring counter* which, on his turn, counts the length of each signal by means of 6 elements of 20 ms and 1 element of 30 ms. A special control circuit interposed between delay network and ring counter ensures the 30 ms length of the stop element.

During the stop element, the transmitter T send 67 c (5-wire simultaneous) is stepped, and the next code combination in the perforated tape is fed into the *5 storing relays* A through E.

By means of contacts a_1 through e_1, the ring counter permits the generation of the signal in its normal consecutive composition (simultaneous/sequential translation), while the distortion program is being controlled via contacts a^2, a^3 through e^2, e^3.

The output of the *electronic signal switch* operates in the cadence of the 20 ms element intervals and decides whether or not, in conformity with the respective signal, a characteristic instant should occur while the output of the *electronic delay switch* will decide whether or not this characteristic instant should be delayed.

Thus, the above two circuits influence the *signal formation circuit* by supplying two criteria :

1) the sampling pulse I_1 for the non-delayed characteristic instant, which is permanently available across the output of the delay network ;

2) the sampling pulse I_2 for the delayed characteristic instant, which, depending on the setting of the selector switch " amount of distortion " may be tapped at different points of the delay network and will therefore lag behind I_1 by a predetermined time.

Whether I_1 or I_2 becomes effective for the initiation of the characteristic instant depends on the position of the electronic delay switch (for more details on the distortion process consult the following paragraph).

The electronic *output switch* relays the signal in the form of ± 20 mA double current or + 40 mA single current to the 3000 ohms consumer (telegraph line or selector magnet of a teleprinter).

Distortion program

An ideal solution to requirement *(c)* on page 2 would be the use of a perforated tape containing the desired distortion program and stepped in synchronism with the perforated tape containing the test code. However, to reduce equipment complexity, a simplified method has been suggested which makes the distortion of each signal dependent on the entire preceding text. If, as it is common practice, the same test code is repeated line by line, a reset feature actuated with the code combination for Carriage Return may be used to have the distortion process start anew with each beginning of a line. The result is a uniform distortion program for all lines.

Distortion of the *code combination* has been so arranged that the characteristic instant of the first intelligence element, if it appears in accordance with the test code, will first be delayed, the next time undelayed, then again delayed and so on. The same pattern is followed for the other 5 characteristic instants. Thus, the decision whether a characteristic instant is to be delayed or not will be entirely independent of the other elements of the same signal, and the total distortion will be very irregular. Nevertheless, it can be predetermined, so that this requirement is also met.

As far as the characteristic instant of the *start element* is concerned, provision has been made that *two each* consecutive characteristic instants will be delayed and the next two will be without delay. In this way, the *length of the signal* will follow the pattern : normal, prolonged, normal, reduced, i.e. 50 % of the signals will be of normal length, 25 % will be prolonged and 25 % shortened. It is a distinct feature of this distortion program that 2 adjacent signals are affected by an early distortion, the next 2 signals by a late distortion, the next 2 signals again by an early distortion and so on.

Figure 3 and the oscillograph display (Figure 4) show the distortion program for the English test code.

Two option switches have been provided to " switch " the start pulse and the code group separately to " no delay " (uv), " steady delay " (kv) and " alternate delay " (wv). The resulting *types of distortion* have been compiled in the following table.

Code combination	Start element		
	uv (no delay)	*kv* (steady delay)	*wv* (alternate delay)
uv no delay	no distortion	steady early	alternate early
kv steady delay	steady late	no distortion	alternate late
wv alternate delay	alternate late	alternate early	alternate early and late

With the types of distortion shown in column " start element wv ", the length of the signal is varied, with all other types of distortion it remains constant.

Figure 5 shows the distortion adjusting options on the front panel of the electronic distortion generator.

Additional features of the electronic distortion generator

Instead of the perforated tape of the tape transmitter, any signal may be set manually for continuous transmission.

For special purposes, current of stop polarity may be applied in lieu of every second signal.

Operation of another switch causes the teleprinter to stop each time the Carriage Return signal occurs. This permits line-by-line variation of the magnitude of distortion.

A further switch serves for suppressing distortion for the code combinations Carriage Return and Line Feed (this is important in the case of long test runs !). Besides, for certain checks, the reset feature for the distortion programme can be deactivated.

The stop element can be " switched " to a length of 20 ms, 30 ms or 40 ms.

With single current operation, R.C. elements are cut into the output circuit. This permits close simulation of the current wave form as it is produced by the spark suppressed mechanical send contact of a teleprinter. These elements may be disconnected to permit mathematically exact signals to be transmitted into a ohmic load (see Figure 4).

A special divider stage permits the delay network to be tapped for a 250 c/s synchronizing frequency to be used in connection with a stroboscope for checking the motor speed of a teleprinter with crystal accuracy.

The built-in 20 kc/s oscillator may be disconnected and, via a jack pair, an A.C. voltage of another frequency may be applied to the delay network. In this way the distortion generator

can be easily adapted to another telegraph speed, e.g., to 75 bauds by means of a 30 kc/s frequency. In this case, the tapetransmitter would have to be the T send 67 b model (Siemens & Halske A.G.).

The transistors used in the circuits of the electronic distortion generator are of the types TF 65, TF 65 s and TF 71 (Siemens).

Reference material

(1) H. Wüsteney : Verzerrungen im Fernschreibbetrieb, Schwachstrom 17, p. 19, 1941.
(2) F. Schiweck : Fernschreibtechnik, p. 94, 1942.

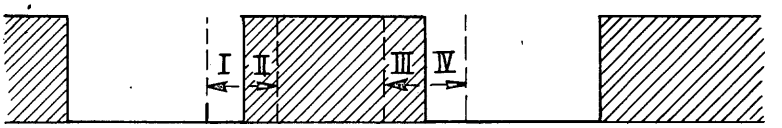


Fig. 1. — Possible Types of Displacement 1 — IV of the Characteristic Instants of a Teleprinter Signal.

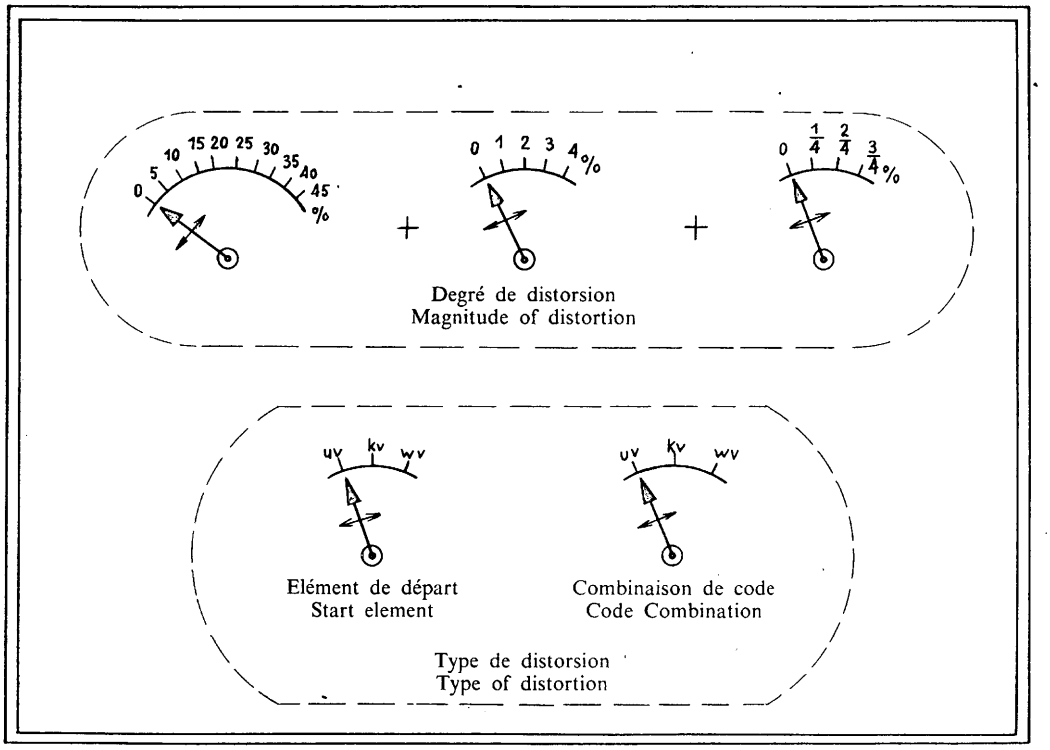


Fig. 5. — Distortion Adjusting Options on Front Panel of Electronic Distortion Generator

(*uv* = no delay, *kv* = steady delay, *wv* = alternate delay)

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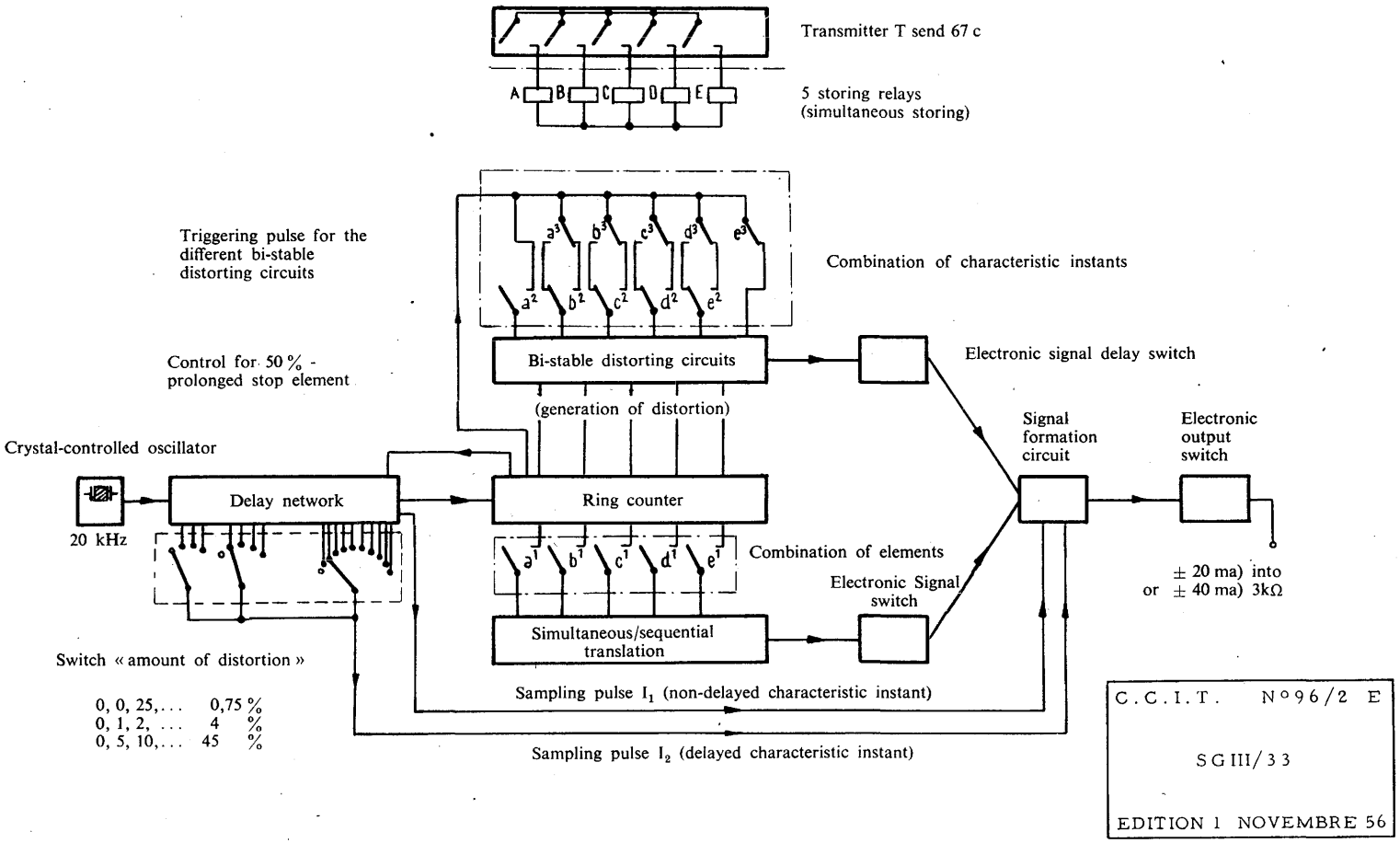


Fig. 2. — Block Diagram : Electronic Teleprinter Signal Distortion Generator.

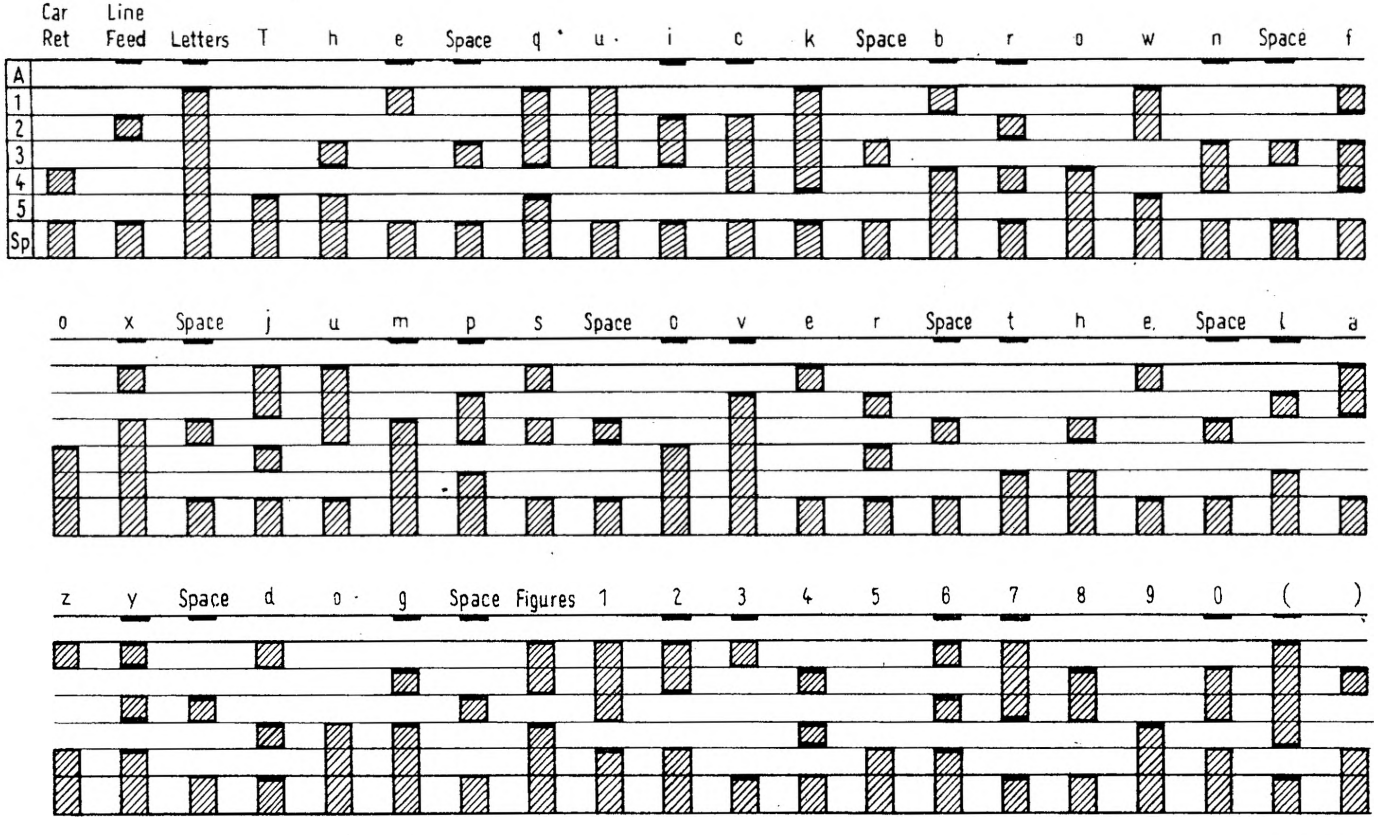


Fig. 3. — Distortion Program for the English Test Code
(Bold lines represent delayed characteristic instants)

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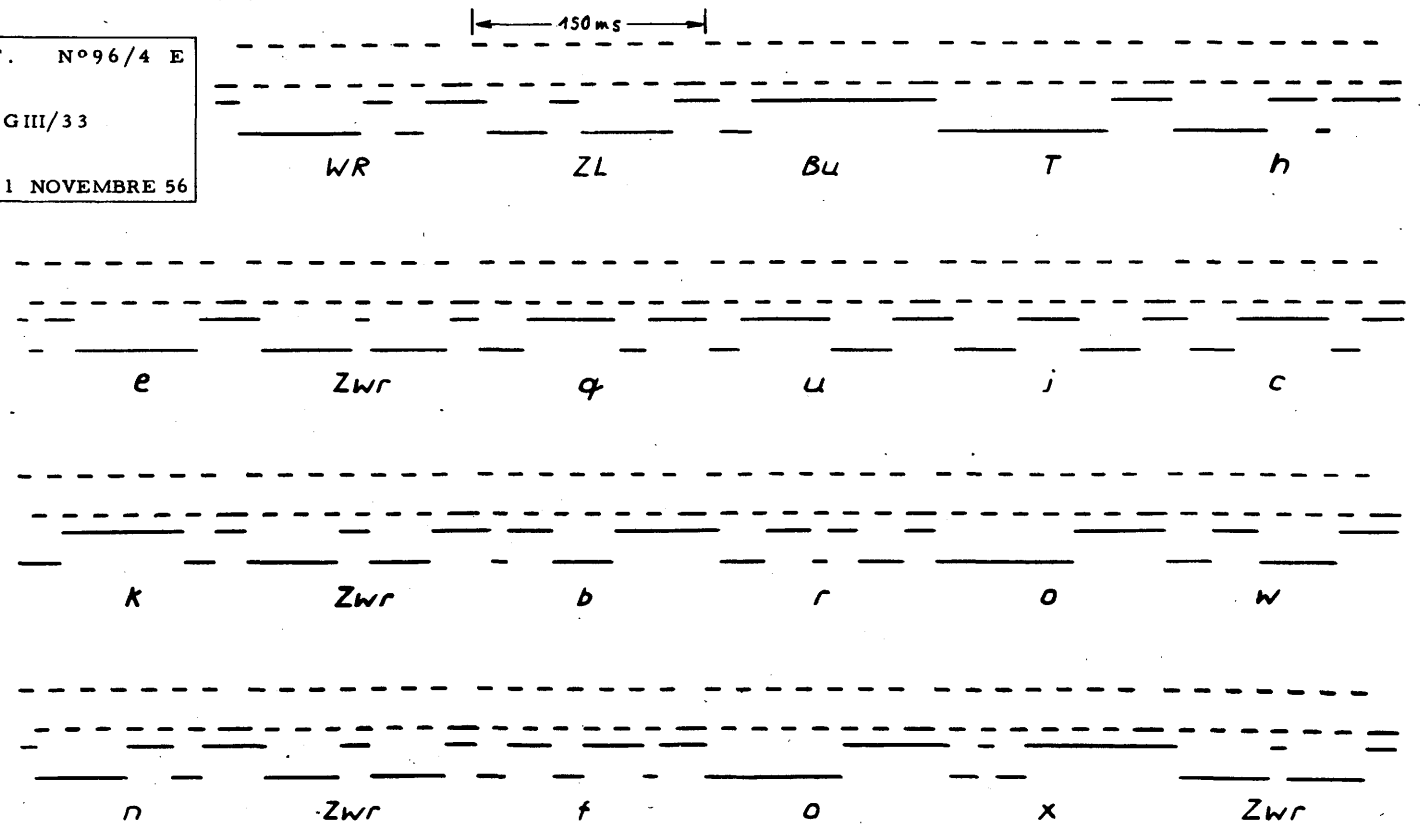


Fig. 4. — Test code with 50 % alternate distortion as it appears across the output of distortion generator.

STANDARDIZATION OF SYNCHRONOUS SYSTEMS

(C.C.I.T. Question 42 — C.C.I.T.T. Question 6/8)

SIEMENS HALSKE
(Federal German Republic)

Document S.G. III/27
25 February 1956

Standardization of distributor cycles for synchronous telegraph systems

Summary

In view of the need for fruitful cooperation between start-stop teleprinter transmitters and regenerative repeaters, we have calculated the bandwidth required for the distributor cycles at C.C.I.T. and United States speeds. Within these bands, we have each time proposed a standard value, which, from the electronic and electromechanical points of view, should be easy to obtain for the various numbers of unit intervals possible in one revolution of the distributor. We discuss two procedures for the electronic production of the various unit interval frequencies.

By analogy to the conditions known to be obtained for the cycles of regenerative repeaters, we must also maintain definite cycle conditions for synchronous regeneration in teleprinter circuits, to avoid obstacles in the passing of calls, and hence loss of signals. To this end, we must try to obtain a uniform value for the distributor cycle, applicable to all operating conditions: retransmission with and without perforated tapes, connections with or without regenerative repeaters, transmission channels sensitive or not to parasitic noise, equipment for one or several channels, and codes with different numbers of units.

A. *Synchronous repeaters with transmission of start and stop signals*

The distributor is not bound to any definite period of revolution. It merely has to have a time diagram corresponding to the nominal value of the unit internal of transmission (according to the C.C.I.T., 20 ms; in the United States, 21.955 or 21.970 ms). The difference in r.p.m. of the transmitter of departure is made good by the fact that the stop signals, according to need, are retransmitted with a duration equal to, or a multiple of, the unit interval.

B. *Synchronous repeater without start and stop signals*

1. *Passage from the teleprinter network to the synchronous repeater*

A distinction has to be made here according to whether or not a perforated-tape retransmitter is used. Because of technical transmission difficulties, we need to have a perforated-tape retransmitter when transmitting from a network of high telegraph speed to one where speed is low (from Europe, for example, to the United States), or when we have to deal with circuits sensitive to disturbance, with automatic R.Q. Retransmission by perforated tape may be necessary, too, for technical reasons in connection with switching. In other cases, for service reasons, the perforated-tape retransmitter can be suitably replaced by devices which require no upkeep and give rise to no operating costs.

a) *Perforated-tape retransmitter at the entry to the synchronous communication*

In view of the almost unlimited capacity of retransmission by perforated-tape, there is no major restriction on the distributor cycle. But, to avoid useless lengths of tape and unnecessary delays in transmission, it would be well if we were to make the distributor cycle shorter than the signals of the departure transmitter.

b) *Feed circuit with storage of two signals at the entry to the synchronous communication*

In all cases, the distributor cycle must be shorter than the signals of the departure transmitter. When there are several regenerative repeaters between the departure transmitter and the synchronous transmission, a few successive signals may, because of distortion and speed drift, occur at intervals of 140 ms, or a little less, at the synchronous transmission. This accumulation causes a transitory advance phase in relation to the distributor for the signals, an advance smaller than the unit interval at transmission and made good by the accumulation in the feed circuit.

2. *Passage from the synchronous transmission into the teleprinter network*

We must assume here, too, that there are regenerative repeaters in the connection to the subscriber. The difference in the cycles of the departure transmitter and distributor makes itself felt in the synchronous section in such a fashion that numerous signals follow one another without interruption and a marking signal is inserted if necessary. When we transmit by means of storage, groups of signals have the length of about 30 signals. When we use a perforated-tape transmitter, many signals can, if we so desire, follow one another without interruption. In all cases, the distributor cycle must be longer than the regenerative repeater cycle. And we must bear in mind that irregular distortion may cause signals to be accumulated at one of the regenerators. When single-axis regenerators are used, the following regenerator may, accordingly, suffer a loss, the margin of its tolerance to unfavourable speeds being reduced.

The following figures for departure transmitters (teleprinters, perforated-tape transmitters) and regenerators, will help us to assess the admissible limits for the distributor cycle.

C.C.I.T. telegraph rate: 50 bauds.

Length of departure transmitter signals: 150 ms (to begin with, we shall neglect the lower limit of at least 7.4 units per signal, as laid down in the C.C.I.T. Recommendation of 1953). Speed tolerance: $\pm$ 0.75 %. Regenerator cycle: 140 ms. Cycle tolerance: $\pm$ 0.5 %.

United States telegraph rate: 60 words per minute.

According to a communication from the Teletype Corporation, the following figures are standardized:

Transmission unit interval: 21.955 and 21.970 ms (according to the r.p.m., 3,600 or 3,000 r.p.m.).

Length of the departure transmitter signals: 162.963 and 163.077 ms. For these unit intervals, the regenerator cycle works out at 153.683 and 153.791 ms.

If, now, we calculate with the speed tolerances laid down by the C.C.I.T., and if we assume small, negligible speed differences for synchronous-movement feeds, we shall obtain the following for the distributor cycle T_v:

C.C.I.T.: $140.70 < T_v < 148.87$ (ms)

U.S.A.: $154.56 < T_v < 161.74$ (ms).

If, for safety, we assume double speed tolerances (i.e., ± 1.5 % for teleprinters and ± 1 % for regenerators), we shall obtain the following :

$$\text{C.C.I.T.}: \quad 141.40 < T_v < 147.75 \text{ (ms)}$$

$$\text{U.S.A.}: \quad 155.33 < T_v < 160.52 \text{ (ms)}.$$

Calculation of the possible loss of the margin for two regenerators following the synchronous transmission gave the results illustrated by Diagram No. 84/1. The staged curve shows the greatest possible loss in margin at the second regenerator for a 30 % irregular distortion on all line sections and a tolerance of ± 0.5 % for the number of revolutions in the regenerators. The dotted-line curve applies for a tolerance of ± 1 % in the number of revolutions. Loss in the margin appears only in the event of several unfavourable circumstances. The curve of the frequency of loss in margin, also shown in Diagram No. 84/1, was drawn by calculation of probabilities for a 30 % distortion according to a Gaussian law, and assuming a 1 % difference in the cycles of the two regenerators in the unfavourable direction. In the band of interest for the distributor cycle, the frequency of loss in the margin is some few per cent. The maxima shown by the curve are attained only in very exceptional circumstances. Bearing in mind these possible losses in margin, we can give about 142.5 ms as the lower admissible limit of the distributor cycle. Hence, for the final limit of the distributor cycle, we obtain :

$$\text{C.C.I.T.}: \quad 142.5 < T_v < 147.7 \text{ (ms)}.$$

For the United States telegraph rate, a similar calculation gives Diagram No. 84/2, and we get the following :

$$\text{U.S.A.}: \quad 156.5 < T_v < 160.5 \text{ (ms)}.$$

With the TOR and TOM equipment belonging to the Dutch P.T.T. Administration, $T_v =$ 140 ms or, alternatively, 163.333 ms, are possible. These two figures fall outside the above-mentioned bands. However, a service with this equipment is practicable because no repeater is at present inserted in radioteleprinter circuits, and the perforated-tape retransmitter intercepts surplus signals.

With our radioteleprinter equipment Mux 4 D7, we have been obliged to work with the Dutch apparatus, and hence have adopted the cycle of 163.333 ms for communications with the united States. We could freely choose our distribution cycle and first of all decided on 145 ms. This figure is readily obtainable with electro-mechanical apparatus, but difficulties arise with electronic equipment.

A proposal has been made for multiplex seven-unit systems for radiocommunications. The distributor revolution periods of 145 and 158 fall in the prescribed bands. They are readily obtainable with electronic equipment and with electro-mechanical apparatus, too (by means of two-stage gearing). But they make no allowance for synchronous systems with different numbers of units per revolution.

In this analysis, mention should be made of the fact that the electro-mechanical and electronic equipment used to produce the basic frequency in electro-mechanical apparatus operate in entirely different ways. With electro-mechanical apparatus, the period of the distributor revolution is given as a fundamental period by the feed-motor frequency. The frequency of the unit element is produced by the multiplication of frequencies. On the other hand, with electronic equipment, the frequency of the unit element is given by the frequency of the generator and the period of revolution of the distributor is consequently set up by frequency demultiplication chains. This different way of working shows that the standardization of the cycle does not offer any difficulties

for electro-mechanical apparatus, but on the other hand, causes serious complications for electronic apparatus. In addition, transformation ratios may be arrived at by the use of gears, while frequency changes are bound up with certain simple ratio figures.

For reasons of operational safety the following methods should preferably be used to obtain unitary intervals according to the frequency of the master-oscillator :

1. Demultiplication of frequencies with binary division stages. Partial ratios 2 : 1, 4 : 1, 8 : 1, etc. may be arrived at. By making a coupling by reaction of one divider stage on another divider stage of higher frequency, we are able to obtain different partial ratios. (In the coupling by reaction channel, a delay is to be expected.) All partial ratios 2 : 1, 3 : 1, etc. up to 16 : 1 may be obtained with from one to four divider stages, and with from zero to two coupling by reaction channels.
2. Doubling of frequency by rectification.
3. Multiplication of the frequency by an uneven number by producing a rectangular curve and filtering the harmonic wave desired.

The ratio between frequency f of the master-oscillator and the unit frequency is :

$$\mathfrak{G} = \frac{T_v \cdot f}{n},$$

where T_v = revolution period of the distributor in ms, f is measured in kc/s, and n = the number of elementary intervals per revolution period of the distributor. For n, the following products of the number of channels by the number of units per signal must be taken into account :

$$n = 1,\ 2,\ 4 \times 5,\ 6,\ 7,\ 8,\ 10.$$

T_v must be determined in terms of the admissible band calculated above, so that ratios $\mathfrak{G}$ obtainable as easily as possible may exist for all n values in an appropriate value of frequency f.

The selection of bands admissible for the distributor cycle gave the following specially indicated values :

C.C.I.T. : $T_v = 144 = 2^4.3^2$ (ms). $\quad \mathfrak{G} = 2^4.3^2.\frac{f}{n}$

U.S.A. : $T_v = 160 = 2^5.5$ (ms). $\quad \mathfrak{G} = 2^5.5\ .\frac{f}{n}$

A revolution period of 144 ms likewise allows of an admissible stop-signal element of 140 % for the teleprinter, according to the C.C.I.T. recommendation.

These cycles may be given fairly easily by a master-frequency of 1 kc/s (or 2 or 4 kc/s) for all the number of unitary intervals n considered in each revolution of the distributor. Table I (Proposal I) lists the ratios necessary for the different values of n.

For the purposes of frequency demultiplication, only factors 3, 5 and 9, which are all obtainable by stages of binary dividers, are of any interest for powers of 2. For 7-unit intervals, multiplication must be made by 7. For 5 and 10-unit intervals, multiplication must be made by 5 in the C.C.I.T. system. For 6-unit intervals, multiplication must be made by 3 in the U.S.A. system.

Multiplication of frequencies may be avoided by having different master-frequencies for the different numbers of units per signal. In this way ratios are obtained which are uniformly independent of the number of units per signal for a given number of channels (see Table II, Proposal II). Sketch No. 85 shows a circuit appropriate for this purpose. It contains from 5 to 8 stages of binary dividers with two coupling by reaction channels according to the number of channels. It is possible to change C.C.I.T. rate into U.S.A. rate very simply, by inversion of one coupling by reaction channel. The two coupling by reaction channels may also be shifted

one stage towards the right, contrary to the indications of Figure No. 85. Unit interval figures $n = 15$ and 30 could also be obtained with a master-frequency of 3.75 kc/s.

For a rate of 75 bauds we must replace a divider stage of 3 by a divider stage of 2 in the two propositions, i.e., in each case we use a flip-flop stage and a coupling by reaction channel.

In electro-mechanical apparatus, cycles of 144 and 160 ms can be given by a single pair of gear wheels starting from the 3,000 turns per minute point.

TABLEAU I (Proposition I)
TABLE I (Proposal I)

Fréquence maître unique f = 1 kHz
n = nombre d'intervalles unitaires par période de révolution du distributeur.

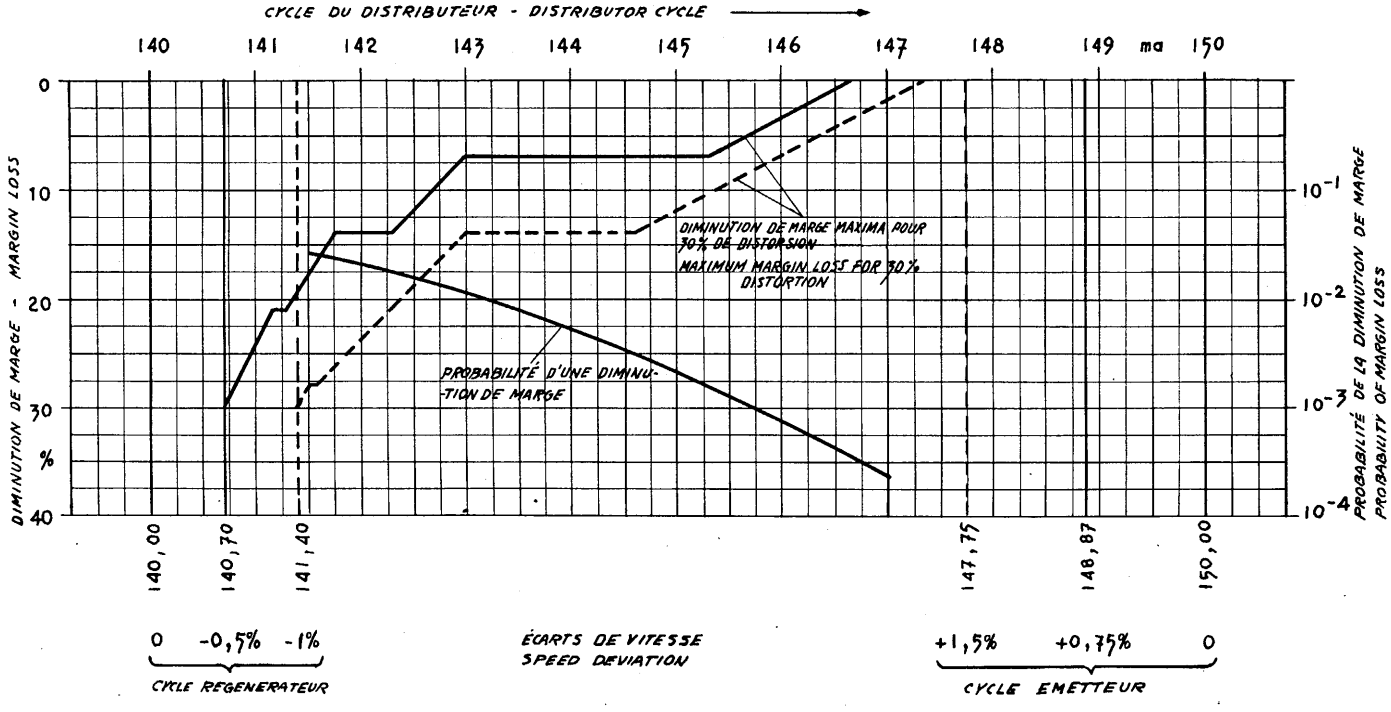
Uniform Master-Frequency f = 1 kc/s
n = number of unit intervals per period of revolution of the distributor.

Rapport τ	Ratio τ	
n	C.C.I.T. (144)	U.S.A. (160)
5	$2^4 \cdot 3^2/_5$	2^5
6	$2^3 \cdot 3$	$2^4 \cdot 5/_3$
7	$2^4 \cdot 3^2/_7$	$2^5 \cdot 5/_7$
8	$2 \cdot 3^2$	$2^2 \cdot 5$
10	$2^3 \cdot 3^2/_5$	2^4
12	$2^2 \cdot 3$	$2^3 \cdot 5/_3$
14	$2^3 \cdot 3^2/_7$	$2^4 \cdot 5/_7$
16	3^2	$2 \cdot 5$
20	$2^2 \cdot 3^2/_5$	2^3
24	$2 \cdot 3$	$2^2 \cdot 5/_3$
28	$2^2 \cdot 3^2/_7$	$2^3 \cdot 5/_7$
32	$3^2/_2$	5
40	$2 \cdot 3^2/_5$	2^2

TABLEAU II (Proposition II)
TABLE II (Proposal II)

n = nombre d'intervalles unitaires par période de révolution du distributeur.
n = number of unit intervals per distributor revolution period.

Rapport τ		Ratio τ	
n	f (kc/s)	C.C.I.T. (144)	U.S.A. (160)
5	5	$2^4 \cdot 3^2$	$2^5 \cdot 5$
6	3		
7	3,5	$2^3 \cdot 3^2$	$2^4 \cdot 5$
8	4		
10	5		
12	3		
14	3,5	$2^2 \cdot 3^2$	$2^3 \cdot 5$
16	4		
20	5		
24	3		
28	3,5	$2 \cdot 3^2$	$2^2 \cdot 5$
32	4		
40	5		



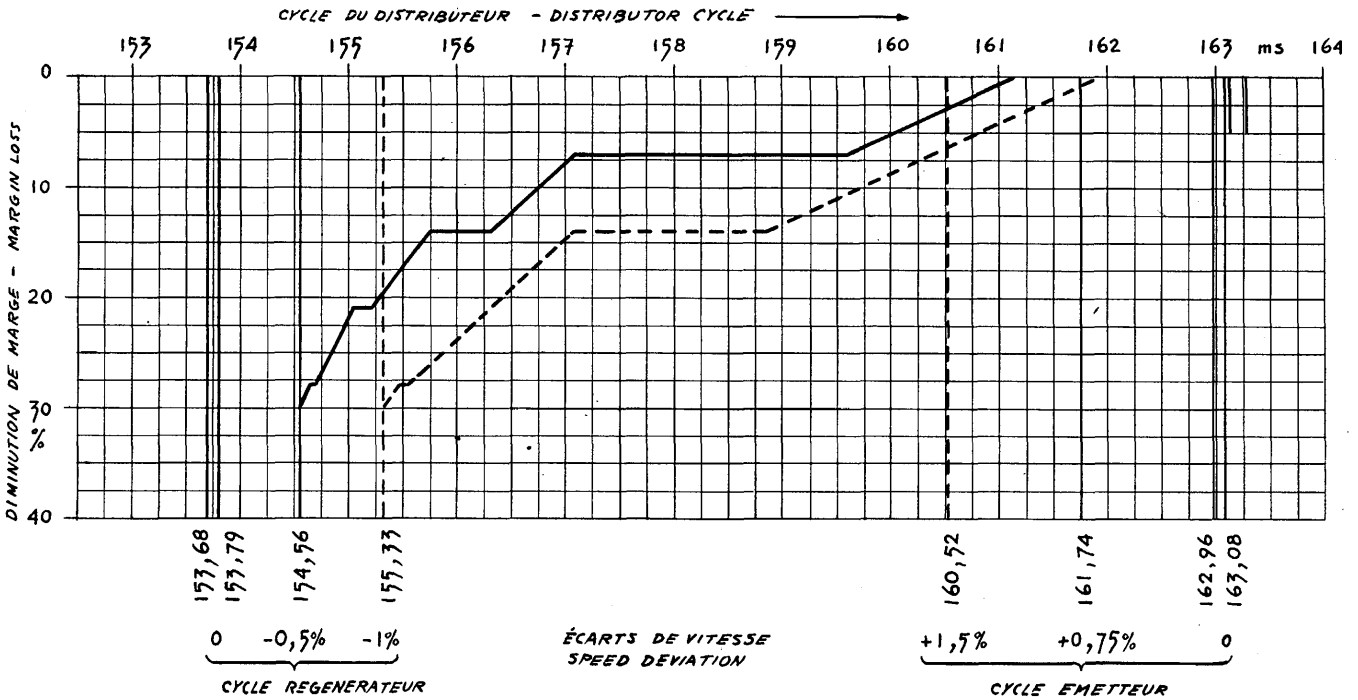
DISTRIBUTEUR POUR VITESSE NORMALISÉE 50 BAUDS

DISTRIBUTOR FOR STANDARDIZED MODULATION RATE 50 BAUDS

C C I T N°84/1 E/F

SG III/27

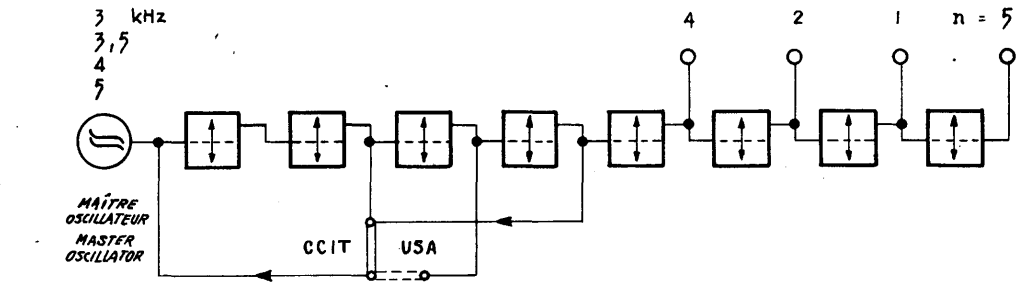
ÉDITION 1 25-II-56



DISTRIBUTEUR POUR VALEURS USA 60 MOTS MINUTE
DISTRIBUTOR FOR USA SPEED (60 WPM)

CCIT N°84/2 E/F
SG III/27
ÉDITION I 25·II·56

DIVISION DE FRÉQUENCES - FREQUENCIES DIVISION



RAPPORT RATIO									
CCIT	3/2	3	9/2	9	18	36	72	144
USA	5/3	10/3	5	10	20	40	80	160

CCIT N°85 E/F

SG III/27

ÉDITION I 25·II·56

U.S.S.R.

Document S.G. III/32-E
2 November 1956

Co-operation between synchronous and start-stop systems

To be sure that the input margin of the synchronous system is not less than 30 %, the speed of the synchronous transmitter must exceed the speed at which the start-stop apparatus is working by not less than 4.2 %.

In this case the cycle of the synchronous distributor is 144 millisec, (V_{tlg} = 50 bauds) and

$$K = 7.5.$$

This coincides with the figure recommended for the transmission cycle, 144 millisec., chosen with an eye to other requirements. (See the report by Study Group III, Document S.G. III/29, Question 42).

How this conclusion is reached is explained below.

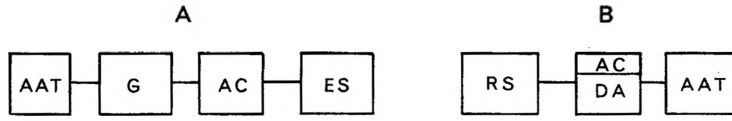
REPORT

by the Administration of Postal and Electrical Communications of the U.S.S.R. on question 42

(Study Group III of the C.C.I.T.)

There has been a considerable increase in the number of subscribers' services, and the time is ripe to consider the joint operation of synchronous and start-stop systems from a new angle, bearing in mind that at present the majority of the channels of synchronous systems are used by subscribers possessing start-stop terminal apparatus. In this case, the problem arising out of the co-ordination of the start-stop equipment with the synchronous transmitter cannot always be solved by local synchronization (by making the synchronous distributor control, the isochronous working of the terminal apparatus) for the subscriber may be hundreds of miles away. Retransmission by reperforators may not always be desirable, because the mechanical fittings of the reperforator require attention from the staff.

We consider that the most widely applicable procedure, with minimum storage, would be something like that set forth in Annex 4 to C.C.I.T. Document A.P. VII/20 (Fig. 1) (Supplements to the Arnhem Documents, Volume I, page 369).



Legend : AAT — terminal start-stop apparatus ;
G — generator ;
AC — storage unit ;
ES — synchronous transmitter ;
RS — synchronous receiver ;
DA — start-stop distributor.

Figure 1

Let us now consider, in a general way, the question of co-ordinating start-stop telegraph modulation with the synchronous transmitter.

The start-stop apparatus gives a continuous series of pulses.

Cycle of the start-stop combination T_o

Cycle of the synchronous transmitter T_p

The speed with which the elements of the synchronous transmitter are transmitted must always be higher than that of the terminal apparatus.

Hence $T_p < T_o$.

The group of storage units acts as co-ordination equipment.

Let :

Θ represent the duration of the information element and

Δ the delay of the information element.

(Generally, we shall be able to take, as the information element, either the entire combination of a start-stop signal, or the separate emission of one element in the combination).

$\Im_{max}$ — maximum delay provided by the storage units.

The graph in Figure 2 shows how the co-ordination equipment works and enables us to calculate the maximum number of elements continuously co-ordinated on the assumption that the start-stop apparatus sends the signals without any interval between them.

The instant at which the synchronous distributor takes up the information is about the middle of each element.

The cycle of continuous co-ordination will end when the provisional store of the group of storage units runs out ($\Im$ max). From this point (which we shall call the critical point), the synchronous transmitter operates with no load in order not to cause the last co-ordinated element to be repeatedly transmitted. Thereafter the working continues as explained above.

We have considered the case in which

$$\Im_{max} = T_p \qquad \text{and} \qquad \Delta = \Theta - T_p.$$

In this case :

$$\Im = \Im_{max} - K.\Delta;$$

$$\Im = T_p \left[1 - K\left(\frac{\Theta}{T_p} - 1\right)\right]$$

Let :

$$\frac{\Theta}{T_p} = \alpha$$

Then :

$$\Im = T_p\,[1 - K\,(\alpha - 1)]$$

The maximum number of continuously co-ordinated elements will be :

$$K_{max} = \frac{\Im_{max}}{\Delta} = \frac{T_p}{\Theta - T_p} = \frac{1}{\frac{\Theta}{T_p} - 1} = \frac{1}{\alpha - 1}$$

If the printing apparatus transmits the signals with a duration of 150 millisecs without any interval and if the cycle of the synchronous transmitter is 140 millisecs, then :

$$K_{max} = \frac{1}{\frac{\Theta}{T_p} - 1} = \frac{1}{1.07 - 1} = 14$$

after which there is an interval of 140 millisecs.

In the case of co-ordination of the start-stop telegraph modulation with the single-contact distributor, the procedure takes place in similar fashion, but the additional cycle is equal to 20 milliseconds.

Above we stated that at present the majority of the channels in synchronous systems with several channels are used by subscribers who are often several hundred miles away. This raises the urgent problem of how the high margin at the input to the synchronous system is to be maintained.

Let us consider the provisional diagram (Fig. 3) :

Where : T_o is the cycle of the start-stop apparatus ;

T_p is the cycle of the synchronous distributor ;

Θ_o is the duration of transmission of one unit of the start-stop combination, and

$\Im 3$ is the indication area of the critical point.

In the technical solutions of the co-ordination diagram, the critical point normally corresponds to the coincidence of the regeneration pulses (at the middle of the pulses of the start-stop signal) registering information in the two-position storage units with the respective pulses from the synchronous transmitter removing information from the storage units.

In case of coincidence the storage unit operates several times. To eliminate this disagreeable effect we have to predict it at the start of the cycle by means of a device for indicating the critical point, after which the removal pulses are blocked, the current pulse is sent over the line with a duration T_p and the information stored is transmitted during a following cycle of the synchronous transmitter.

At the critical point the danger is that in the presence of distortion in the start-stop cycle the leading edge of the following cycle may for the second time coincide with the indication area and thus the storage units will not be discharged in time.

From the provisional diagram we determine the input margin of the synchronous system at the critical point.

Let us take a case : $T_p = 7\ \Theta_o$;

$$i = \frac{(T_o - T_p) - \overline{\Im}_3}{2\ \Theta_o},$$

or :
$$i\% = \frac{(K-7) - \frac{\overline{\Im}\,3}{\Theta_o}}{2} \cdot 100$$

where K is the contact division of the start-stop apparatus.

Thus, for apparatus with $K = 7.5$,

$$i\% = \frac{0.5 - \frac{\overline{\Im}\,3}{\Theta_o}}{2} \cdot 100$$

The figure two in the denominator makes allowance for the possibility of bilateral distortion in the start-stop cycle.

The value of the indication area is determined by the relative instability of the frequency of the start-stop and synchronous generators and may be reduced to a minimum when a generator is used in order to receive the regenerative start-stop pulses as well as the synchronous ones.

It is not always sensible to increase considerably the speed of the synchronous distributor as is done in the example under consideration $\left(\frac{T_o}{T_p} = 1.07\right)$. This can be justified only by the relative simplification of the apparatus.

But to effect a later repetition of point B we must have a prolonged stop pulse in the start-stop signal. Hence, in case of need, for retransmission, we may put the " two-axis " repeater at the input to the transmitting part of the synchronous system, modifying the duration of the unit pulses and that of the stop pulse, while keeping the cycle of the start-stop apparatus unchanged. In this case we shall bring to the input of the transmitting part of the synchronous system a start-stop signal with a duration other than that of the stop pulse in relation to any other signal unit. Without changing the method of co-ordination this enables the speed of the synchronous distributor to be diminished.

If we attribute to the indication area a time which is considerably less than the duration of the unit pulse, if, that is to say, we must assume :

$\overline{\Im}_3 << \Theta_o$, then we shall have

$$i = \frac{K-7}{2}.$$

According to the C.C.I.T. recommendations for the receiving part of start-stop apparatus, the margin must not be less than 30 % ($\pm$ 15 %).

Then : $K = 7.3$

or $T_p = 144$ milliseconds,

and the excess of speed will be 4.2 %.

On this occasion we can restitute, at B, the start-stop signal with $\Theta_o = 20$ millisecs and

$$K = 7.\ \frac{\Theta\ \text{stop}}{\Theta_o} = 7.2.$$

Such a start-stop signal can support two or three repetitions with the simplest single-axis repeaters.

Conclusions : To ensure an input margin at the synchronous system of not less than 30 % the speed of the synchronous transmitter must exceed that of the start-stop apparatus by at least 4.2 %.

In this case the cycle of the synchronous distributor will be equal to — 144 milliseconds.

Thus we have reverted to the result confirming the recommended value of the cycle : 144 milliseconds, chosen with an eye to other requirements.

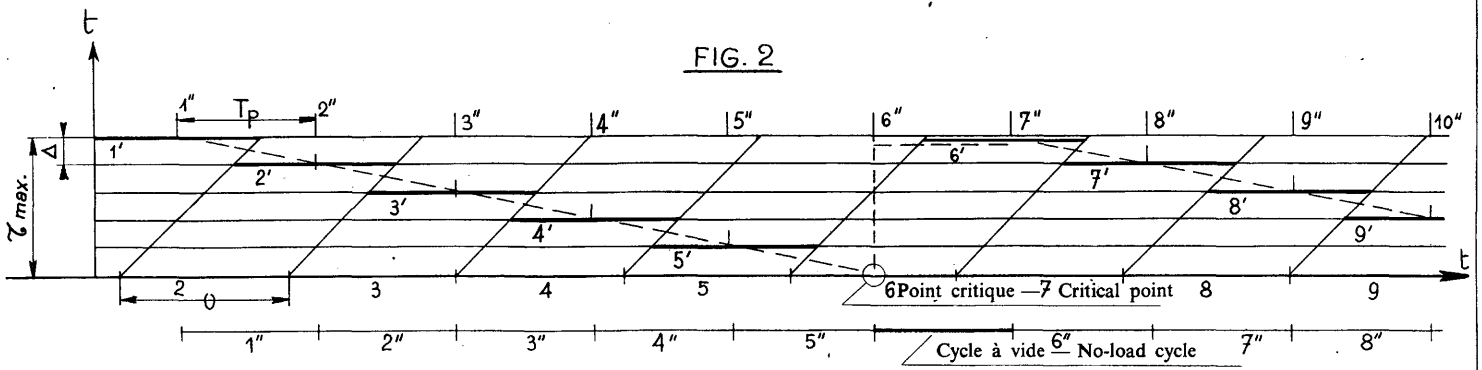


FIG. 2

1, 2, 3... n { Succession des impulsions arythmiques / Succession of start-stop pulses

1', 2', 3',... n' { Impulsions arythmiques retardées / Delayed start-stop pulses

1", 2", 3",... n'' { Succession des impulsions synchrones / Succession of synchronous pulses

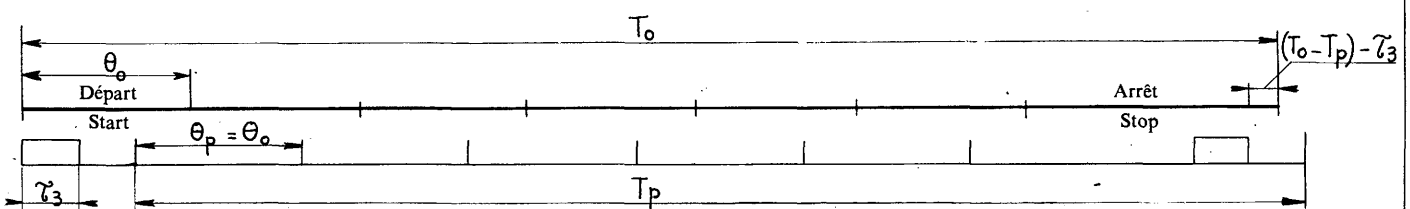


FIG. 3

C.C.I.T._ SG III/32

NEW ALPHABET

(C.C.I.T.T. Questions 22/8 — 22/21)

POLAND

Document S.G. III/24
15 February 1956

Study of a new teleprinter alphabet

The deliberations of C.C.I.T. Study Groups and Plenary Assemblies show that most Administrations require facilities over and above those offered by International Alphabet No. 2. Another proof of this assertion is the fact that in many countries many different uses of the 32nd combination have been introduced. And other plans are on foot in this connection. In addition, several cases are known in which use is made of alphabets constructed on different principles, for example, the 6-unit code.

Among the major drawbacks in International Alphabet No. 2 is the fact that telegraph correspondence is limited by the excessively few signs available. For example:

a) No difference is made between capital and small letters. This will be clear when we compare the writing produced by a teleprinter with that of a typewriter. This means that all the various shades of meaning in the text sent by telegram are not reproduced. And the rules of spelling are not observed.

b) In the case of many national alphabets, not all the letters can be included in a group of signs. Hence either numerous inversions have to be used, and efficiency is sacrificed, or the transmission of certain letters has to be foregone. For example, there are many cases in which, to transmit a Polish word, two inversions have to be used, and in a few cases as many as four.

c) To put letters in one group and figures and punctuation marks in another has very serious drawbacks when telegrams are transmitted, composed of letters, figures and punctuation marks all mixed together.

d) The same combinations represent entirely different signs. In many cases, this leads to errors in the reception of telegrams.

e) With the development of Telex and the improvement in automatic transit procedures, the need for several additional combinations is making itself felt. These are not really signs of the alphabet, but rather operating signals designed to control mechanical movements.

The above list of the shortcomings inherent in International Alphabet No. 2 is doubtless incomplete. It does, however, show that the invention of Alphabet No. 2, based on the 5-unit code with 32 combinations, for world-wide telegraphy, and in theory supposed to offer the same

facilities as a typewriter, is attributable to the state of telegraph technique at the time. But the alphabet is now such as to hamper the future progress of start-stop telegraphy.

True it is that there would be many difficulties in changing the teleprinter alphabet, in view of the great scale on which teleprinters are now being used and the modifications that would be required in their manufacture. If it were decided to make a change, careful preparation would be needed over several years, and the changes themselves would have to be gradually introduced. For this very reason, however, it would be well to begin a study of this question here and now.

To sum up, then, Alphabet No. 2 offers too few combinations to meet all needs and is an obstacle to future progress. Hence there are good reasons for setting a new question for study. It might, perhaps, run as follows :

1. Is there a case for devising and introducing a new teleprinter alphabet ?

2. If so, on what principles should this new alphabet be based ? For example, number of units, number of groups, etc.

3. And if so, what action should be recommended for the changeover period ?

N. B. : To begin with, the C.C.I.T. needs to have the views of Administrations on the following points :

A. What signs of the alphabet are desirable for the national and international transmission of telegrams ?

B. What are the shortcomings of Alphabet No. 2 ?

C. If a change were made in Alphabet No. 2, must it be accomplished without any falling-off in efficiency and with an increase in modulation rate or on the contrary ?

ITALY

Document S.G. III/37-E
5 December 1956

Special-code telegraph apparatus

The Italian Administration, continuing its studies on automatic telegraph networks, has evolved a system for carrying out money order operations at a distance.

This system calls for the use of an automatic switched network known as " POSTATELEX ", in which the 13th combination (figure case) of the International Telegraph Alphabet No. 2 is employed as the " hundred " digit (first figure of the local number). On this matter it should be noted that the " hundred " signal determines in Italy " prohibition " between the various automatic networks envisaged, i.e. :

mi 0 to 8	TELEX network
mi +	" PUBLITELEX " network (for public offices)
mi —	" TELESTATO " network (for State services)
mi 9	" EUROPEAN TELEGRAPH " network
mi .	" POSTATELEX " network

In the " POSTATELEX " network a post office has at its disposal a special apparatus for carrying out money order transactions at a distance. The following procedure is followed :

1. The sending office selects the office of destination (e.g. mi. 02).
2. The two offices are connected together and they receive the normal signalling adopted in all Italian automatic networks (e.g. mi. 02, mi. 02 rm. 03 15 20 12 50).
3. The sending office selects the account number requested (e.g. 32132) and confirmation of this number is returned to it, followed by the name of the subscriber to whom the account number belongs.
4. The sending office then carried out the money order transaction, putting before it either (+) or (—) according to the type of the operation itself.
5. Each sequence of figures is always followed by a special signal.
6. The receiving office carries out the transaction requested by means of its static computer, automatically deducting the last total from the account.
7. The receiving office sends back all the details of the transaction that has been carried out to the calling subscriber.
8. The sending office can ask the receiving office for the totals corresponding to a series of transactions, as a means of checking.

Since all the operations mentioned are carried out automatically, the Italian Administration feels that it would be desirable to introduce six-unit telegraph equipment, which would make available extra characters in addition to those of the alphabet No. 2 ; these would ensure greater reliability and would be useful for checking " money order transactions ". In particular the following uses could be envisaged :

a) the use of a combination preceding the number of the account ;

b) the use of a combination preceding a credit transaction ;

c) the use of a combination preceding a refund transaction ;

d) the use of a combination for end-of-sequence ;

e) the use of a combination to request a check.

With six-unit apparatus represented by the 5-unit code plus one " stop " and one " start " unit (always of a duration of 20 ms), the following can be effected :

1. with the " stop " unit : connection to sets of 5-unit apparatus (and in the opposite direction at a lower rate) ;
2. with the " start " unit : 32 new combinations towards sets of 6-unit apparatus.

In view of what has been said above, and considering the possibility of using, in international relations, automatic networks equipped with apparatus capable of more characters than those of the 5-unit code, the Italian Administration considers it desirable to examine the following new question :

" Is it desirable to introduce for special automatic networks (for example, automatic networks for carrying out money order transactions at a distance) 6-unit code telegraph apparatus ? If so, is it desirable for the 6-unit code to ensure connection between 6-unit apparatus and the existing 5-unit teleprinters ? "

SUPERVISION AND CONTROL OF APPARATUS

(C.C.I.T. Questions 35 and 36 — C.C.I.T.T. Question 4/8)

U.S.S.R.

Document S.G. III/34
5 November 1956

Signals for the supervision and control of apparatus

Study of five-unit supervisory and control signals

The need has arisen, or is envisaged, for the use of five-unit signals for supervisory purposes and for the control of apparatus.

The special signals needed include :

— calling and clearing signals for certain switching systems ;

— start of message, start of text and end of message signals for tape-relay systems ;

— waiting and error indicating signals for synchronous systems and signals for the control of apparatus (e.g., connecting and disconnecting a reperforator) ;

— a signal to indicate a fault in the course of a communication.

Could they be obtained by using the secondaries of combinations Nos. 6, 7 and 8 and combination No. 32 either singly or in groups ?

If not, how is it proposed to obtain them ?

It is desirable that in studying this question the following factors be borne in mind :

Signals destined to initiate some auxiliary function, such as the operation of switching or control equipment in reperforator switching systems, should preferably be of a type which would never legitimately occur within the body of the message. While it is desirable that they should have a pattern which may be recognized by means of a simple equipment, if their spurious occurrence is likely to have serious results, they should not—unless they require to be repeated more than once or are used in combination with other signals—be of a type which is prone to spurious generation by transient faults.

We would make the following comments in response to the questions raised by Study Group III :

1. In order to put the letters of the Russian alphabet into International Alphabet No. 2, we intend to use combinations 11 and 12 in the figure-shift position, besides combinations 6, 7 and 8 chosen for the Administrations.

2. Combination 32 is used in the Soviet Union for message separation in the tape-relay systems.

To this end this combination is twice repeated at the end of the telegram.

We would point out that the extension of telegraph technical facilities, designed to meet the requirements of telegraph users, as well as development prospects for telegraph services of the new kind, make the choice of particular combinations for the automation of telegram handling procedures ever more urgent.

Moreover, some countries, in their national alphabets, use more characters than 26 + 3[1]. They are: the Soviet Union, Czechoslovakia, Poland, and others.

When these countries come to use International Alphabet No. 2, additional combinations must be chosen besides combinations 6, 7 and 8, reserved for Administrations, so that they can include characters from their national alphabets.

The inadequacy of the possibilities afforded by Alphabet No. 2 is demonstrated in detail in Document S.G. III/24, by the Delegate of Poland.

Formation of additional combinations by means of the repetition of certain signs leads to operating complications and entails relatively complicated apparatus. Study Groups III and VII observe, and very rightly, that such a solution cannot be considered as satisfactory.

Bearing in mind the experience acquired with the use of certain combinations of the alphabet used in the Soviet Union in the figure-shift position, it would, we feel, be good to consider the proposal made by the Study Group Chairman, Mr. Pellé, and the Vice-Chairman, Mr. Freebody, relative to the formation of additional signals by means of combinations at present provided for in the international service for other ends (for example, for the " colon " sign, which seems to be the least important of all punctuation marks).

Certain countries are already using combination 32 for their services apart from combinations 6, 7 and 8.

Study Groups III and VII, when analysing in Annex 6 the factors determining the choice of a message-separation signal (in response to Question 60), reach the following conclusions:

— it is not necessary that the various combinations making up the message-separation signal be effective in every country;

— Administrations could, if necessary, be free to choose which combination in the signal would be effective in their own countries.

Hence, things being what they are, the simplest solution would be to choose combination 32 and certain figure-shift signs for the special signals.

We propose that in the figure-shift position combinations 11 and 12 of Alphabet No. 2 be chosen (open parenthesis and closed parenthesis) together with combination 32, and that Administrations be authorized to use them over and above combinations 6, 7 and 8, in their national services.

Elimination of the brackets would entail no difficulties in the operation of international services, for these signs can be adequately replaced by a fraction bar.

In using International Alphabet No. 2, we intend to use combinations 6, 7 and 8 of the figure-shift, together with combinations 11 and 12 of this Alphabet, to represent Russian letters.

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[1] Combinations 6, 7 and 8 in the figure-shift position of Alphabet No. 2.

DRUM FACTOR

(C.C.I.T. Question 48)

FEDERAL GERMAN REPUBLIC

Extracts from Document S.G. IV/16
20 December 1954

Drum size for phototelegraph apparatus

Chart for the cooperation of apparatus with different drum dimensions

1. Sizes of drums in phototelegraph apparatus already show wide variations from one country to another in the European system. On account of the increasing expansion of phototelegraphy outside the European system, new picture sizes are constantly occurring. This state of affairs will have to be put up with for a long time to come, as phototelegraph apparatus of different designs are interworked, even if future developments tend towards a fixed ratio between drum length and diameter.

When there is interworking between apparatus of different designs, should the transmitter drum and the receiver drum have different diameters, the pictures are enlarged or reduced by the transmission; this is less troublesome than the fact that it cannot be reliably ascertained whether the receiver can receive the original without splitting it into separate parts and time is lost in discussion between the sender and the receiver in an effort to clear up this question. In many cases, phototelegraph users ask what is the largest size of picture that can be transmitted without decomposition in a given traffic relation. These questions can always be answered when the drum factor of the receiver is known. Annexed is a monogram which facilitates such answers.

2. The value of minimum drum length for phototelegraph apparatus should be interpreted, not as absolute, but as relative (a given multiple of the drum diameter). Any study of this question should first take account of the fact that in the international phototelegraph service the question will always arise of the differences between the sizes of picture which are commonly used in various countries. The best-known sizes are given in the following tables:

	Size of picture		Aspect ratio
Group 1	13 cm × 18 cm		1 : 1.4
	18 cm × 24 cm		1 : 1.33
	6.5 cm × 8,5 cm	(16.5 cm × 21.6 cm)	1 : 1.3
	7 cm × 9 cm	(17.8 cm × 22.4 cm)	1 : 1.3
	8 cm × 10 cm	(20.4 cm × 25.4 cm)	1 : 1.25
Group 2	8 cm × 10 cm	(20.4 cm × 25.4 cm)	0.8 : 1
	8.5 cm × 11 cm	(21.6 cm × 28.0 cm)	0.75 : 1
	9 cm × 12 cm	(22.4 cm × 30.5 cm)	0.75 : 1
	21 cm × 27 cm		0.8 : 1
	21 cm × 28 cm		0.75 : 1

This table shows that in spite of the different sizes the aspect ratio is practically the same for all sizes, i.e. 1 : 1.3 ($\approx$ 0.75 : 1). Bearing in mind the fact that part of the drum circumference is used for the address and other service indications and that another part is taken up by the picture-retaining clips and the phasing signal, a phototelegraph drum with an aspect ratio of 2 : 1 should be adequate in all cases. The decisive factor in the size of the picture that can be taken by a phototelegraph apparatus should then be the choice of the drum diameter. For large sizes (above 8.5 " × 11 "), under these conditions a diameter of more than 88 mm would be required.

The result would be inadequate scanning density. For this reason, pictures of the sizes in Group 2 above are placed round the drum, not lengthwise, but breadthwise. Interworking between Group 1 apparatus (lengthwise) and Group 2 apparatus (breadthwise) is hampered by this fact. Group 2 apparatus cannot obtain the full benefit of the drum length (cf. reply to Part 1 above).

8 " × 10 " is the only size which appears in both groups. With a drum diameter of 88 mm and a corresponding drum length (at least equal to the circumference), it can be scanned equally well in either direction. The obvious conclusion is that a minimum drum length equal to the circumference should be a basic requirement. There is no need to stress the advantages of being able to turn the pictures round 90° and scan them in the new direction. However, according to experience gathered here, these advantages are not decisive. Practice has shown that there is no noticeable decrease in the quality of pictures that are scanned up to three times in the same direction, whereas far greater losses of definition are produced by the frame (tramage, in french) required for newspaper printing. Moreover, a minimum drum length equal to the circumference would in any case be unattainable for the other phototelegraph apparatus in group 2.

The Federal German Administration of Posts and Telecommunications considers that a far more important aspect of the question under study is how to achieve transmission of two pictures in a single operation. If this could be done, the photographic treatment required after the first picture could be avoided and the total transmission time for the two pictures could be shortened. For apparatus in group 1, the drum length would then have to be at least four times the diameter. In this way, the difficulties of interworking between group 1 and group 2 would be automatically eliminated. Interworking phototelegraph stations would merely have to agree between themselves whether the picture was to be secured lengthwise or breadthwise. In the transmission of a picture held lengthwise, only half the receiver drum would have to be covered by the photographic material and in the transmission of two pictures simultaneously or of one picture secured breadthwise the whole of the receiver drum would have to be covered.

The Federal German Administration of Posts and Telecommunications proposes that a minimum drum length of four times the diameter be envisaged for future design of phototelegraph apparatus, which would then be suitable for the transmission of 1 or 2 pictures lengthwise or of 1 picture breadthwise in the case of large-size pictures. It would also be possible, in cases of retransmission, to scan the pictures perpendicularly to the original direction when the purpose or particular character of a picture makes this necessary. Hence, the recommendation

Drum length (L) $\geq$ 4 times drum diameter (D)

should satisfy all the conditions occurring in practice in the intercontinental and transatlantic phototelegraph service.

Bonn, 11 December 1954.
11 L 2 3036-O-B

Dr. KRAWINKEL,
Ministerialdirigent.

Annex

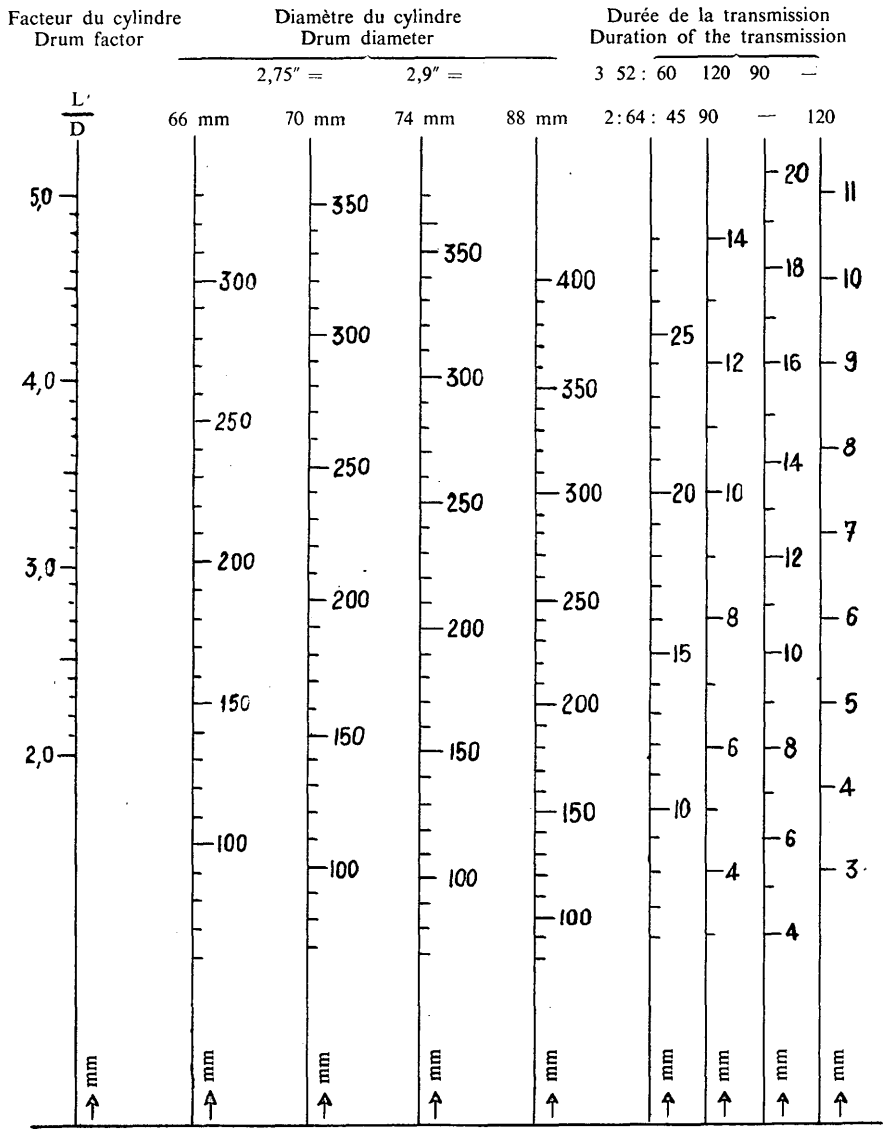
CHART FOR THE COOPERATION OF PHOTOTELEGRAPH APPARATUS WITH DIFFERENT DRUM DIMENSIONS

Note : In the chart, there are four scales corresponding to the drum diameters used in practice. On the transmitter diameter scale, select the point corresponding to the length of the original in the direction of the axis of the drum. Then, if we now cross horizontally to the drum factor scale, the value obtained must not exceed the receiver drum factor, if the picture is to be transmitted without recourse to splitting-up.

To ascertain the length to which the transmitter drum can be used, we must find, on the transmitter diameter scale, the value (L/D) corresponding to the receiver drum factor.

The chart also provides information about the duration required for picture scanning with indices 352 and 264 in normal circumstances, and in the variants allowed.

ABAQUE pour la coopération d'appareils phototélégraphiques différant par les dimensions du cylindre	CHART For the cooperation of phototelegraph apparatus with different drum dimensions



CCIT N°43 E/F
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TRANSMISSION BY FACSIMILE OF LARGE SIZE DOCUMENTS

(C.C.I.T. Question 46-2 and 46-3 — C.C.I.T.T. Questions 18/8 and 9/8)

UNITED KINGDOM

Extracts from Document S.G. IV/29
S.G. V/10
6 February 1956

Transmission for business documents

a) *Direction of Scanning*

It seems possible that some small users of documentary facsimile services may wish to use existing phototelegraph machines (within their limitations) for transmitting and receiving business documents. From this point of view it would be desirable to adopt the direction of scanning at the transmitter which is the C.C.I.T. standard for phototelegraphy, i.e., over a right-hand helix. On the other hand, there are already in existence large numbers of machines specially designed for documentary facsimile operation, employing direct-recording at the receiving stations, which scan the transmitter drum over a left-hand helix. (This applies also to large machines for transmitting meteorological charts). On the whole it appears that it would be best to recommend the adoption of the left-hand direction of scanning at the transmitter. This would not exclude all phototelegraph transmitters, since many of them (notably those operating on radio circuits) already use left-hand scanning whilst some can scan over either right-hand or left-hand helix. In the case of phototelegraph receivers, it is always possible to make a correction by reception on film.

It seems unlikely, however, that there will be very much scope for cooperation between machines primarily concerned with documentary facsimile and those primarily concerned with phototelegraph working, and it is important that the design of documentary machines should in no way be restricted by such considerations.

b) *Amplitude Modulation*

When using amplitude modulation, the greatest simplicity of design of direct-recorders can be achieved if maximum signal is transmitted for black. This is the opposite condition to that universally practised (although not actually mentioned in C.C.I.T. recommendations) for phototelegraphy. It is proposed that the conditions for documentary facsimile telegraphy be standardized to suit direct recorders, and that users of conventional phototelegraph equipment, whether transmitter or receiver, be required to adjust their equipment suitably when using the business document service. Such adjustment could usually be made without difficulty.

The transmission of maximum amplitude for black also has the advantage that for most documents the mean power of the signal will be less than if maximum amplitude were transmitted for white.

c) *Drum diameter*

The comments appended to the question 46 show that Study Group IV considered it to be unnecessary to introduce any new drum diameter. It appears, however, that the normal and preferred alternative drum diameters mentioned in Recommendation No. D.1 are not ideal for business documents, which for the most part are 8 to 8 ½ inches wide (203 to 216 mm). Thus, allowing 15 mm for retaining clips, it is seen that :

A drum 66 mm dia : gives approximately 193 mm or 7.6 inches usable circumference.

A drum 88 mm dia : gives approximately 262 mm or 10.3 inches usuable circumference.

The first is too small and the second wastefully large.

To accommodate paper 8 ½ inches wide, a drum of a diameter not less than, and not greatly exceeding, 74 mm is preferable.

d) *Drum length*

A drum length of 300 mm as mentioned in the comments of Study Group IV appended to the question, would not be sufficient for all commercial stationery. The greatest length known, which it may be desired to transmit, is 14 inches (355 mm) and a minimum length of 360 mm is therefore proposed.

e) *Index of Co-operation*

For the scanning of 10 point type or 12 pitch typewritten characters, the scanning density should be not less than 90 lines/inch (3.54 lines/mm) in order to provide adequate resolution ; appreciably more than 90 lines/inch would usually be wasteful of transmission time.

Thus, of the existing indices of co-operation (for phototelegraphy), 352 is too large, whilst 264 appears to be suitable. However, using the same arguments as those applied to the case of the direction of scanning, realization of the most suitable design should not be inhibited by adherence to existing standards for phototelegraphy and if any index can be shown to be more suitable than 264, it should be adopted.

Having regard to manufacturing considerations, it seems desirable for the chosen index of co-operation to be quoted, subject to a permissible tolerance, which for the present might be, say, ± 2 ½ %.

f) *Distortion in reproduction*

It may be desirable to study the limits of distortion permissible in various types of documentary image, due to :

i) Speed difference between transmitter and receiver

ii) Speed oscillations or variable rate of paper feed in the receiver.

iii) Differing indices of co-operation in transmitter and receiver.

iv) Dimensional changes in the recording paper.

For instance, the recommendations on stability of rotation speed given in Recommendation D.1 for phototelegraphy are not necessarily appropriate for documentary facsimile telegraphy. A documentary subject may very well show the effects of judder, for example, more clearly than

a typical photograph, and yet be able to tolerate a greater degree of degradation before it becomes unsuitable for its purpose ; i.e., the value of a documentary reproduction often depends on its legibility rather than its perfection.

g) *Asymmetrical sideband transmission*

It seems possible that there may be a demand for transmissions combining high quality of definition with high speed of transmission. For such cases it may be necessary to permit asymmetrical attenuation of the sidebands in transmission and to envisage, therefore, the recommendation of a new carrier frequency.

h) *Reproduction characteristics*

Some study seems desirable of the relative merits of two-tone and continuous tone-range reproduction.

i) *Stop signal for continuous recorders*

It seems probable that there will be an increasing tendency to use continuous recorders at unattended receivers, although this may apply more to internal than to international communications.

It may therefore be desirable to recommend suitable characteristics for a stop signal which, when sent to the recorder at the end of a message, would cause it to stop and so avoid wastage of the recording medium.

Preliminary study and experiment in the United Kingdom indicate that the stop signal :

1. must be acceptable for transmission over landlines ;
2. must be capable of transmission over radio links, and in particular must not lose its identifying characteristics when subjected to AM/FM and FM/AM conversion ;
3. cannot conveniently be confined to the clip zone period of drum rotation and hence should be distinguishable from the facsimile signal.

It is tentatively proposed that :

1. the stop signal shall be formed by substituting for the facsimile information, before modulation, two tones, e.g. 400 c/s and 600 c/s, sent concurrently, each at a level of 40 to 50 % of the peak facsimile signal amplitude ;
2. the duration of the stop signal shall be at least one drum revolution and not more than two drum revolutions.

j) *Contrast Ratio*

A study of the practicability of standardizing contrast ratio in transmission seems desirable.

UNITED STATES

Extracts from Document S.G. IV/35
S.G. V/14
9 March 1956

Facsimile transmission for business documents

There are large numbers of facsimile machines in use in the United States for the transmission of business documents, such as letters, memoranda, drawings, orders, etc. It is probable that there will be a large increase in international facsimile traffic of business documents. Therefore, in order to prevent incompatible equipment from coming into general use on international circuits, the United States recommend the following standards for equipment for documents used in the usual course of business:

	Millimeters	Inches
1. Cylinder diameter	70.0	2.75
2. Cylinder circumference	219.91	8.66
3. Useful cylinder length	330.2 [1]	13.0 [1]
4. Minimum useful circumference	203.2	8.0
5. Maximum document size	213.4 × 330.2 [1]	8.5 × 13.0 [1]
6. Line advance	3.77 l. p. mm.	96 l. p. in.
7. Index of cooperation	264	
8. Cylinder speed [2]	180 r. p. m. [3]	
9. Direction of scanning	Left to right and top to bottom of subject copy.	

On the other hand, there are many machines of different specifications in use or under test in the United States to meet particular requirements of private users, such as for space reservations on public transportation, brokers' orders, as aids in equipment design, in conducting plant efficiency surveys, etc. Any Recommendation adopted by the C.C.I.R. and the C.C.I.T. should specifically recognize the right of users to operate special facsimile equipment designed to meet their particular needs in their own installations and over their own circuits or over circuits leased from the Administrations or Recognized Private Operating Agencies, provided that such use shall not cause electrical interference to other users of the network.

UNITED KINGDOM

Extracts from Document S.G. IV/32-E
S.G. V/12-E
9 March 1956

Facsimile telegraphy for large size documents

Question 46 (ex VI, 8 modified) C.C.I.T. and Question 94 C.C.I.R.

What should be the characteristics of apparatus for the transmission by facsimile of:

1. .....
2. .....
3. documents of large size such as, for example, meteorological charts?

---

[1] Or unspecified when continuous rolls are used.
[2] Corresponds to number of scanning lines per minute.
[3] Alternate speeds of 90 and 360 r.p.m. may be used. (90 r.p.m. will normally be used on radio circuits.)

Reply

It is concerned primarily with the special case of the transmission of meteorological charts, and is based both on the operation of such a service by the U.K. and on certain equipment already in use in several countries.

Chart Size

The maximum dimensions of a meteorological chart (of normal proportions) which can be handled within a reasonable time by apparatus of a convenient size, when operating over a standard telephone circuit, are about 18×22 in. (45×55 cm). If the circumference of the transmitting drum is approximately equal to the lesser dimension, it is possible conveniently to handle a smaller chart of roughly the same aspect ratio i.e. 15×18 in. (37×45 cm). A chart of about this size appears to be used by a number of countries for some purposes.

Scanning Density

Experience has shown that a scanning density of about 100 lines per inch (or 4 lines per millimeter) provides sufficient definition for meteorological charts.

In view of the large number of equipments in use having a scanning density of 96 lines per inch (3.8 lines per mm), it is considered that this value should be adopted.

Drum Diameter

If the apparatus is to handle the size of chart indicated above, the transmitter drum must have a circumference of approximately 19 inches (or 48 cm). A large number of equipments in use have a drum diameter of 6 inches (152 mm), i.e. circumference 18.85 inches (479 mm) and this value is therefore recommended.

Note : Providing that the requisite index of cooperation is maintained, there are no compelling reasons why apparatus having different scanning densities and drum diameters should not be compatible. However, if charts are to be reproduced on the same scale as the originals, then it is necessary to specify definite values.

Drum Length

In order to accommodate the size of chart indicated above, the drum length of the transmitter must be about 22 inches (56 cm), i.e. the apparatus should have a Drum Factor $\frac{\text{Length}}{\text{(Diameter)}}$ of approximately 3 ½. The U.K. considers that drum type recorders are obsolescent and therefore it is unnecessary to specify any limiting values for the drum factor, because continuous roll recorders can receive a chart of any length.

Index of Coo eration

This follows logically from the values chosen for scanning density and drum diameter. A very large number of machines using an index of 576 are already in use and this value now appears to be generally acceptable.

Drum Speed

The U.K. considers that any drum speed less than 60 r.p.m. results in unacceptable transmission times. Where circuits of suitable quality are available, good results can be obtained at 120 r.p.m. The U.K. therefore recommends the adoption of 60 r.p.m. as the standard drum speed, and 90 and 120 r.p.m. as supplementary speeds for use when the copy and circuit conditions permit.

Direction of Scan

There are already in existence large numbers of machines for meteorological purposes which employ direct recording over a left-hand helix. As it seems unlikely that there will be much occasion for cooperation between machines primarily designed for meteorological purposes and those primarily intended for photo-telegraphy, it is important that the design of the former should in no way be restricted by the fact that the C.C.I.T. specifies a right-hand helix for photo-telegraphy. The U.K. therefore considers that transmission/reception over a left-hand helix should be specified for meteorological purposes.

Gripping Loss

It is recommended that the gripping loss should not exceed 5 % of the total length of the scanning line.

Phasing

It is recommended that " phase white " be used and that, with amplitude modulated transmissions, the carrier frequency of the phasing signals be the same as is used for picture signals. The following reasons apply :

a) in the case of automatic recorders the same signal can be used both for phasing and for the setting of levels ;

b) it gives a visible indication, prior to the picture transmission, that recording will take place evenly over the full length of the scanning line.

Note : Phase white is a phasing signal consisting of a pulse corresponding to picture white, followed for the remainder of the drum revolution by a signal corresponding to picture black.

The phasing pulse (or interruption) should have a duration of not less than 5 % of the total time taken to scan one line (e.g. 50 m/sec. at 60 r.p.m.).

The phasing signal should be transmitted for about 30 seconds before the transmission of picture intelligence, regardless of the drum speed employed.

Synchronization

The scanning speeds of equipment should be maintained within $\pm$ 5 parts in 10^6 of their normal values (in the case of apparatus having a six inch drum diameter, and an index of 576, this represents a maximum permissible skew of approximately 1 in 60 if the transmitter and recorder have the maximum acceptable discrepancy in opposite directions).

Note : It is an advantage if the fork frequency used is such that it can be easily compared with the 1000 c/s frequency which is available from standard frequency transmissions which are maintained within $\pm$ 2 parts in 10^8 of their nominal values.

Start/stop signals

For land-line transmissions, it is possible to operate satisfactorily with automatic recorders which start on the receipt of white phasing pulses and which close down when the picture carrier frequency is removed from the line. However, for radio transmissions it is considered that more positive signals are necessary if spurious operation is to be avoided. A preliminary study in the U.K. indicates that these stop/start signals :

a) must be acceptable for transmission over land-lines ;

b) must be capable of transmission over radio links, and in particular must not lose their identifying characteristics when subjected to AM/FM and FM/AM conversion ;

c) cannot conveniently be confined to the dead sector period of drum rotation, and therefore should be distinguishable from the facsimile signal.

It is tentatively proposed that the stop/start signals should be formed by substituting for the facsimile information before modulation either one or two tones having frequencies of the order of several hundred c/s.

Note : If positive start/stop signals are employed for radio transmissions, it will probably be convenient to employ the same procedure over land-lines.

Signal frequencies and levels

Land-line transmission. — For land-line transmission, amplitude modulation (AM) is recommended. It is difficult to state a specific carrier frequency(ies) on account of the fact that various countries will wish to employ different values according to the quality of circuits available and to suit their particular requirements (e.g., in the case of the U.K., the use of 2100 c/s permits the facsimile channel and ten channels of telegraph to be accommodated on the one telephone circuit). It is considered that the requirements for international exchanges by land-line will be limited, but nevertheless it is desirable that there should be an agreed carrier frequency for international working, because in automatic recorders it is advantageous to be able to use control circuits which are responsive to the carrier frequency. It is tentatively proposed that this frequency should be of the order of 1800 c/s. It is however desirable that apparatus should be constructed so that it can be easily adapted to operate on picture carrier frequencies in the range 1300-2100 c/s.

Maximum amplitude of the carrier should correspond to the transmission of picture black.

It is desirable that equipments should be capable of operation using either a 12 or 35 db contrast ratio.

Note : By contrast ratio is meant the ratio in decibels between the sending levels for black and white signals.

Recorders for land-line operation should accept a black signal in the range of + 5 to — 40 decibels relative to 1 milliwatt.

Radio transmission. — Two forms of modulation are commonly employed for meteorological facsimile telegraphy transmissions over radio circuits. It is recommended that the following standards should be employed :

a) sub-carrier frequency modulation, S.C.F.M. ; black frequency 1500 c/s ; white frequency 2300 c/s.

Note : The apparent anomaly between these values and those specified by C.C.I.T. for phototelegraphy is explained by the fact that it is customary to substitute the lower of the two frequencies (1500 c/s) for the signal represented by maximum amplitude when AM/FM conversion takes place. (For phototelegraphy apparatus maximum amplitude corresponds to picture white.)

b) Frequency shift keying, FSK :
+ 400 c/s picture black ; — 400 c/s picture white.

Tone Reproduction

For meteorological purposes, it is desirable that the apparatus should be capable of distinguishing a limited number of tones between black and white.

FRANCE

Extracts from Document S.G. IV/34
S.G. V/13
9 March 1956

Transmission of large size documents
(meteorological charts)

Taking into account the experience of the French meteorological services, it seems that apparatus should have the following characteristics.

In order to standardize the size of documents, it may be advisable to restrict transmission to charts having a maximum height of 42 cm, although charts with a greater height may be of particular interest for covering an area of a suitable size with a simple scale.

Therefore a drum diameter of 132 mm seems justified.

Definition depends on the type of chart to be transmitted. The experience of the French meteorological services has shown that a density of approximately 2 lines per mm is acceptable for charts giving only summary indications (e.g., isobars, general wind directions), which have to be transmitted with the utmost speed. This mediocre density allows the use of a transmitting drum rotation of 120 r.p.m. at the same time involving a rather small bandwidth, so that transmission on the ordinary telephone lines may be satisfactory. In some special cases more detailed charts must be sent : but, as they are relatively few in number, they can be comfortably transmitted with a density of about 4 lines per mm at a speed of only 60 r.p.m., although this obviously needs four times the time.

Scanning is done with a left-hand helix.

With regard to the choice of index, it seems that all national meteorological services definitely prefer an index of 288 for a low definition and an index of 576 for the high definition. It may be regretted that indexes 264 and 528 have not been adopted, which would have allowed us to provide for the future, and to reduce the bandwidth necessary for transmissions in the ratio of 11/12.

Isochronization of speeds is carried out either by the local supply circuit, or by a standard frequency source.

It also appears that, apart from a few exceptions, meteorological services have adopted continuous automatic reception, as in France. This, incidentally, raises the special problem of remote control of definitions and speeds ; as far as the French Administration is aware, only

the French meteorological services have proposed solutions to this problem, it being understood that only two combinations are suggested, i.e. index 288/speed 120 r.p.m. and index 576/speed 60 r.p.m.

For transmission using systematic broadcasting, the most practical method is broadcasting over radio channels.

On metallic lines, modulation is transmitted by a carrier.

Although sufficient experience is lacking, the following values have been adopted for the amplitude-modulated carrier frequency:

1300, 1500, 1800, 2100 c/s.

The black corresponds to transmission of the carrier.

For automatic control of the facsimile receiver, the following code is used:

Permanent black: condition of non-transmission.

White pulses on a black background: signals for starting, for remote control of the choice of speed/index combination, for phasing, for showing the presence of the facsimile sender (these last signals lasting 5 % of the time taken by the transmitting drum to rotate).

The return to permanent black causes the receiver to stop automatically.

For transmission on radio channels, modulation converters ensure direct control of frequency modulation in transmitters which may be of the telegraph type: the automaticity of the receivers does not raise any problems in this respect.

C.C.I.T. STUDY GROUP IV

Annex 7 to Document A.P. VIII/27-E
3 December 1956

Note to the W.M.O. concerning the facsimile transmission of meteorological charts

The C.C.I.T. has considered the proposals contained in the Resolution A.20 of Regional Association VI of the W.M.O. (see Document C.C.I.T. A.P. VIII/5 Annex 2) [1] and gives its comments, for the information of the W.M.O., in the following paragraphs.

(*Note :* The paragraph numbering below is in conformity with that in the W.M.O. document to facilitate cross-reference.)

Introduction § a)

The C.C.I.T. took note of the fact that the dimensions 45 × 55 cm correspond to an approximate maximum size and that there is in use a large number of machines capable of handling documents of a maximum size of 45 × 30.5 cm only.

Introduction § b) and c)

No comment.

Introduction § d)

The " standard telephone circuits " referred to were regarded as those prescribed by the C.C.I.F., but it was understood that transmissions would also be made over various types of

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[1] Published hereafter.

radio circuits. In this connection it is relevant to note that long distance radio telephone circuits, operating at frequencies below 30 Mc/s, may not necessarily transmit audio frequencies above 2600 c/s (see C.C.I.R. Recommendation No. 40 of London).

Introduction § e)

No comment.

Standard characteristics

1. *Index of Cooperation*

Primary 576

The C.C.I.T. recommends that this index of cooperation be adopted as the normal value for the facsimile transmission of meteorological charts.

Supplementary 288

Where direct recording is employed, it is not practicable, on account of the difficulty of changing the writing elements (viz. writing edge, stylus or scribing wheel), to provide an alternative index of 288 on a recorder designed to operate with an index 576. It is however possible to double the line advance of the paper (or of the recording head) in order to co-operate with a transmitter having an index of 288. In this case each recorded line will be separated from its neighbours by a gap approximately equal to its own width.

In the case of a transmitter, the adjustment of both scanning pitch and scanning aperture, necessary to provide the alternative index, presents no serious difficulties and such a change permits the drum speed to be doubled with no significant increase in the nominal modulating frequency. If the aperture is not increased in size and the transmitter is merely adjusted to scan alternate lines, then the apparatus cannot be considered as having a true index of 288, since the nominal modulating frequencies correspond to the primary index of 576.

In the latter case, the transmission time, as compared with an index of 576 for the same drum speed, is halved, but the nominal modulating frequency is the same for both.

The C.C.I.T. sees no objection to the use of the lower definition. Nevertheless, it considers it incorrect to associate an index of 288 with apparatus designed for an index of 576, but adjusted to scan alternate lines. The C.C.I.T. is not competent to state whether the lower definition is satisfactory for the purpose envisaged (i.e. the transmission of line charts) ; this is a matter for the meteorological services to decide.

2. *Drum Speed*

The C.C.I.T. recommends the adoption of 60 r.p.m. as the normal standard. Whereas with an index of 576, in association with a drum speed of 60 r.p.m., satisfactory reception can be expected on normal metallic circuits, the quality of the recording may be impaired at higher drum speeds depending upon the composition of the circuit and the presentation of the original document : the extent to which such degradation can be tolerated is a matter for the user to decide from the content of the document.

3. *Drum Diameter*

Provided that the standardized indices are adhered to, it is not essential to specify a standard drum diameter. The C.C.I.T. notes, however, that there is already a very large number of equipments in use having a drum diameter of 152 mm and only a few having other diameters, e.g. 132 mm. Where machines having different drum diameters cooperate, the received copy will be reproduced on a scale which is different from that of the original.

4. *Scanning Density*

See comment to Index of Cooperation (1) above.

5. *Drum Length*

See comment to Introduction paragraph *(a)* above.

6. *Direction of Scan*

The C.C.I.T. has adopted a new definition for the direction of scanning which, in the case of the equipment used in the meteorological service, would be as follows :

" At the transmitting apparatus, the plane (developed in the case of a drum transmitter) of the message surface is scanned along lines from left to right, commencing at the top, so that scanning commences at the top left-hand corner of the surface and finishes at the bottom right-hand corner : this is equivalent to scanning over a left-hand helix on a drum. The orientation of the message on the scanning plane will depend upon its dimensions and is of no consequence.

At the receiving apparatus, scanning takes place from left to right and top to bottom (in the above sense)."

7. *Gripping loss*

No comment.

8. *Phasing*

8.1 In view of the increasing use of automatic continuous roll recorders, it is considered that one standard should be adopted. The C.C.I.T. suggests that the *initial* phasing signals should be " white " pulses in all cases, to ensure the reliable remote control of the receiver and to enable the adjustment of the black recording level before the commencement of transmission of the subject matter. In view of the fact that there is some existing receiving apparatus which requires phasing pulses throughout the transmission of the subject matter, these latter pulses should be " black ". It is therefore desirable that receiving equipment should be capable of accepting both " phase-white " and " phase-black " to ensure correct operation during the whole of transmission, and to permit a receiver to be phased correctly to a transmission which has already commenced.

8.2 *Length of Phasing Pulses*

The C.C.I.T. is of the opinion that the length of the phasing pulse should be within the limits $4\% \pm 1\%$ of the total time taken to transmit one scanning line.

8.3
8.4 No comment.

9. *Synchronization*

The view of the C.C.I.T. is that the amount of skew which can be tolerated is a matter for the user to decide. The imposition of a smaller speed tolerance than that quoted ($\pm$ 5 parts in 10^6) would be likely to increase the cost and complexity of the equipment. The C.C.I.T. has observed that the maximum skew can be 1 : 55 for the speed tolerance quoted.

10. *Signals for Automatic Operation*

The C.C.I.T. took note of the contributions made by France and the United Kingdom (see appendix). It is also noted that a contribution on this subject has been submitted direct to the W.M.O. by the Federal German Republic. It was considered that insufficient is known on this question, which should receive further study in relation to both meteorological apparatus and the wider requirement which includes apparatus for business documents. In this connection, before formulating standards, it is necessary to determine precisely what functions of the apparatus have to be controlled automatically.

11. *Modulation*

The C.C.I.R. at its VIIIth Plenary Assembly issued a Recommendation No. 226 dealing with the modulation characteristics for sub-carrier frequency modulation. It has also set a new question, 130, for the study of direct frequency modulation.

12. *Picture Carrier Frequency and Signal Levels*

The C.C.I.T. has no comments to make at this stage on the question of picture carrier frequency.

The C.C.I.T. considers that it is desirable and practicable for automatic recorders on metallic circuits to function correctly on receipt of signals corresponding to picture black within a range of 25 db, the limits to be capable of adjustment to meet particular requirements.

13. *Contrast Ratio*

The C.C.I.T. notes that contrast ratios of 12 db and 25 db appear to be in current use : at this stage no further comment can be offered.

14. *Tone Reproduction*

No comment.

Annex to Resolution A-20

STANDARDIZATION OF FACSIMILE EQUIPMENT AND TRANSMISSION CHARACTERISTICS FOR METEOROLOGICAL PURPOSES

Introduction

The requirement is for facsimile apparatus which will

a) transmit meteorological charts up to an approximate maximum size of 45 × 55 cm (18 × 22 inches) ;

(b) transmit a chart of this maximum size in less than forty minutes at the lowest transmission speed;

(c) produce the received copy without any subsequent processing;

(d) operate over standard telephone circuits;

(e) be capable of operation by unskilled personnel and, as far as possible, be automatic in operation.

Standard Characteristics

The suggested characteristics are given below; they are of different character: some of them represent obligatory standards whilst others are characteristics considered desirable by meteorologists.

1. *Index of Cooperation* (Module de coopération)

Primary 576
Supplementary 288

Note: It is considered that an index of 288, as given by a drum diameter of 152 mm (6 in.) and a scanning density of 1.89 lines per mm (48 lines per inch), is satisfactory for the transmission of charts made up wholly of contour lines.

2. *Drum Speed* (Vitesse de rotation du cylindre)

Primary 60, 120 r.p.m.
Supplementary 90 r.p.m.

3. *Drum Diameter*

It is desired that the drum diameter should be between 130 mm and 160 mm. — 152 mm and 132 mm are the values currently employed.

4. *Scanning Density* (Finesse d'exploration)

It is obtained from the relationship $\frac{\textit{index of cooperation}}{\text{drum diameter}}$ and must be approximately 4 lines per mm for the index of cooperation 576 and approximately 2 lines per mm for the index of cooperation 288.

5. *Drum Length*

As an ever increasing use is being made of continuous roll recorders, it is considered unnecessary to specify a maximum length for the transmitter drum.

The minimum length of the drum must permit transmission of a chart of the size stated in the Introduction.

6. *Direction of Scan* (Direction d'exploration)

Transmission/reception over a *left-hand helix* (hélice à gauche)

Note: It is recognized that this is not in accordance with the existing C.C.I.T. standard for phototelegraphy but it is adopted because:

a) there are already a large number of equipments employing a left-hand helix in use for meteorological purposes;

b) it seems unlikely that there will be much occasion for cooperation between equipment primarily intended for meteorological purposes and those intended for phototelegraphy.

7. *Gripping Loss* (Secteur mort)

A maximum of 5 of the total length of the scanning line (ligne d'exploration), e.g. total circumference of the transmitting drum—should be allowed for securing the original to the drum.

8. *Phasing* (Mise en phase)

8.1 Apparatus should be capable of operation using either phase white or phase black (mise en phase sur blanc ou sur noir).

Note: In view of the fact that in the case of automatic apparatus designed to operate on a single standard, the use of inverse phasing will probably necessitate manual adjustments at the recording terminal, it would be useful to formulate a single standard for apparatus operating entirely by remote control.

8.2 *Length of Phasing Pulse* (Durée de l'impulsion de mise en phase)

The length (or duration) of the phasing pulse should be not less than 5 % of the total transmission time of one scanning line (e.g. 50 milliseconds at 60 r.p.m.) and should also not exceed this value if the transmission of phasing pulses is continued throughout transmission of picture intelligence.

8.3 *Duration of Transmission of Phasing Pulses*

Phasing pulses should be transmitted *for not less than 30 seconds* before the transmission of picture intelligence, *regardless of the drum speed employed*. Phasing pulses may continue to be sent throughout the period of transmission of picture intelligence provided that the length of the pulse does not exceed 5 % of the total time taken to transmit one scanning line.

8.4 *Sequential or Continuous Transmission*

If a sequence of charts is sent from automatically coupled transmitters, or if a flat bed (continuous scanning) transmitter is employed, the length of picture transmitted without re-phasing should not exceed a figure more than approximately three times the total length of the scanning line.

9. *Synchronization*

The scanning speeds of apparatus used should be maintained within $\pm$ 5 parts in 10^6 of their nominal values.

Note : This tolerance admits a maximum skew of approximately 1 : 100 in the case where the transmitter and recorder operate at the maximum permitted deviation in opposite directions.

10. *Signals for automatic Operation*

In the case of automatic equipment, standards have to be formulated for the following signals at least :

— for starting,
— for phasing,
— for stopping.

These signals must be acceptable for both landline and radio transmissions ; in the latter case, they should retain their identifying characteristics when subjected to AM/FM and FM/AM conversion.

It is recommended that the C.C.I.T. be asked to study this question and to make suitable recommendations.

11. *Modulation*

11.1 *Landline :*

Primary : Amplitude modulation (AM)—maximum amplitude of the carrier frequency should correspond to the transmission of picture black.

Supplementary : Sub-carrier frequency modulation (SCFM)—see under 11.2 for frequencies.

11.2 *Radio Facsimile Transmissions*

Primary : Frequency shift keying (FSK) : $\pm$ 400 c/s.

Note : It is recognized that in the case of L.F. transmissions a smaller shift of approximately $\pm$ 150 c/s may be used.

Supplementary : Sub-carrier frequency modulation (SCFM)
1500 c/s black
2300 c/s white.

12. *Picture Carrier Frequency and Signals Levels*

It is recognized that the optimum carrier frequency and signal levels will depend upon the quaiity of landline circuits available and also upon particular requirements. It is, therefore, desirable that apparatus should be so constructed that it can easily be adapted to operate on picture carrier frequencies of the order of 1800 c/s. It is also desirable that recorders for landline operation should accept signals in the range + 5 dbm to — 20 dbm.

It is recommended that the C.C.I.T. should be asked to study these questions and to make suitable recommendations.

13. *Contrast Ratio* (Contraste)

At least 12 db.

It is, however, recommended that the C.C.I.T. should be asked to study this aspect and to make a suitable recommendation.

14. *Half-Tones* (Demi-tons)

It is desirable, but not essential, that a limited number of tones between white and black should be capable of transmission.

CIRCUITS CHARACTERISTICS FOR FACSIMILE TRANSMISSION

(C.C.I.T. Question 45 — C.C.I.T.T. Questions 12/8 and 16/8)

U.S.S.R.

Document S.G. IV/44
6 November 1956

The use of asymmetric limitation of sidebands for facsimile transmission * on carrier telephone circuits

Existing methods for facsimile signal transmission on carrier telephone channels do not make the best use of the channels, which are engaged for quite a long time for the transmission of each facsimile telegram. Speeding-up of transmission time is especially important for the facsimile transmission of meteorological charts of large size over carrier channels.

This increase in speed may be brought about by means similar to those used for carrier telephone transmission on one sideband. The fact that some facsimile signals are present in the modulated band on frequencies close to the carrier (the difference is 1 c/s) makes it impossible to separate the band modulated by the facsimile signal from one of the sidebands. Hence, in facsimile telegraphy, unlike telephony, we can proceed by partially reducing one of the sidebands. This is called the method of asymmetric limitation of sidebands. The basis of this method is as follows. The modulated facsimile signal containing the carrier frequency, as well as the upper and lower side frequencies, is applied to a filter with slopes symmetrical around the carrier (FH) and with linear phase characteristic (see Figure 3). In this filter, unlike the normal lowpass filter, the attenuation curve in the transient region meets the condition,

$$e^{-b_1} + e^{-b_2} = 1, \qquad (1)$$

where b_1 and b_2 are the composite attenuations at adjacent frequencies equidistant to the right and left of the middle frequency (F_H) in the transient region. The phase characteristic of this filter is linear in the passband as well as in the transient region. This filter provides partial reduction of the upper sideband and transmission of the side frequencies equidistant to right and left of the carrier, where the sum of the amplitudes of these two frequencies at the output of the filter will be equal to the overall amplitude. Through this limitation of the sidebands, amplitude and attenuation distortion and phase distortion are eliminated in the neighbourhood of the lower picture frequencies. This is because the lower frequencies, from 0 to 300 c/s approximately, are transmitted over the modulated channel on the lower and upper side frequencies at the partial amplitudes e^{-b_1} and e^{-b_2} and the picture frequencies, from 300 c/s upwards, are transmitted over the modulated channel on a lower side frequency at the amplitude $e^{-b} \approx 1$.

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* The expression "facsimile" is used here in the meaning defined in the draft Glossary of Definitions of Essential Telegraph Terms, July, 1955, pages 8-9.

Since at the output of the detector (in the receiver) the upper and lower side frequencies are added together, if condition (1) is fulfilled, the complete picture frequency band from 0 to the maximum picture frequency (f max. im.) will have no attenuation distortion.

Since at the output of the symmetrical filter the modulated facsimile signal is applied to the carrier telephone channel, we shall transmit the carrier widened to 2800 c/s, over this channel, together with the lower sideband and the 10 % residue of the upper one. Thanks to the widened spectrum of the lower sideband up to 2800 c/s, this method enables us to increase by 1.8 times the facsimile transmission speed in relation to the maximum possible transmission rate with double sideband.

Asymmetric limitation of sidebands inevitably involves quadrature distortion, the origin of which is illustrated by the vectorial diagram in Figure 1, *a* and *b*.

With symmetric limitation of the sidebands (Figure 1 *a*), the resultant vector coincides with the vector of the carrier in direction, whereas when the side frequencies are asymmetrically limited, the resultant vector does not coincide with that of the carrier. The geometrical figure described by the point of the resultant vector is an ellipse. In this case, we shall have not only amplitude modulation, but also disturbing phase modulation. The distortions in quadrature increase as the residue of the upper sideband is reduced.

A study of the influence of quadrature distortion on facsimile transmission shows that in transmitting pictures with much detail, i.e., when short group pulses are transmitted with small intervals between them, and when long pulses are transmitted with small intervals, the components in quadrature of the two successive pulses are mutually offset and the distortion they produce is not apparent when the group details and finer points of the picture are reproduced. When isolated white lines are reproduced, that is to say, isolated pulses, and the " unit step " pulse, the distortions in quadrature appear as widened pulses, i.e. as a decrease in the steepness of the leading and trailing edges.

Since the first group of details predominates in facsimile telegrams, quadrature distortion does not introduce any appreciable reduction in the quality of transmission. Quadrature distortion can be reduced by cutting down the modulation rate. The vectorial diagram in Figure 1 *b* shows there is a decrease in the argument (ϕ 2) characterizing the rate of undesired modulation as the desired modulation rate is reduced, or (the same thing) as the vector of the carrier undergoes a relative increase.

The above-mentioned increase in the speed of facsimile transmission due to asymmetric reduction of the sidebands can be obtained only on carrier telephone channels corrected in accordance with the argument.

In the Soviet Union, we have perfected an instrument for facsimile recording on photographic paper or film which enables transmission to take place on carrier telephone channels with a band from 300 to 3400 c/s by the method of asymmetric limitation of sidebands for transmission speeds of 240 and 360 lines per minute. Figure 2 represents this diagrammatically. It shows :

1. Photoelectronic multiplier with ten-stage electronic multiplication.

2. Cathodyne.

3. Lowpass filter for elimination of the picture frequencies higher than the carrier, otherwise the higher picture frequencies after frequency transformation might penetrate the frequency band of the modulated signal and create distortion.

4. A carrier oscillator of 3100 c/s for transmission of modulated facsimile signals on the carrier channels. This particular frequency is chosen because of the transmission of the lower sideband at a width of 2800 c/s and 10 % of the residue of the second sideband.

C.C.I.T. N°93 F

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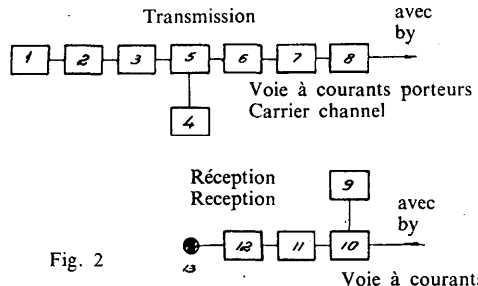


Fig. 2

Diagramme symbolique de l'appareil fac-similé
Diagram showing facsimile apparatus

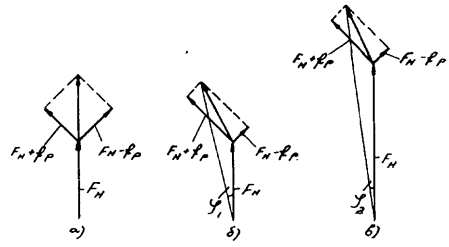


Fig. 1

Diagrammes vectoriels correspondant à la limitation symétrique (*a*) et dissymétrique (*d b*) des bandes latérales

Vector diagrams corresponding to symetric limitation (*a*) and asymmetric limitation (*d b*) of the sidebands.

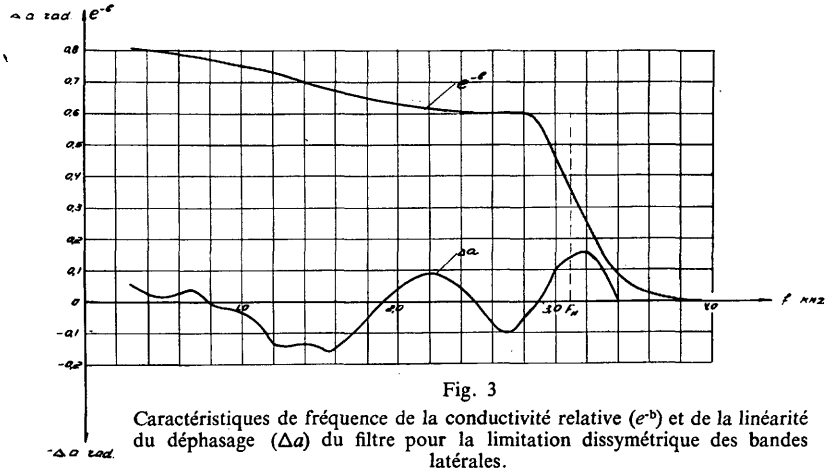


Fig. 3

Caractéristiques de fréquence de la conductivité relative (e^{-b}) et de la linéarité du déphasage (Δa) du filtre pour la limitation dissymétrique des bandes latérales.

Frequency characteristics of the relative conductivity (e^{-b}) and of the dephasing linearity (Δa) of the filter for Asymmetric limitation of sidebands.

5. A balanced modulator designed for modulation of the carrier by the picture signals. The modulated signal at the output of the balanced modulator contains the following frequencies : the carrier, and the lower and upper sidebands. The picture frequency band is balanced in the balanced modulator.

6. To reduce quadrature distortion, the modulation rate is made equal to 70%. As from the output of the balanced modulator, the modulated signals, after appropriate amplification in the amplifier (6), are applied to the filter (7).

7. A lowpass filter with symmetric slopes and linear phase characteristics (see Figure 3) provides partial reduction of the upper sideband.

On leaving the filter, the facsimile signal, after the amplifier (8), is transmitted over the carrier telephone channel, corrected in accordance with the argument towards the facsimile receiver (Figure 2). In the facsimile receiver, the signal passes from the channel output to the modulator (10) where the linear carrier amounts to 12.7 Kc/s. This increase in the carrier is designed to restore the envelope before detection, which in its turn should help to increase the picture's definition. After eliminating the useless products of transformation by means of a filter (11), the facsimile signal enters the photographic recording receiver (12), where the discharge tube (13) is used as a light modulator.

Delay distortion in the channel of the facsimile apparatus and in the carrier telephone channel is corrected with an accuracy of up to 300 microseconds.

Tests of this apparatus under line conditions have shown that the asymmetric limitation of the sidebands makes it possible to transmit facsimile telegrams on carrier telephone channels (300-3400 c/s) with phase compensation, at speeds of 240 and 360 lines a minute.

U.S.S.R.

Document S.G. IV/45-E
5 November 1956

Equalization of the delay characteristics of carrier communication channels intended for the transmission of phototelegrams

Delay distortion within telephone channels (deviations of delay as a function of frequency from a constant value) is one of the main factors limiting the speed of transmission of phototelegrams.

Any increase of transmission speed is limited primarily by delay distortion rather than by the finite width of the channel transmission band.

This is especially evident in the operation of communication channels with several retransmissions. In this case, the width of the frequency band remaining unchanged, delay distortion increases to an extent which is prohibitive to the transmission of phototelegrams even at low speeds.

In standard carrier communication channels (K-12, K-24, K-60 channels etc.), having a band of effectively transmitted frequencies of 300-3400 c/s, delay distortion is introduced mainly by crystal filters used in channel units.

Every channel is equipped with two crystal filters, one at the transmitting, and the other at the receiving end.

The number of filters used in the circuit is increased if retransmission is effected at intermediate points.

It must be indicated that additional delay distortion may be contributed by any group equipment filters provided. However, this distortion affects only the channels occupying extreme positions in basic 12-channel groups.

The system of phototelegram transmission presently used depends upon transmission speeds which correspond to a comparatively narrow frequency band of a phototelegraph signal occupying the middle of a channel transmission band where delay distortion is small. Accordingly, even less than a half of the effectively transmitted frequency band is used.

If delay equalization is provided, transmission speed may be at least doubled. Using delay equalization conjointly with the vestigial side band transmission principle, it is possible to increase transmission speed additionally at least 1.6-1.7 times. The total increase of transmission speed will, therefore, be 3.2-3.4 times the presently used value.

Considering that a substantial part of phototelegram cost is contributed by channel costs, it is reasonable to introduce delay equalization of channels to achieve more effective operation. The provision of delay equalization naturally calls for a certain capital investment for the production and installation of necessary delay equalizers.

The study of this question has shown that standard delay equalizers may be mostly used for the equalization of standard carrier communication channels.

Owing to this fact, the costs of delay equalizers may be considerably reduced, and their operation simplified.

To determine delay distortion on carrier communication channels, many of these channels were tested on different long-distance routes.

The results of measurements have shown a relatively narrow spread of delay-frequency characteristics (see Figure I, hatched area).

Hence, equalization is feasible, if a standard delay equalizer is used providing for the correction of characteristics with an accuracy equivalent to the limit of the virtual deviation of characteristics from the average value.

To evaluate the effect of unequalized residual distortion, the admissible value of distortion has to be determined.

Theoretical computations and practical experience in the field of phototelegraphy, as well as television, have shown that maximum admissible values of continuous deviations of a delay-frequency characteristic from constant value should not exceed the transmission time of a picture element.

This may be stated mathematically as follows:

$$\Delta t \leq \tau = \frac{60}{\pi \, MN} \text{ sec} \qquad (1)$$

where:

Δt = maximum admissible value of continuous delay deviation for a given number of r.p.m., N, and for an index of co-operation M;

τ = transmission time of a picture element.

In Figure 2 curve (a) $\Delta t = f(N)$, which is a plot of (I), is compared with the maximum spread of delay characteristics (curves (b)) which are plotted in accordance with characteristics of Figure I, allowing for the value of the index of co-operation as a function of r.p.m. value used in the transmission.

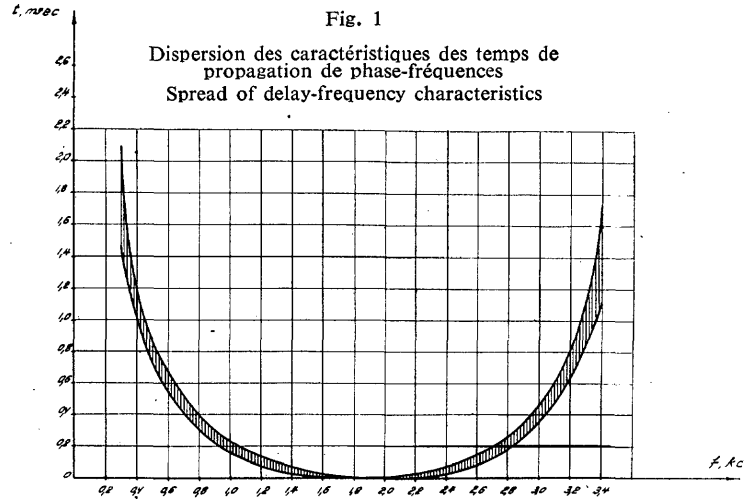


Fig. 1

Dispersion des caractéristiques des temps de propagation de phase-fréquences
Spread of delay-frequency characteristics

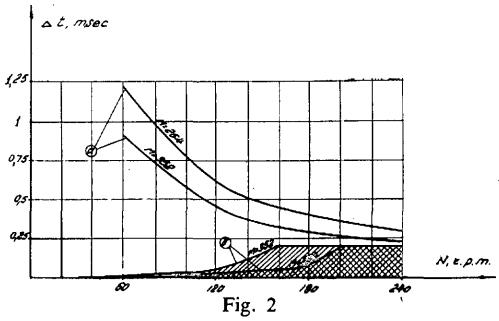


Fig. 2

Comparaison de la dispersion des caractéristiques des temps de propagation de phase-fréquences avec les écarts admissibles en fonction de diverses vitesses de transmission :

a) courbes illustrant les écarts admissibles pour diverses valeurs du module de coopération ;

b) courbes illustrant la dispersion des caractéristiques des temps de propagation-fréquence pour diverses valeurs du module de coopération.

Comparison of the spread of delay-frequency characteristics with admissible delay deviations at various transmission speeds

a) curves illustrating admissible deviations at various values of the index of co-operation;

b) curves illustrating the spread of delay-frequency characteristics at various values of the index of co-operation.

C.C.I.T. N°97/1 E

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It must be pointed out that for a value of M = 352 the maximum number of revolutions is about 160 r.p.m., while for M = 264 it is about 210 r.p.m.

The speed may be further increased only if vestigial side band transmission is used. However, in this case no further extension of the frequency band takes place, and the spread of characteristics is not, consequently, increased but remains constantly at its maximum. This latter circumstance is demonstrated by horizontal sections of the curves.

Referring to characteristics given in Figure 2, it is evident that the use of a standard delay equalizer is fully justified because, if there are no retransmissions, even the maximum spread of characteristics remains within admissible deviation limits.

If retransmission is effected, deviations will add statistically. Hence, it is to be assumed that deviations will remain within standard limits even with 2 or 3 channels connected in tandem.

Therefore, delay equalization of carrier telephone channels is feasible using standard delay equalizers inserted in the communication path.

These standard delay equalizers may be cut into line directly by an operator in charge of a phototelegraph apparatus.

It must be indicated, however, that only the channels occupying middle positions in a basic 12-channel group may be equalized. The channels at the extremes of this group should not be used for the transmission of phototelegrams. Moreover, when any channels are allowed to be used, the operator must be informed about the number of retransmissions for each particular channel.

We have designed, produced, and tested a standard delay equalizer. The results of its test are shown in Figure 3. This device equalizes the delay characteristic of a channel within a frequency range of 450-3250 c/s with an accuracy equivalent to oscillatory delay deviations (" ripples ") of $\pm$ 0.08 msec from constant value.

It is known (2) that oscillatory deviations result in the appearance of positive and negative secondary images (" ghosts ").

The delay equalizer was designed with an objective to minimize the number of sections. Another design objective was that a secondary image resulting from systematic oscillatory deviations (which add arithmetically if several delay equalizers are connected in tandem) was to be at least 20 times weaker than a primary image, even if 3 retransmissions were effected. This was achieved with a minimum of 8 sections (see Annex).

Annex

SELECTION OF THE NUMBER OF DELAY EQUALIZER SECTIONS

In the design of a delay equalizer, the approximation of a given characteristic is the more accurate, the greater is the number of equalizer sections. From economic considerations, however, it is desirable to minimize the number of sections.

In choosing the number of sections, considerations given below should be taken into account.

Every phase section (Fig. 4) is characterized by following parameters.

$$\omega o = \frac{1}{\sqrt{L_1 C_1}} = \frac{1}{\sqrt{L_2 C_2}}, \text{ resonant frequency} \qquad (2)$$

$$m = \sqrt{\frac{L_2}{L_1}} = \sqrt{\frac{C_1}{C_2}}, \text{ parameter determining the slope} \tag{3}$$

$$R = \sqrt{\frac{L_1}{C_2}} = \sqrt{\frac{L_2}{C_1}}, \text{ characteristic impedance} \tag{4}$$

Moreover, there are some parameters determining the co-ordinates of zeroes and poles of the transfer ratio of a section on a complex frequency plane (see Figure 5), viz :

$$Kn = \frac{\omega o}{2m} \tag{5}$$

$$\omega n = \omega_o \sqrt{I - \frac{I}{4m^2}} \tag{6}$$

For a given value of R the above values characterize amply every section.

If there is a sufficient number of sections having the same value of Kn, their resonant frequencies being equally distributed along the frequency axis with intervals of $\Delta\,\omega$ between them, the total phase delay (1) will be

$$t \cong \frac{2\pi}{\Delta\,\omega}\,(1 - 2\,e^{\frac{-2\pi\,Kn}{\Delta\omega}}\,\mathrm{Cos}\,\frac{2\pi}{-\Delta\,\omega}\,\omega)$$

$$= t_o - \Delta\,t \quad \cos t_o\,\omega = t_o\,(1 - \frac{\Delta t}{t_o}\cos t_o\,\omega) \tag{7}$$

$$\text{where } t_o = \frac{2\,\pi}{\Delta\,\omega} = \frac{1}{\Delta\,f}, \text{ average delay} \tag{8}$$

$$\Delta t = 2t_o\,e^{-Knto} \quad \text{amplitude of cosine delay deviations (“ ripples ”)} \tag{9}$$

It is known (2) that small cosine delay deviations result in signal distortion appearing in form of paired echoes ; the ratio of the paired echo amplitude to the main signal amplitude is given by

$$x = \frac{\Delta t\ \Delta f}{2} \tag{10}$$

Assuming that a delay equalizer is approximately analogous to a delay line with a sufficient number of sections, it is possible to determine the relation between Kn and $\Delta\,\omega$ for a given value of echo resulting in the appearance of “ ghosts ” on a phototelegram.

It results from (8), (9) and (10) that, to obtain $x < x_1$ where x_1 is the admissible secondary image, we should have

$$Kn > \frac{\Delta\,\omega}{2\,\pi}\,\mathrm{ln}\,\frac{1}{x1} \tag{11}$$

Hence, admissible delay deviations are a determining factor for the minimum value of Kn.

In practice we have to deal with a finite number of delay equalizer sections defining a delay characteristic within the given frequeney range $\omega_1 - \omega_2$. This number of sections will be

$$N \cong \frac{\omega_2 - \omega_1}{\Delta\,\omega} \tag{12}$$

as a first approximation.

The greater is the value of Kn for a given section number, the smaller will be the slope of a delay characteristic at the edge of a frequency range. From the theory of potential analogy (2), (3), phase delay may be derived as

$$t \cong \frac{2}{\Delta\,\omega}\,[\varphi_1(\omega) + \varphi_2(\omega)] \tag{13}$$

for a group of phase sections having zeroes and poles of the transfer ratio (corresponding to a constant value of Kn (Fig. 6) equally distributed at intervals $\Delta\,\omega$ from each other.

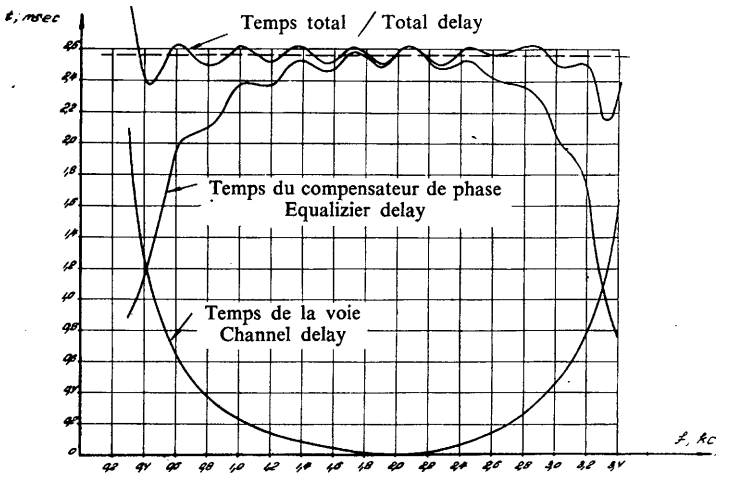


Fig. 3

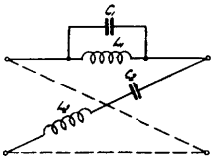


Fig. 4

Section de compensation de phase
Phase section

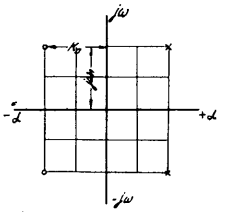


Fig. 5

Zéros et pôles du rapport de transfert de la section de compensation de phase

Zeroes and poles of the transfer ratio of phase section

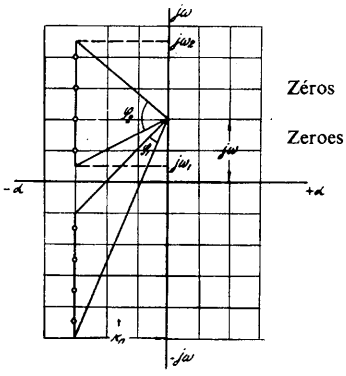


Fig. 6

Zéros du rapport de transfert d'un groupe de sections de compensation de phase

Zeroes of the transfer ratio of a group of phase sections

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Such group of phase sections may be chosen as a first approximation to be a reference group for the design of a delay equalizer. The sections are to be selected in such a way that the values of maximum delay introduced (T_o) and maximum slope $\left(\frac{dt}{d\omega}\right)_{max}$ at the edge of the frequency-range would be greater than those of a delay equalizer required.

It is important in this case that the condition of maximum slope be fulfilled at the lower edge of the transmission band, the slope being always smaller at this edge.

Maximum slope of a delay-frequency characteristic is determined (3) as

$$\left(\frac{dt}{d\omega}\right)_{max} \approx \frac{2}{\Delta\omega Kn}\left[1 - \frac{1}{4}\left(\frac{Kn}{\omega_1}\right)^2\right] \tag{14}$$

It has been mentioned above that the value of slope for a reference group of sections should not be smaller than that of a delay characteristic of a channel being equalized. Hence, the value of Kn should not exceed

$$Kn < 2\omega_1\sqrt{1 + \left[\frac{\Delta\omega}{2}\omega_1\left(\frac{dt}{d\omega}\right)_{max}\right]^2} - \omega_1\Delta\omega\left(\frac{dt}{d\omega}\right)_{max} \tag{15}$$

In figure 7, (11) and (15) are plotted, defining the delay characteristic of a typical carrier communication channel.

For the design purposes, the extreme lower frequency is assumed to be $f = 450$ c/s, i.e. $\omega_1 = 2\pi \cdot 450$.

The slope of delay characteristic calculated graphically for this frequency is

$$\left(\frac{dt}{d\omega}\right)_{max} = \frac{3\,10^{-6}}{2\pi}$$

The relative value of secondary image was assumed to be 0.015 considering, that with 3 retransmissions the secondary image should not exceed 5 % of the primary image. Such secondary image should not be visible.

The admissible value of Kn must remain within the hatched area. The optimum value of Kn is to be found at the crossing of the curves, $\Delta\omega$ reaching in this case its maximum value and the section number being, therefore, at a minimum.

The values of Kn and $\Delta\omega$ are thus selected as a first approximation.

The number of sections is derived from (12). The value of ω_2 for a carrier channel is assumed to be 150 c/s lower than the extreme upper frequency of the channel frequency band

$$\omega_2 = 3400 - 150 = 3250 \text{ c/s}.$$

$$N \cong \frac{\omega_2 - \omega_1}{\Delta\omega} = \frac{(3250 - 450)}{2100} = 8.3 \approx 8$$

In figure 3 a characteristic is plotted of a delay equalizer having 8 sections.

Parameter values of every section are chosen according to calculation data derived from the groups of Figure 7, and subsequently estimated more accurately using the nomographs of reference (3).

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2. WHEELER, H. A. *The Interpretation of Amplitude and Phase Distortion in Terms of Paired Echoes.* Proc. IRE. June 1939.
3. DAVIDOV, G. B. *Theory and Design of Delay Equalizers.* A book (in print).

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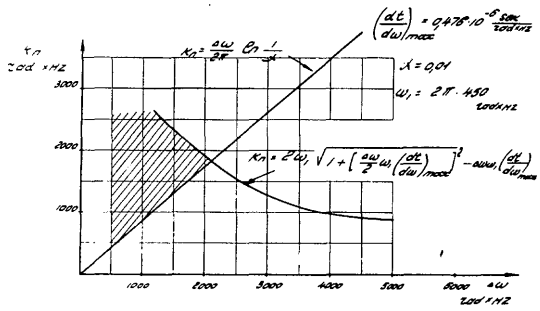


Fig. 7

Détermination des valeurs optima de K*n* et de $\Delta\omega$
Determination of optima values of K*n* and $\Delta\omega$

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VOCABULARY DEFINITIONS SYMBOLS

(C.C.I.T.T. Question 4/7)

NETHERLANDS

Extracts from Document S.G. VI/11
S.G. VII/3
25 October 1954

Definitions of relay terms

RELAYS

GENERAL LIST

No.	Term	Definition
		1.
1.1	(Electrical) relay	P.M.
		2.
2.1	Actuating quantity	Quantity on which the condition (position) of the relay is meant to be dependent.
2.2	Stable condition (position)	Condition (position) which, if the actuating quantity does not change, and any movable parts of the relay do not move, can be maintained for an indefinite time.
2.3	Unstable condition (position)	Condition (position) which, if the actuating quantity does not change and any movable parts of the relay do not move, cannot be maintained.
2.4	Final condition (position)	Any stable condition (position) in which all the switching functions have been properly performed. *Remark :* With electro-mechanical relays, this is e.g. the case, if, with closed contacts, the contact pressure and with open contacts, the contact gap, at least correspond with the prescribed values.
2.5	Condition 0 (position)	Final condition (position) of a relay, if the actuating quantity is zero and the locking, if any, has ceased to act. *Remark :* Condition (position) 0 is only spoken of, if a relay practically has one condition (position) like that.
2.6	Condition I (position)	Final condition (position) not corresponding with condition (position) 0. *Remark :* Condition (position) I is only spoken of, if the relay also has a condition (position) 0. So a two-step relay and a polarized relay, with centre final position, have two conditions (positions) I. With polarized relays having two final conditions (positions), etc. it is not possible to speak of condition (position) I and condition (position) 0.

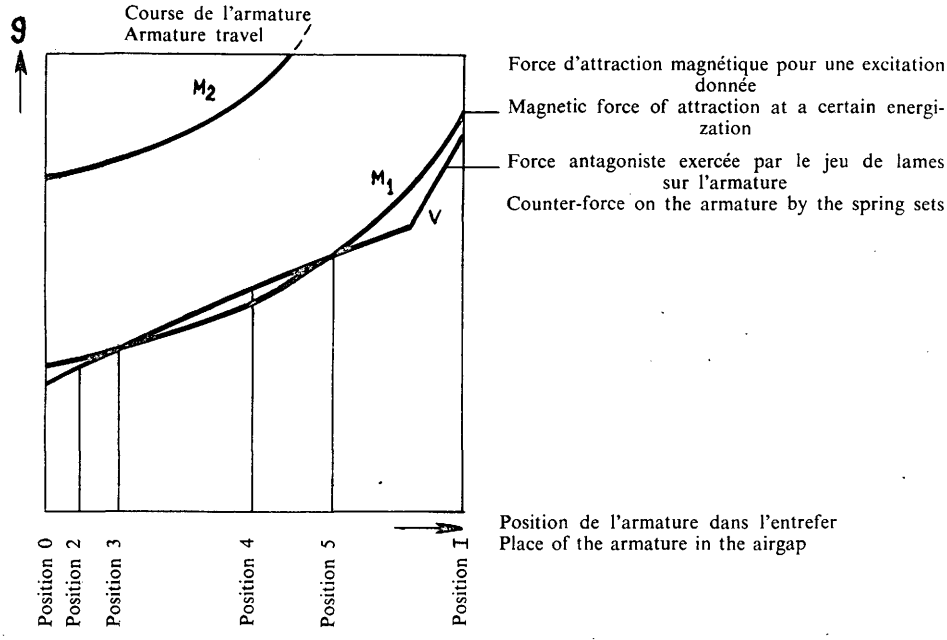


Fig. 1

The spring set of a relay will press with a certain force on the armature. This force is dependent on the place of the armature in the air-gap.

At a certain energization the armature is operated magnetically. This magnetic force of attraction is also dependent on the place of the armature in the air-gap.

As an example, a relay has been chosen with one contact, the force of the spring set exercised on the armature being represented by the line V. The bend of the line is the point at which the springs change their condition, viz. from making contact to not making contact.

The curve M_1 indicates the magnetic force of attraction at a certain energization.

If in this condition the armature would be held in position 2, it will leave this position when no longer fixed, because the magnetic force of attraction is larger than the force exercised by the spring set. The armature moves in the direction of position I.

If the armature would be in position 4, at the moment when it stops to be fixed, it will go in the direction of position 0.

Now the position 3 is a stable one. If the energization is not changed, the armature maintains its position.

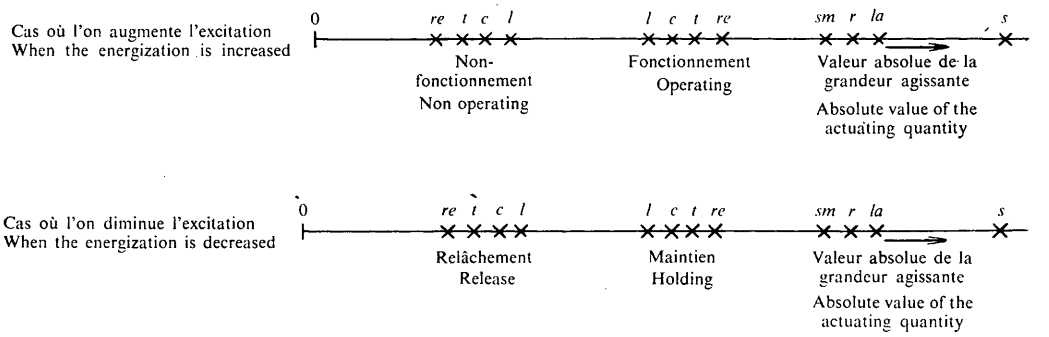
At this energization all the other positions are unstable. Position 5 is unstable too, because a very slight deviation from this position is immediately accompanied by a force increasing the deviation from this position.

Another energization can effectuate other stable positions. For the energization corresponding with the curve M_2, the position I is the only stable one; when there is no energization only the position 0 is stable.

No.	Term	Definition
2.7	Condition A (position)	Final condition (position) in which the relay is ready to perform its main function. E.g. with maximum relays, if the relay carries too little current to operate and with zero voltage relays, if the relay carries too much current to change-over.

No.	Term	Definition
2.8	Condition F (position)	Final condition (position) in which the relay has performed its main function. *Remark :* The conditions (positions) A and F are only spoken of, if moving from A to F is the main function.
		3.
3.1	Energize	To submit a relay to the actuating quantity.
3.2	Change over	To pass from one stable final condition (position) to another.
3.3	Operate	To pass from condition (position) 0 to condition (position) I.
3.4	Release	To pass from condition (position) I to condition (position) 0.
3.5	Respond	To pass from condition (position) A to condition (position) F.
3.6	Re-set	To pass from condition (position) F to condition (position) A.
		4.
4.1	Rating	Value of a quantity, adopted when the relay was designed.
4.2	Operating value	Value of the actuating quantity, at which from the condition (position) 0 the relay just reaches the condition (position) I.
4.3	Saturation	Condition in which the actuating quantity has such a value that the magnetic power in the ferro-magnetic circuit does no longer change linear with the actuating quantity (is situated in the bend of the magnetization-curve).
4.4	Release value	Value of the actuating quantity ,at which from the condition (position) I the relay just reaches the condition (position) 0. *Remark :* For electro-magnetical relays it is of importance to know what energizing condition is started from. Mostly the saturation condition is taken as such.
4.5	Non-operating value	Value of the actuating quantity at which the relay just does not leave the condition (position) 0.
4.6	Holding value	Value of the actuating quantity, at which the relay just does not leave the condition (position) I.
4.7	Critical value	Value of the actuating quantity, at which the relay can just reach a final condition (position) or just remain in it.
4.8	Testing value	Value of the actuating quantity at which, taking into account a normal maintenance period, a normal getting out of adjustment of the relay, and the spread owing to the manufacturing process, the readjustment of the relay is considered just not to be required.
4.9	Readjustment value	Value of the actuating quantity at which, taking into account a normal getting out of adjustment of the relay, after a normal maintenance period, the testing value is just not reached.
4.10	Operating-ampere-turns (in an electro-magnetic relay)	The number of ampere-turns at which the relay just reaches position I. *Remark :* The operating-ampere-turns are directly related to the critical value.

Example of the different values in non-polarized non-measuring relays

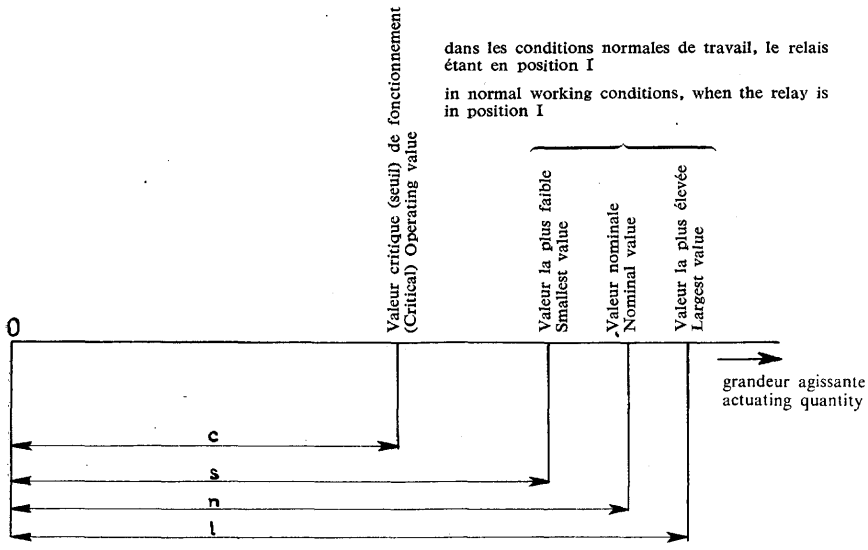


l = limit between making and not making contact
c = critical value
t = testing value
re = readjustment value
r = rating
s = saturation
sm = smallest actuating quantity
la = largest actuating quantity
} in normal working conditions

Remark : It is possible that in some relays one or some of the points mentioned here, coincide.

Fig. 2

No.	Term	Definition
4.11	Nominal operating reserve	Difference, expressed in percentage, between the operating value and the rating of the actuating quantity, considered with respect to the rating.
4.12	Minimum (respectively maximum) operating reserve	Difference, expressed in percentage, between the operating value and the lowest (respectively highest) value of the actuating quantity, which can occur in normal working-conditions, the relay being in position I, considered with respect to that lowest (respectively highest) value.
4.13	Release-operating ratio	The ratio of the release value to the operating value.
4.14	Responding value	Value of the actuating quantity at which the relay from the condition (position) A just reaches the condition (position) F.
4.15	Resetting value	Value of the actuating quantity at which the relay from the condition (position) F just reaches the condition (position) A.
4.16	Resetting-responding ratio	The ratio of the resetting value to the responding value.
		5.
5.1	Throw-over time	P.M.
5.2	Operating-make time	Time interval between the moment at which the energization is transferred from zero to the rating and the moment at which the make contact closes.



Nominal operating reserve $= \frac{n - c}{n} \cdot 100$

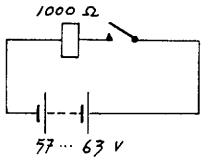
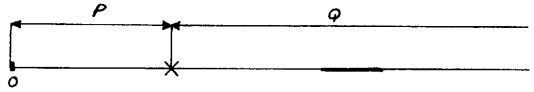
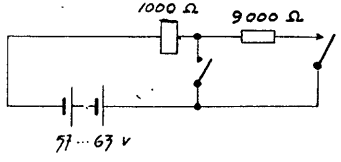
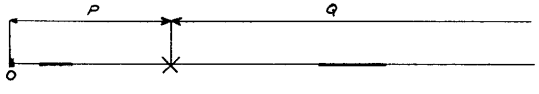
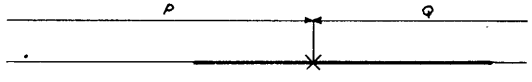
Minimum operating reserve $= \frac{s - c}{s} \cdot 100$

Maximum operating reserve $= \frac{l - c}{l} \cdot 100$

Fig. 3

No.	Term	Definition
5.3	Operating-break time	Time interval between the moment at which the energization is tranferred from zero to the rating and the moment at which the break contact opens.
5.4	Release-make time	Time interval between the moment at which the energization corresponding with the saturation (for electro-magnetic relays) and with the rating (for other relays) respectively, is reduced to zero, and the moment at which the make contact opens.
5.5	Release-break time	Time interval between the moment at which the energization corresponding with the saturation (for electro-magnetic relays) and with the rating (for other relays) respectively is reduced to zero and the moment at which the break contact closes.
5.6	Responding time	Time interval between the moment at which the responding value is reached or surpassed and the moment at which the contact has consequently changed over.
5.7	Re-setting time	Time interval between the moment at which the re-setting value is reached or surpassed and the moment at which, in consequence of this, the contact has just changed over.
5.8	Immediately operating relay	Relay for which no special measures have been taken to delay the change-over.
5.9	Delay	Time interval between the being changed of the electrical condition at the input of the relay, at which the relay cannot maintain the condition (position) in which it was, and the moment at which the relay reaches the other condition (position) at the output.

No.	Term	Definition
5.10	Slow (operating)/(releasing) relay	Relay for which special measures have been taken to delay the change-over.
		6.
6.1	Power consumption	Power consumed at the input of the relay at the rating of the actuating quantity.
6.2	Loading current	Current which can be carried by the relay at the output continuously or for a certain period of time.
6.3	Admissible switching-on power	Admissible value of the power which can be switched on by the relay under prescribed circumstances.
6.4	Admissible switching-on current	Admissible value of the current which can be switched on by the relay under prescribed circumstances.
6.5	Admissible switching-off power	Admissible value of the power which can be switched off by the relay under prescribed circumstances.
6.6	Admissible switching-off current	Admissible value of the current which can be switched off by the relay under prescribed circumstances.
		7.
7.1	Electromechanical relay	Relay in which the change in one or more electrical circuits is effectuated by the opening or closing of contacts.
7.2	Electromagnetic relay	Relay in which the opening or closing of contacts is effectuated by the force exercised by a magnetic field on ferromagnetic parts.
7.3	Electrodynamic relay	Relay in which the opening or closing of contacts is effectuated by the force which current carrying conductors experience in a magnetic field.
7.4	Ferrodynamic relay	Electro-dynamic relay in which ferromagnetic parts intensify the functioning.
7.5	Magneto-dynamic relay	Electro-dynamic relay in which the magnetic field is originated by a permanent magnet.
7.6	Induction relay	Relay in which the opening or closing of contacts is effectuated by the force of a magnetic field exercised on a conductor (e.g. ring, disc, drum) carrying current induced by this field.
7.7	Thermal relay	P.M.
7.8	Electrostatic relay	Relay in which the opening or closing of contacts if effectuated under the influence of an electrostatic force.
7.9	Electrostrictive relay	Relay in which the opening or closing of contacts if effectuated by the change of shape of the dielectricum which is influenced by an electric field.
7.10	Piezo-electrical relay	Electrostrictive relay in which the opening or closing of contacts is effectuated by the change of shape of a crystal.
7.11	Magnetostrictive relay	Relay in which the opening or closing of contacts is effectuated by the change of shape of magnetic material which is influenced by a magnetic field.
7.12	Static relay	P.M.
7.13	Electronic relay	Relay in which the change in one or more electrical circuits is effectuated by electronic means.

EXEMPLE - EXAMPLE	PAYS-BAS = DÉFINITIONS POUR LES RELAIS NETHERLANDS = DEFINITIONS FOR RELAYS — FIG. 4		UTILISATION USED AS
		UTILISATION NON MARGINALE USED NON-MARGINALLY	RELAIS AUTRES QUE LES RELAIS DE MESURE NON-MEASURING RELAY
		UTILISATION MARGINALE USED MARGINALLY	
RELAIS A MAXIMUM MAXIMUM RELAY			RELAIS DE MESURE MEASURING RELAY

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III/14
EDITION 2
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——— = COURANT CONSIDÉRÉ COMME ADMISSIBLE POUR LE RELAIS
CURRENT SUPPOSED TO BE POSSIBLE FOR THE RELAY

× = COURANT POUR LEQUEL LE RELAIS PASSE D'UNE POSITION A L'AUTRE
THE CURRENT AT WHICH THE RELAY CHANGES FROM ONE CONDITION INTO THE OTHER

P = CONDITION P

Q = CONDITION Q

No.	Term	Definition
7.14	Transductor relay	Relay in which the change in one or more electrical circuits is effectuated by a transductor.
7.15	Rectifier relay	Relay in which the change in one or more electrical circuits is effectuated by an arrangement of rectifiers.
		8.
8.1	Current relay	Relay in which the actuating quantity is dependent on a current.
8.2	Voltage relay	Relay in which the actuating quantity is dependent on a voltage.
8.3	Power relay	Relay in which the actuating quantity is dependent on a product of voltage and current.
8.4	Directional relay	Relay of which the condition (position) is dependent on the direction of a certain quantity.
8.5	Directional power relay	Relay of which the condition (position) is dependent on the direction in which a certain power is transmitted.
8.6	Frequency relay	Relay in which the value of the actuating quantity is dependent on a frequency.
8.7	Product relay	Relay in which the value of the actuating quantity is dependent on the product of two electrical quantities.
8.8	Quotient relay	Relay in which the value of the actuating quantity is dependent on the ratio between two electrical quantities.
8.9	Differential relay	P.M.
8.10	Biased relay	Relay in which the change-over is moreover influenced by an energization which is not dependent on the actuating quantity.
8.11	Measuring relay	Relay in which the value of the actuating quantity at which the relay changes over is contained in the uninterrupted series of values which are possible for this relay.
8.12	Non-measuring relay	Relay in which the value of the actuating quantity at which the relay changes over is not contained in the series of values which are possible for this relay.
8.13	Marginal (with a non-measuring relay)	The utilization of a relay, if it can obtain a certain energization different from zero, at which it must not operate.
		9.
9.1	Polarized relay	P.M.
9.2	Symmetrical adjustment (of a polarized relay)	Adjustment at which the value of the actuating quantity at which the relay changes over in one direction, is equal but opposed to the value at which the relay changes over in the other direction.
9.3	Non-symmetrical adjustment (of a polarized relay)	Adjustment at which the value of the actuating quantity at which the relay changes over in one direction is not equal to the opposite of the value at which the relay changes over in the other direction.
9.4	Remanence relay	Electromagnetic relay which, when operated, remains operated in consequence of remanent magnetism, even when the actuating quantity becomes zero.
9.5	Locking relay	Relay which cannot leave a final position before the locking has ceased to act.
9.6	Shunt-field relay	P.M.
9.7	Two-step relay	Relay with two I conditions (positions) in which one I condition (position) can be reached from condition (position) 0 only via the other I condition (position).

PAYS-BAS : DÉFINITIONS POUR LES RELAIS

NETHERLANDS : DEFINITIONS FOR RELAYS.

FIG. 5

DIFFÉRENCE ENTRE RELAIS POLARISÉ ET RELAIS NON POLARISÉ

DIFFERENCE BETWEEN POLARISED RELAY AND NON POLARISED RELAY

DIFFÉRENCE ENTRE RÉGLAGES < SYMÉTRIQUE / NON SYMÉTRIQUE

OU ENTRE RELAIS < A ÉXCITATION PRÉALABLE (FAVORISÉ) / SANS ÉXCITATION PRÉALABLE (NON FAVORISÉ)

DIFFERENCE BETWEEN < SYMMETRICAL / ASYMMETRICAL > ADJUSTMENT

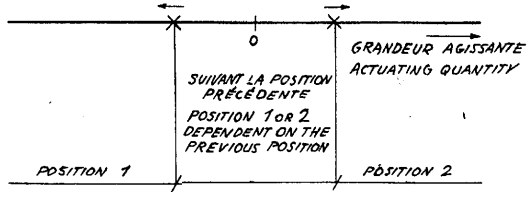
OR BETWEEN < PRE-ENERGIZED (BIASSED) / NON PRE-ENERGIZED (NON BIASSED) > RELAY

RELAIS POLARISÉ (A DEUX POSITIONS)

POLARIZED RELAY (WITH TWO FINAL POSITIONS)

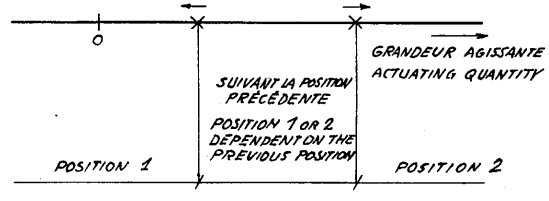
RÉGLAGE SYMÉTRIQUE, NON FAVORISÉ

SYMMETRICALLY ADJUSTED, NOT PRE-ENERGIZED (NOT BIASSED)



RÉGLAGE NON-SYMÉTRIQUE OU FAVORISÉ

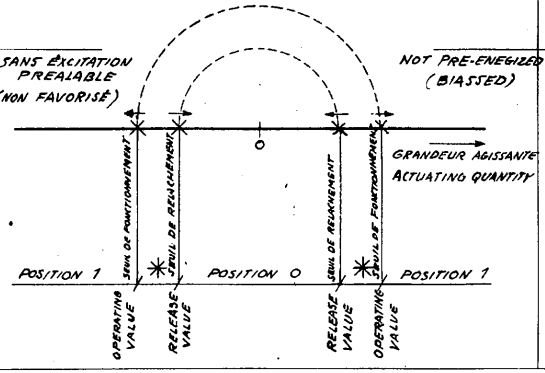
EXAMPLE OF ASYMMETRICAL AJUSTMENT OR PRE-ENERGIZED (BIAS)



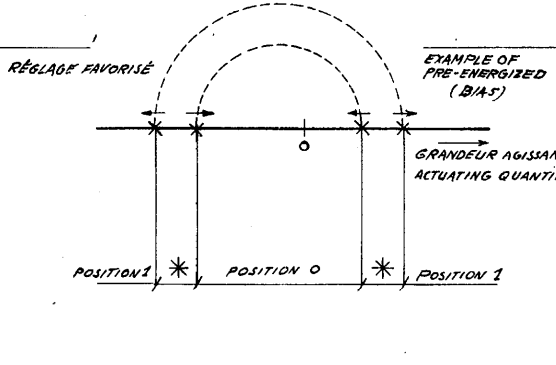
RELAIS NON POLARISÉ

NON-POLARIZED RELAY

✱ POSITION 0 OU 1 SUIVANT LA POSITION PRÉCÉDENTE
POSITION 0 OR 1 DEPENDENT ON THE PREVIOUS POSITION



RÉGLAGE FAVORISÉ



← X, X → : POINTS AUXQUELS LE RELAIS, ETANT DANS L'AUTRE POSITION, DÉPLACE SON ARMATURE SI LA GRANDEUR AGISSANTE VARIE DANS LE SENS INDIQUÉ PAR LA FLÈCHE.

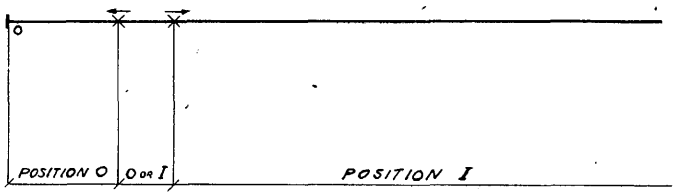
POINTS AT WHICH THE RELAY BEING IN THE OTHER POSITION MOVES ITS ARMATURE IN THE VALUE OF THE ACTUATING QUANTITY CHANGES IN THE DIRECTION OF THE ARROW.

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PAYS-BAS = DÉFINITIONS POUR LES RELAIS NETHERLANDS = DEFINITIONS FOR RELAYS FIG. 6

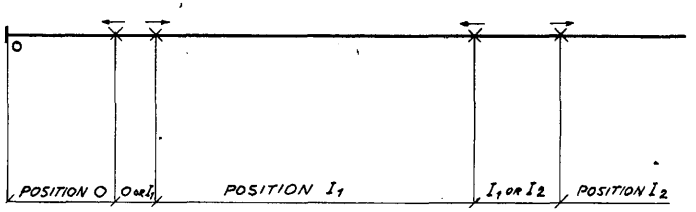
RELAIS A UN SEUL SEUIL

ONE-STEP RELAY



RELAIS A DEUX SEUILS (A CONTACTS ÉCHELONNÉS)

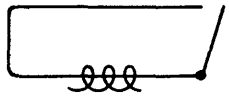
TWO-STEP RELAY

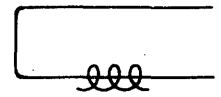


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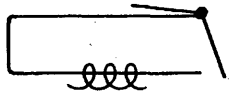
No.	Term	Definition
9.8	Balance relay	Relay the movable part of which has the shape of a balance which is subjected to two electrically-derived counteracting forces.
9.9	Side-stable relay	Relay with only two final conditions (positions) which cannot be defined as I respectively 0 condition (position) and which are taken alternately, in which the last taken condition (position) is maintained when the actuating quantity becomes zero.
9.10	Plug relay	Relay in which the connection between the relay and the wiring is made by means of plug contacts.
		10.
10.1	Front armature relay	Electromagnetic relay in which the armature can move exclusively in the plane through the core and the yoke, and in which the armature forms a short side of a rectangular magnetic circuit.
10.2	Angle armature relay	Front armature relay of which the armature is L-shaped.
10.3	Side armature relay	Electromagnetic relay in which the armature can move exclusively perpendicular to the plane through the core and the yoke.
10.4	Parallel armature relay	Electromagnetic relay in which the armature is situated almost parallel to the core.
10.5	Z-armature relay	Electromagnetic relay in which the armature is Z-shaped.
10.6	Moving coil relay	Electrodynamic relay in which the moving part exists of a coil which can rotate in an air gap.
10.7	Core armature relay	Electromagnetic relay in which the armature wholly or partly forms the core.
		11.
11.1	Turn	Loop-shaped conductor.
11.2	Winding	P.M.
11.3	Active winding *	Winding enclosing the main flux. * The word *active* must only be used if it is necessary to make a discrimination.
11.4	Holding winding	Winding destined to keep a relay in position I when this relay is already in this position.
11.5	Shortcircuit winding	Winding which is closed in itself.
11.6	Bifilar winding	Winding consisting of two insulated adjoining conductors, in which the current in the two conductors flows in opposite direction so that hardly any field is generated.
11.7	Coil	P.M.
11.8	Coil holder	Bearer of the winding(s).
11.9	Coil flange	Piece part at the ends of a coil.
		12.
12.1	Core	Ferromagnetic part of the magnetic circuit which is surrounded by a winding.
12.2	Yoke	Fixed ferromagnetic part of the magnetic circuit, which is not surrounded by a winding.
12.3	Joint	Part of the air route where two non-moving ferromagnetic parts of the magnetic circuit touch each other.

No.	Term	Definition
12.4	Armature	Device which wholly or partly is part of the magnetic circuit, and which can be moved under the influence of the magnetic flux.
12.5	Armature travel	Maximum distance over which the armature can move.
12.6	Pole (piece)	Part of the magnetic circuit from which the lines of force pass into the air gap and which is destined to influence the distribution of the flux in the air gap.
12.7	Residual—(e.g.—stud—plate)	Device in the air route which limits the length of the air route to a certain minimum value in order to prevent magnetic adherence.
12.8	Air route	Part of the magnetic circuit which does not consist of ferromagnetic material.
12.9	(Main) air gap	Part of the air route limited by those ferromagnetic parts which supply the greatest contribution of pulling force for the change-over of the relay.
12.10	Hinge air gap	Part of the air route in the neighbourhood of the hinge.
		13.
13.1	Contact	Set of conductive members which through their relative movement effectuate or interrupt the continuity of an electrical circuit.
13.2	Contact member	A conductive part destined to establish a contact.
13.3	Spring set	Mechanical unit of a member of contact springs.
13.4	Follow-up	Distance covered by both contact members from the moment at which they just make contact with each other till the moment at which the armature has reached the final position.
13.5	Stud ; plunger ; bridge ; comb ; ladder	Mechanical part between the armature and one or more contact springs, or between contact springs mutually.
13.6	Clearance	P.M.
13.7	Driven spring	Spring driven a stud ; plunger ; bridge ; comb ; ladder.
13.8	Non-driven spring	Spring that can only be moved when another spring is moved, these springs forming together one contact.
13.9	Contact travel	Distance covered by the contact point of a driven spring, when the armature moves from one final position to another. *Remark :* A driven spring can move over a distance equal to the contact travel. A non-driven spring can move at most over a distance equal to the follow-up. The contact travel is equal to the sum of contact gap and follow-up.
13.10	Supporting spring	Spring supporting a contact spring.
13.11	Make-contact	P.M.
13.12	Make spring	Non-driven spring which makes contact with a driven spring when the relay is in position I.
13.13	Break contact	P.M.
13.14	Break spring	Non-driven spring which makes contact with a driven spring when the relay is in position 0.

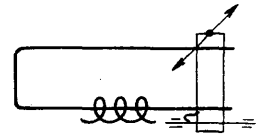




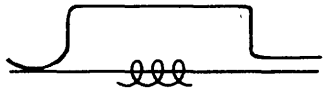
RELAIS A ARMATURE FRONTALE
FRONT ARMATURE RELAY



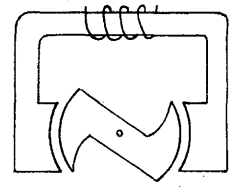
RELAIS A ARMATURE EN L
ANGLE ARMATURE RELAY



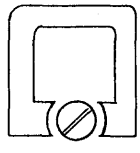
RELAIS A ARMATURE LATÉRALE
SIDE ARMATURE RELAY



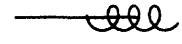
RELAIS A ARMATURE PARALLÈLE
PARALLEL ARMATURE RELAY



RELAIS A ARMATURE EN Z
Z - ARMATURE RELAY



RELAIS A BOBINE MOBILE
MOVING COIL RELAY



RELAIS A NOYAU MOBILE
COR ARMATURE RELAY

PAYS-BAS = DÉFINITIONS POUR LES RELAIS
NETHERLANDS = DEFINITIONS FOR RELAYS

FIG. 7

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No.	Term	Definition
13.15	Change-over contact	P.M.
13.16	Two-way contact with neutral position	Two-way contact having a neutral position between the two final positions.
13.17	Two-way spring	Spring that makes contact with another spring in either final position.
13.18	Make-before-break contact	A two-way contact of which during the change-over the three contact members are simultaneously making contact with each other.
13.19	Break-before-make contact	A two-way contact of which during the change-over the three contact members are not simultaneously making contact with each other.
13.20	Sequence controlled contacts	Contacts which are arranged to switch in a certain sequence.
13.21	Bridge contact	Contact with double break, consisting of two fixed members and a movable bridge.
13.22	Single contact	A contact in which the contact members touch at one surface only.
13.23	Twin-contact	A contact in which the contact members touch at only two surfaces arranged in parallel.
13.24	Multiple contact	A contact in which the contact members touch at more than two surfaces arranged in parallel.
13.25	Snap-action contact	A contact of which the movement is at a certain moment independent of the driving.
13.26	Wiping contact	Contact which during the change-over of the relay makes contact for a short time.
13.27	Contact gap	Distance of the contacts in the break position.
13.28	Contact force	The force which the contact members exercise upon each other in the closed position.
13.29	Chattering (of a contact)	The phenomenon that a contact which has just been closed opens again once or more times, or that a contact which has just been opened closes again one or more times.

SIGNALLING CONDITIONS FOR THE TELEX SERVICE

(C.C.I.T. Question 53 — C.C.I.T.T. Questions 1/10 and 2/10)

UNITED KINGDOM

Annex 9 to Document A.P. VIII/15
13 January 1956

Standardization of the signalling conditions for the Telex service

Barring Arrangements

With the extension of fully automatic switching between Telex subscribers in the International service, it becomes necessary to examine the problem of preventing fraudulent dialling of tandem international calls, as well as the possible requirement of preventing Telex subscribers from gaining access to certain circuits, for example, public office circuits.

Three known methods of controlling access by Telex subscribers to outlets which would otherwise be accessible, are as follows :

4.1 *By Signals*

4.1.1 *Pulse Signal*

With the first method, equipment is provided in association with an outlet or group of outlets so that, on seizure, a forced release condition is returned to the caller. For calls permitted to have access to the outlet, the forced release condition would be absorbed in the originating country. This method of barring access could be used to discriminate against only one class of originating traffic, although, in a given network, it could be used to bar access to outlets serving more than one class of terminating traffic. It is proposed that the form of this signal should be standardized in the International Service and should be used to prevent access by Telex subscribers to specified outlets.

4.1.2 "*Class of Traffic*" *Signal*

A second method of controlling access which may be used when working into permutation code selection systems, is to allot to each class of originating traffic a distinctive code character, which is included in the selecting information transmitted over the International Trunk, so that barring can be effected in the register of the receiving country. It is clearly desirable to standardize the allocation of code characters to classes of traffic.

4.2 *By Examination of Selecting Information*

A third method of controlling access is that of examining the selecting digits in the originating country. With fully automatic switching of international traffic, it will frequently be necessary to examine in the originating country the digits selected by the calling subscriber, in order to perform the following functions :

(a) to determine the point of entry where more than one international trunk route is provided between two countries;

(b) to prevent fraudulent access to outgoing international trunks in distant countries;

(c) to prevent access to public service circuits;

(d) to discriminate between the different tariff zones when more than one tariff zone exists for calls between two countries.

(*Note :* A simpler engineering solution to *(d)* is, however, to abolish multiple tariff zones and this is, in general, the preferred solution.)

The number of digits to be examined in order to perform these functions will determine the complexity of the equipment to be used and the simplest solution is achieved when the examination is limited to a prescribed single digit of the called subscribers number. By extending the examination to two digits, the code identifying capacity would be increased tenfold, with a consequential increase in cost and complexity. Most existing numbering schemes are laid out in such a way that when the foregoing facilities are likely to be required, the examination of a prescribed single digit will enable the requirement to be met. In general, the first digit of the subscribers number would be the prescribed single digit, but for those numbering schemes in which the subscribers have a uniform initial digit (usually " 0 ") to enable discrimination to be effected on inland calls, the following digit would be the one to be examined. It is considered, therefore, that where the numbering scheme is such that access can be barred by examining a prescribed single digit of the called subscribers number, barring should normally be effected in the originating country, and where this method can be used, it is considered preferable to the alternative methods set out in paragraphs 4.1.1 and 4.1.2.

U.S.S.R.

Document S.G. VII/28-E
5 November 1956

Telex signalling

Question 53 (1953-1956)

Is further standardization of the signalling conditions for the Telex service desirable? If so, what should these standards be?

Reply

The signalling system used in our Telex network is similar to the TW-39. The only difference is the " busy " signal, which is characterized by the connection and disconnection of the calling subscriber's apparatus in the case of a local communication and, when the trunk lines and apparatus are engaged. The signal is characterized by the repeated connection (three or four times) of the apparatus during a trunk call when the receiving channels or apparatus are engaged (for transit). This latter case is conditioned by the clearing system on both sides.

The clearing system on both sides is introduced to increase the signal/noise ratio of the automatic Telex connections. If both sides clearance is used, the change in polarity on the trunk

lines does not cause the connections to be broken. Clearing is obtained only when the clearing signal is sent by both subscribers. This principle is shown in Figure 1.

The upper part of the diagram shows the principle of clearance on one side, when the complete interruption of the call takes place as one of the subscribers sends the clearing signal, and, therefore, when the clearing signal is transmitted because of disturbance on the trunk line.

On the other hand, clearing on both sides (shown diagrammatically in the lower part of the figure) entails a complete interruption of the subscriber's connection, i.e. clearing the line and return to rest for the subscribers' sets and station apparatus, when the clearing signal is transmitted by both subscribers. The station is so constituted that clearance of each subscriber influences only the apparatus in his station ; signals similar to clearing signals (according to their polarity and length) arriving in any other station via the trunk line do not, therefore, disconnect the communication. Should the transmission have taken place when the called subscriber is absent, the latter's apparatus is automatically disconnected by means of a thermal relay in two to three seconds after the calling subscriber has sent the clearing signal.

The following is the sequence of signals transmitted over the trunk lines of the Soviet Telex networks for an incoming call :

1. *Line free*

The line free signal is characterized by the permanent start polarity signal.

2. *Call*

This is characterized by the change of start polarity to stop polarity.

3. *Call-confirmation signal*

This is transmitted over the return signalling channel after transmission of the call signal to show that the line is in good condition and to receive the reply of the distant terminal apparatus. The signal is characterized by despatch of a 25 millisec. stop impulse. A change in this pulse of more than $\pm$ 5 millisec. is inadmissible, since it would introduce trouble in the operation of the various elements in the diagram (the relay operating time decreases).

4. *Proceed-to-select*

This coincides with the call-confirmation signal in our system.

5. *Call-connected signal*

This is transmitted via the signalling return channel, showing that the call is transmitted to the called subscriber.

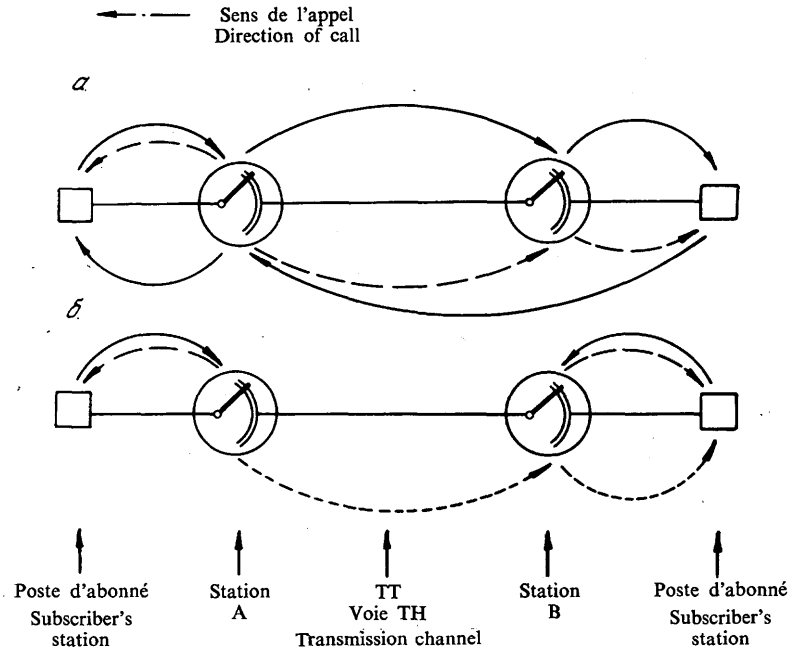
This signal is characterized by transmission of a permanent stop signal.

6. *Idle-circuit signal*

This is characterized by transmission of the permanent stop signal on both signalling channels.

7. *Clearing signal (end)*

This is characterized by transmission of the start signal for at least 300 millisec. and by the return of this signal within two to three seconds (if the message is transmitted when the subscriber is away).



A. Système de libération d'un côté.
System of clearance on one side.

B. Système de libération de deux côtés (principe de protection contre les perturbations des interconnexions).
System of clearance on both sides (protection against interconnection disturbance).

——► Sens principal du signal de libération.
Main direction of the line-free signal

——► Sens de libération.
Direction of clearance

- - -► Sens de libération avec délai (en absence du demandé).
Direction of clearance with delay (in the called subscriber's absence).

Fig. 1

C.C.I.T. N°91 F

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Diagramme du temps des signaux transmis sur les voies interurbaines pour la connexion d'arrivée

Diagram showing sequence of signalling transmitted over trunk lines for incoming connection

ATA-50

		voie transmission transmission channel		voie réception reception channel		Tolérances des paramètres de temps Time parameter tolerances + M sec −	
		polarité «départ» start pol.	polarité «arrêt» stop pol.	polarité «arrêt» stop pol.	polarité «départ» start pol.		
1	2	3	4	5	6	7	8
A	Ligne disponible Line free						
B	Appel / Call						
C	Signal de réponse et d'invitation à numéroter. Call-confirmation signal and proceed-to-select				25 mest (ms)	5	5
D	Numérotation Selection						
E	Signal de réponse du demandé Called subscriber's reply signal						
F	Signal de libération de la part du demandeur sur voie de transmission Clearing signal from the caller on the transmission channel				3-4cst 3-4s		

C.C.I.T. N°92/1 F

SG VII/28

EDITION 1 NOVEMBRE 56

1	2	3	4	5	6	7	8
H	Signalisation de dérangement de l'appareillage à commutation automatique ou de la voie interurbaine d'interconnexion Signal indicating that the automatic switching equipment or the connecting trunk circuit is out of order					50	50 200
J	Signal indiquant que le demandé n'est pas ou n'est plus un abonné Signal indicating that the called person is not or is no longer, a subscriber.						
J	Signal de réponse du commutateur manuel en parallèle en cas du blocage de la voie interurbaine. Reply signal from the manual switchboard in parallel in case of blockage of the trunk channel						

C.C.I.T. N°92/2 F

SG VII/28

EDITION 1 NOVEMBRE 56

1	2	3	4	5	6	7	8
4	Signalisation d'occupation 1. dans le cas d'absence de l'appareillage à commutation libre ou des voies interurbaines Busy signal 1. In case of absence of free switching apparatus or of trunk channels ;					50	50 200
	2. Signal de réponse du commutateur manuel en parallèle lors de l'occupation de l'abonné interurbain 2. Reply signal from the manual switchboard in parallel when the trunk subscriber is engaged.						

C.C.I.T. N°92/3 F

SG VII/28

EDITION 1, NOVEMBRE 56

8. *" Busy " signal*

Characterized by transmission of the stop signal for 150 millisec., followed by a start impulse lasting 1000 millisec.

There is a tolerance of ± 50 ms in the 150 ms pulse.

There is a tolerance of — 200 ms in the 1000 ms pulse.

9. *Service signals*

If the called subscriber's station is out of order, the permanent start signal is transmitted. Should there be a technical fault on the channel, the " busy " signal is transmitted.

UNITED KINGDOM

Document S.G. VII/30-E
12 November 1956

Further standardization of the signalling conditions for the Telex service

Question 53

Is further standardization of the signalling conditions for the Telex service desirable, and, if so, what should the standards be? (See recommendation E.1.)

Reply

The present form of recommendation E.1 is unsatisfactory in that it does not cover adequately the requirements of fully automatic working. The reference to this method of working in the note to Table I of the Annex, has the effect of specifying those signals in existing systems which should be avoided on the international section of the connection in the case of fully automatic working between subscribers. There is, therefore, no positive indication to Administrations wishing to introduce new systems, of the suitability for international working, of the characteristics of the signals they wish to adopt for their internal networks. It is considered highly desirable, therefore, that recommendation E.1 should be revised to indicate clearly the principles on which the signalling standards for fully automatic working should be based.

There are various principles which might be adopted leading to modification at:

a) the outgoing end;

b) the incoming end, or

c) both ends on a prescribed basis.

The last alternative has the potential advantage of allowing standards to be specified so that the range of equipment designs required by an Administration would be kept to a minimum. Thus, if it were possible to standardize on two sets of signal characteristics for working to systems using Type A and Type B signalling respectively, the equipment types to be provided by each

Administration for terminating international Telex trunks would be limited to a single equipment at the incoming end and one each for outgoing circuits to Type A and Type B systems respectively. However, it is very doubtful whether standards could be devised which would be acceptable to all Administrations, in which case it may be preferable to retain the principle already agreed for semi-automatic working (See Rec. H.1 Art. 22) of modifying at the outgoing end, except where otherwise agreed between the Administrations concerned. This assumes that the incoming network conforms to the requirements of recommendation E.1, paragraphs 1 to 9 (as amended by C.C.I.T. Document A.P. VIII/15, Annex 1).

It is proposed therefore that the Annex to recommendation E.1 should be revised so that the tables of signal characteristics show separately the conditions applicable to semi-automatic and fully automatic working respectively, as indicated in the attached draft revised Annex.

For the information of the Study Group, the accompanying diagram (C.C.I.T. No 100) sets out the signalling sequences for the U.K. Automatic Telex System.

Regarding the question of barring, it is noted that Study Group VIII has drawn attention to the need of technical arrangements to prevent irregular access from Telex subscribers to public offices. The U.K. Administration has already given its views on this problem and has no further observations to make at this stage.

H. E. WILCOCKSON,
Reporter Study Group VII.

Annex

REVISED ANNEX (TO RECOMMENDATION E.1.)

The characteristics of the signals defined in paragraphs 3, 4, 6 and 9 may take different forms depending on the nature of the distant switching equipment, the method of working, and the signalling system employed.

Existing signalling systems can be broadly divided into two basic types designated A and B as follows:

System A is characterized by the condition corresponding to the stop element in accordance with International Telegraph Alphabet No. 2 on the backward signalling path during the establishment of a call (TW35).

System B is characterized by the condition corresponding to the start element in accordance with International Telegraph Alphabet No. 2 on the backward signalling path during the establishment of a call.

The characteristics of typical signalling conditions used in existing or projected switching systems are given in detail below:

I. International Telex circuits terminated on distant automatic switching equipment

Table 1 a. Semi-Automatic Working

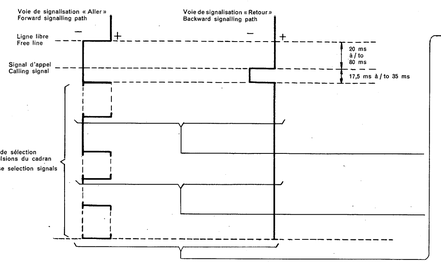
Signal	Type A	Type B
Call-confirmation (See 3 & 4 *a)* above)	i) permanent " stop " polarity	25 ms pulse of " stop " polarity
Proceed-to-select (See 4 *a)* above)	i) teleprinter signal(s) ii) permanent " stop " polarity	25 ms pulse of " stop " polarity
Call connected (See 6 above)	i) teleprinter signals *Note :* the teleprinter signals may be preceded by a 150 ms pulse of start polarity	" Stop " polarity for at least two seconds
Busy (See 9 above)	Teleprinter signals followed by clearing signal	i) 200 ms pulse of " stop " polarity followed by clearing signal ii) 200 ms of " stop " polarity followed by teleprinter signal
Out of order and number unobtainable (See 9 above)	i) teleprinter signals followed by clearing signal ii) clearing signal	i) permanent " start " polarity ii) 200 ms pulse of " stop " polarity followed by clearing signal iii) 200 ms pulse of " stop " polarity followed by teleprinter signals and clearing signal.

O. O. REF.

GROUP. D'M'N.

FIG. 1. SIGNAUX DE SÉLECTION
SELECTION SIGNALS

En provenance du système d'outre-mer
From overseas system



Condition	Durée de la période a) Note 2 / Duration of period (a) Note 2	Expression de code / Code text							
Pas de circuit / No circuits	450 ms à/to 9,2 s	C/R	L/F	L/S	N	C	L/S	C/R	L/F
Le numéro demandé n'est pas attribué ou est inaccessible / The called number is spare or not accessible	130 ms à/to 10,7 s	C/R	L/F	L/S	N	P	L/S	C/R	L/F
L'abonné demandé est occupé / The called subscriber is busy	200 ms à/to 10,7 s	C/R	L/F	L/S	O	C	C	C/R	L/F
L'abonné demandé ne désire pas recevoir des messages / The called subscriber does not wish to receive messages	300 ms à/to 10,4 s	C/R	L/F	L/S	A	B	S	C/R	L/F
La ligne de rattachement est en dérangement / The station line is faulty	130 ms à/to 10,1 s	C/R	L/F	L/S	D	E	R	C/R	L/F

Tableau 1 / Table 1

NOTES :

1. Toutes les durées indiquées sont provisoires.
2. Ne dépasse probablement pas 5 secondes pour plus de 1 % des appels.
3. — polarité d'arrêt, + polarité de départ.
4. Pour la nature des signaux, voir Tableau 1.
5. Pour les appels de ces services, en cas d'occupation, etc., les signaux de service indiqués dans le Tableau 2 seront transmis en retour.
6. Pour les appels des positions d'essai télex, la figure 3 est applicable en cas de réponse immédiate et la figure 4 est applicable en cas d'attente.

FIG. 2. APPEL D'UN POSTE D'ABONNÉ AU TÉLEX
CALL TO TELEX SUBSCRIBERS STATION

Fig. 2 A. Connexion établie / Connexion established

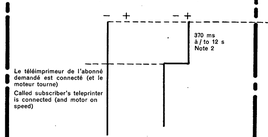
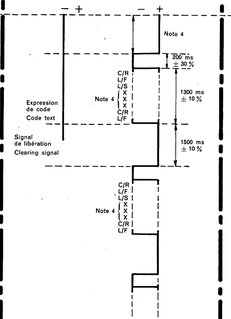


Fig. 2 B. Connexion non établie en raison de l'occupation, etc. / Connexion not established because of busy conditions etc.



Condition	Durée de la période a) / Duration of period (a)	Expression de code / Code text							
Pas de circuit / No circuits	450 ms à/to 3,7 s	C/R	L/F	L/S	N	C	L/S	C/R	L/F
Le numéro demandé n'est pas attribué ou est inaccessible / The called number is spare or not accessible	130 ms à/to 3,7 s	C/R	L/F	L/S	N	P	L/S	C/R	L/F
Toutes les lignes vers le service demandé sont occupées / All lines to the called service are busy	450 ms à/to 3,7 s	C/R	L/F	L/S	O	C	C	C/R	L/F

Tableau 2 / Table 2

NOTES :

1. All timings are provisional.
2. Unlikely to exceed 5 s on more than 1 % of calls.
3. — Stop polarity. + Start polarity.
4. For text end timing of signals see table 1.
5. On calls to these services if busy conditions etc., are encountered, the service signals as shown in 'table 2' will be returned.
6. For calls to telex test positions which are answered immediately figure 3 applies, for calls which encounter waiting conditions figure 4 applies.

FIG. 3. APPEL VERS LA POSITION DE RENSEIGNEMENTS TÉLEX OU VERS LA POSITION D'ESSAI TÉLEX (NOTE 6)
CALL TO TELEX ENQUIRY POSITION OR TELEX TEST POSITION (NOTE 6)

Fig. 3 A. Connexion établie / Connexion established

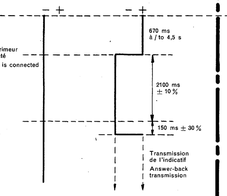


Fig. 3 B. Connexion non établie en raison de la non-réception des signaux d'indicatif / Connexion not established because of failure to receive answer-back signals

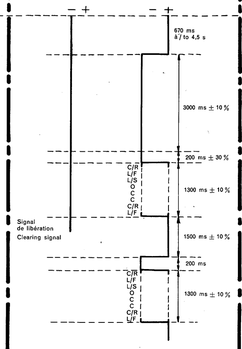


FIG. 4. APPEL VERS LA POSITION D'ESSAI TÉLEX (NOTE 6)
CALL TO TELEX TEST POSITION (NOTE 6)

Fig. 4 A. Connexion établie / Connexion established

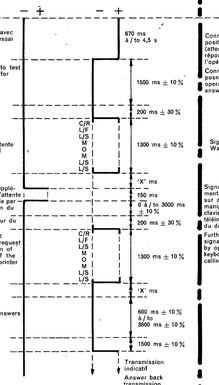


Fig. 4 B. Connexion non établie en raison de la non-réception des signaux d'indicatif / Connexion not established because of failure to receive answer-back signals

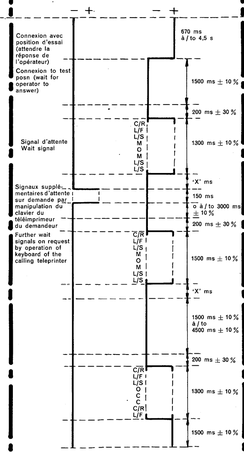


FIG. 5. APPEL DU COMMUTATEUR TÉLEX MANUEL
CALL TO TELEX MANUAL SWITCHBOARD

Fig. 5 A. Connexion établie / Connexion established (Période de conversion) (Note 5) / (Conversion period) (Note 5)

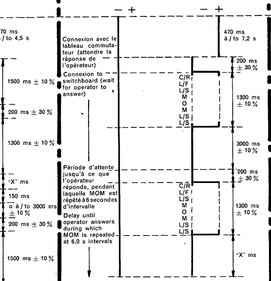
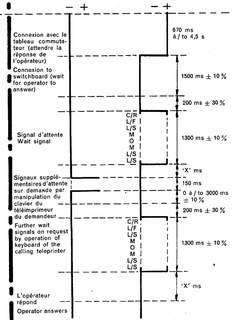


Fig. 5 B. Connexion établie / Connexion established (Disposition provisoire du stade final) (Note 5) / (Provisional ultimate arrangement) (Note 5)



DGM. TG 5278

ROYAUME UNI — SERVICE TELEX
U.K. AUTOMATIC TELEX SERVICE

SIGNAUX POUR LE TRAFIC INTERNATIONAL ENTRANT

SIGNALS FOR INCOMING INTERNATIONAL TRAFFIC

C.C.I.T. N° 100 E
SG VII/30
ISSUE 1 NOV. 56

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Table 1 b). Fully-Automatic Working

Signal	Type A	Type B
Call confirmation (See 3 & 4 *a)* above)	i) permanent " stop " polarity	25 ms pulse of " stop " polarity
Proceed-to-select (See 4 *a)* above)	i) 40 ms pulse of " start " polarity ii) permanent " stop " polarity	25 ms pulse of " stop " polarity
Call-connected (see 6 above)	i) teleprinter signals ii) 150 ms pulse of " start " polarity followed by " stop " polarity for at least 2 seconds	" stop " polarity for at least 2 seconds
Busy (See 9 above)	Teleprinter signals followed by clearing signal	i) 200 ms pulse of " stop " polarity followed by clearing signal ii) 200 ms pulse of " stop " polarity followed by teleprinter signals and clearing signal
Out of order and number unobtainable (See 9 above)	i) teleprinter signals followed by clearing signal ii) clearing signal	i) permanent " start " polarity ii) 200 ms pulse of " stop " polarity followed by clearing signal iii) 200 ms pulse of " stop " polarity followed by teleprinter signals and clearing signal

II. International Telex circuits terminated on distant manual switching equipment

Signal	Type A	Type B
Call-confirmation (See 3 above)	Permanent " stop " polarity	25 ms pulse of " stop " polarity
Proceed to transmit (See 4 *b)* above)	Teleprinter signals	" Stop " polarity followed by teleprinter signals
Call-connected (See 6 above)	Teleprinter signals	Teleprinter signals
Busy, out-of-order and number unobtainable (See 9 above)	Teleprinter signals	Teleprinter signals

NETHERLANDS

Document S.G. VII/29
12 November 1956

Telex signalling time diagram

With reference to paragraph 2 of the preliminary report on the activities of Study Group VII (Document AP VIII/15), I am sending you the time sequence diagram for signals transmitted on Telex circuits to the Netherlands in the fully-automatic service. (Diagram C.C.I.T. No. 99.)

Annex: 1

SWEDEN

Document S.G. VII/31-E
20 November 1956

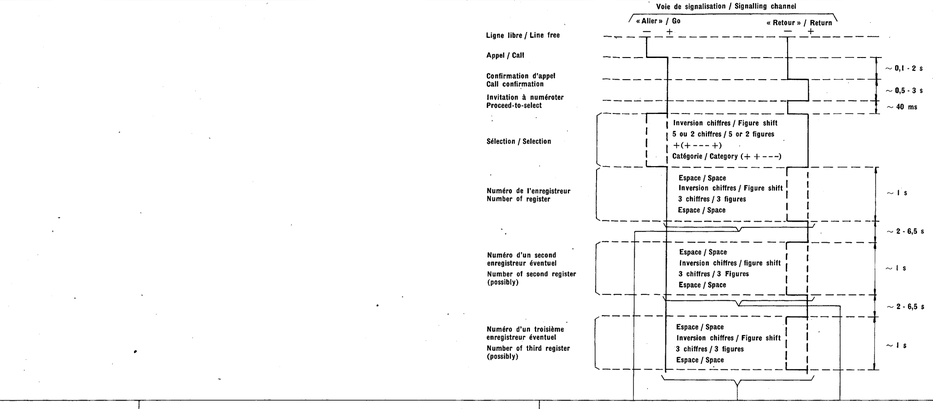
Time diagram for Telex signalling

Dear Sir,

In conformity with the wish expressed by the Chairman of Study Group VII (C.C.I.T. Document S.G. VII/27-E), I am enclosing a time diagram concerning the signalling in Telex calls received in Sweden. (C.C.I.T. Diagram, No. 102, page 199.)

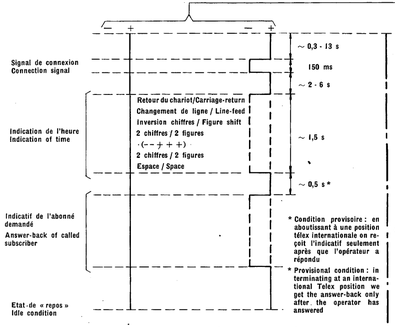
We intend shortly to reduce the normal time between the completion of dialling and the call connection by 1-1.5 seconds.

C.C.I.T. N° 99 F
SGVII/29
EDITION 1 NOV 56



Note : Là où des valeurs de temps minima et maxima sont indiquées, le délai se rapprochera en moyenne du minimum
— = polarité de départ
+ = polarité d'arrêt

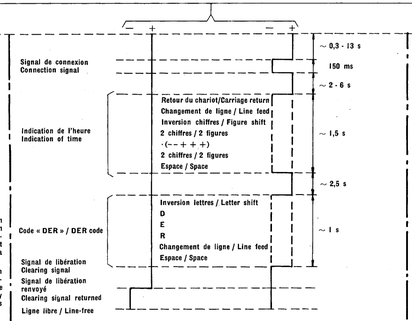
N. B. : Where maximum and minimum times are shown, the average delay will tend to approach the minimum
— = start polarity
+ = stop polarity



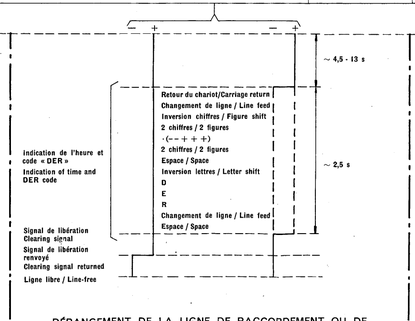
* Condition previsoire : en aboutissant à une position télex internationale on reçoit l'indicatif seulement après que l'opérateur a répondu

* Provisional condition : in terminating at an international Telex position we get the answer-back only after the operator has answered

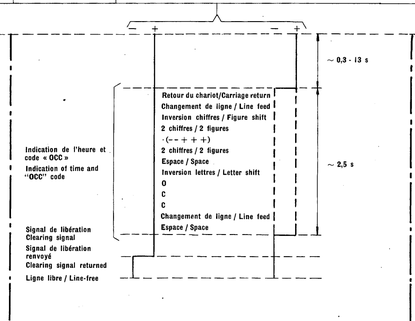
COMMUNICATION ÉTABLIE
CALL ESTABLISHED



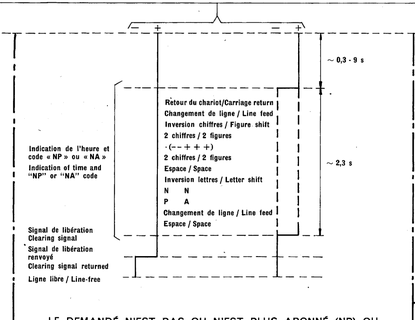
ÉMETTEUR DE L'INDICATIF DE L'ABONNÉ DEMANDÉ NE FONCTIONNE PAS
THE CALLED SUBSCRIBER'S ANSWER-BACK DEVICE IS OUT OF ORDER



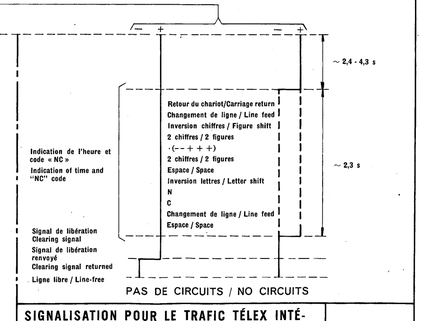
DÉRANGEMENT DE LA LIGNE DE RACCORDEMENT OU DE L'ALIMENTATION DU COFFRET DE COMMANDE DE L'ABONNÉ DEMANDÉ
FAULTY STATION LINE OR FAULTY FEED OF THE CALLED SUBSCRIBER'S CONTROL UNIT



ABONNÉ DEMANDÉ EST OCCUPÉ
THE CALLED SUBSCRIBER IS ENGAGED



LE DEMANDÉ N'EST PAS OU N'EST PLUS ABONNÉ (NP) OU CORRESPONDANCE POUR L'ABONNÉ DEMANDÉ N'EST PAS ADMISE (NA)
THE CALLED PERSON IS NOT, OR IS NO LONGER, A SUBSCRIBER (NP) OR NO CORRESPONDENCE FOR THE CALLED PERSON IS ADMISSIBLE (NA)



PAS DE CIRCUITS / NO CIRCUITS

SIGNALISATION POUR LE TRAFIC TÉLEX INTÉGRALEMENT AUTOMATIQUE VERS LES PAYS-BAS
SIGNALLING FOR FULLY AUTOMATIC TELEX TRAFFIC TOWARDS THE NETHERLANDS

Tgf CB1 J5

PTT CENTR. AFD. TG.

AUTOMATISCH VERKEHR NAAR NEDERLAND — GEDRUCKT VERKEHR

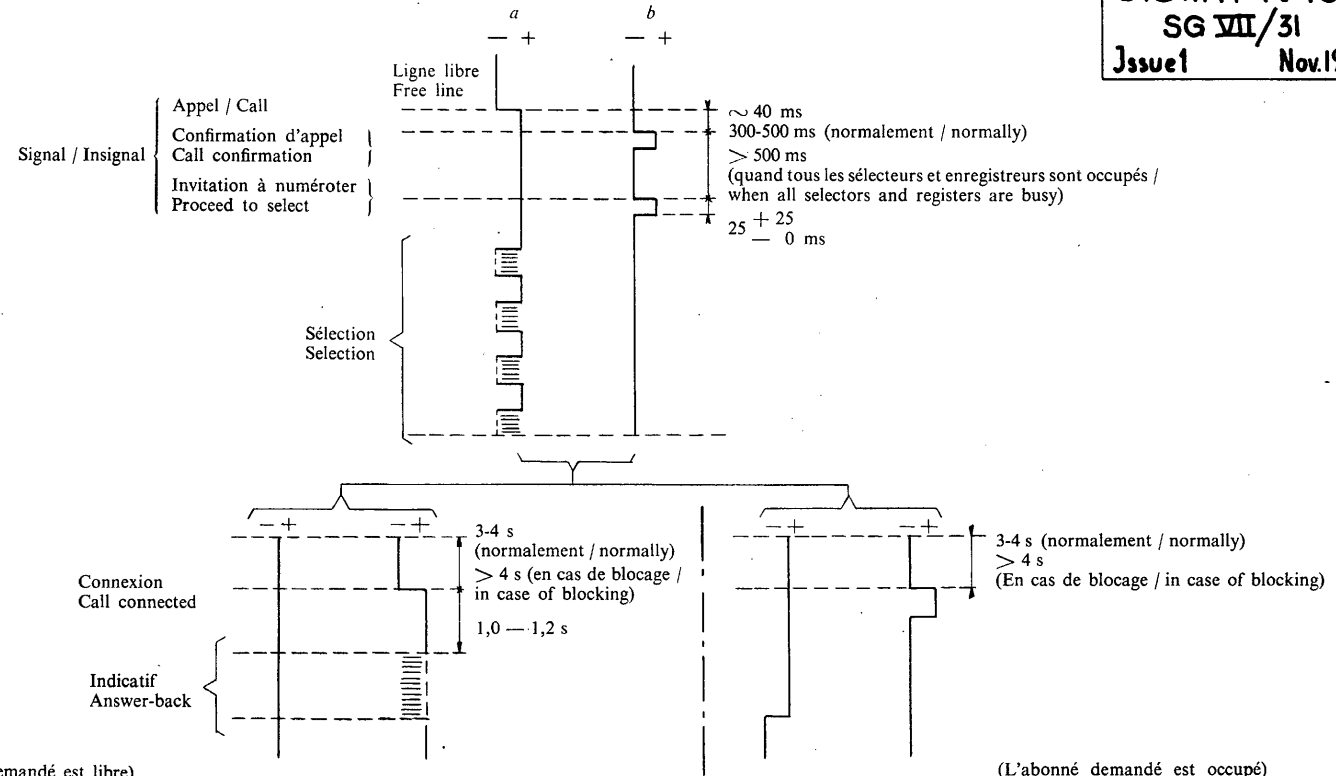
GEZIEN/LU/HO	CHEF TGK	1	7 - 1 - 54	JAAR/AN/YEAR	DATUM/DATE

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Suède : Signalisation des appels en provenance de l'étranger / Signalling in calls from abroad (Sweden)

C.C.I.T. N°102
SG VII/31
Issue1 Nov.1956



FRANCE

Document S.G. VII/32-E
24 November 1956

Telex signalling time diagram

To the Interim Director, C.C.I.T.,

At the request of the Chairman of Study Group VII (C.C.I.T. Document A.P./VIII-15, dated 7 August, 1956, Item 2), I am sending you the contribution of the French Administration for the study of Question 53, consisting of nine time sequence diagrams applying to nine cases likely to occur for automatic or semi-automatic switching on the French network.

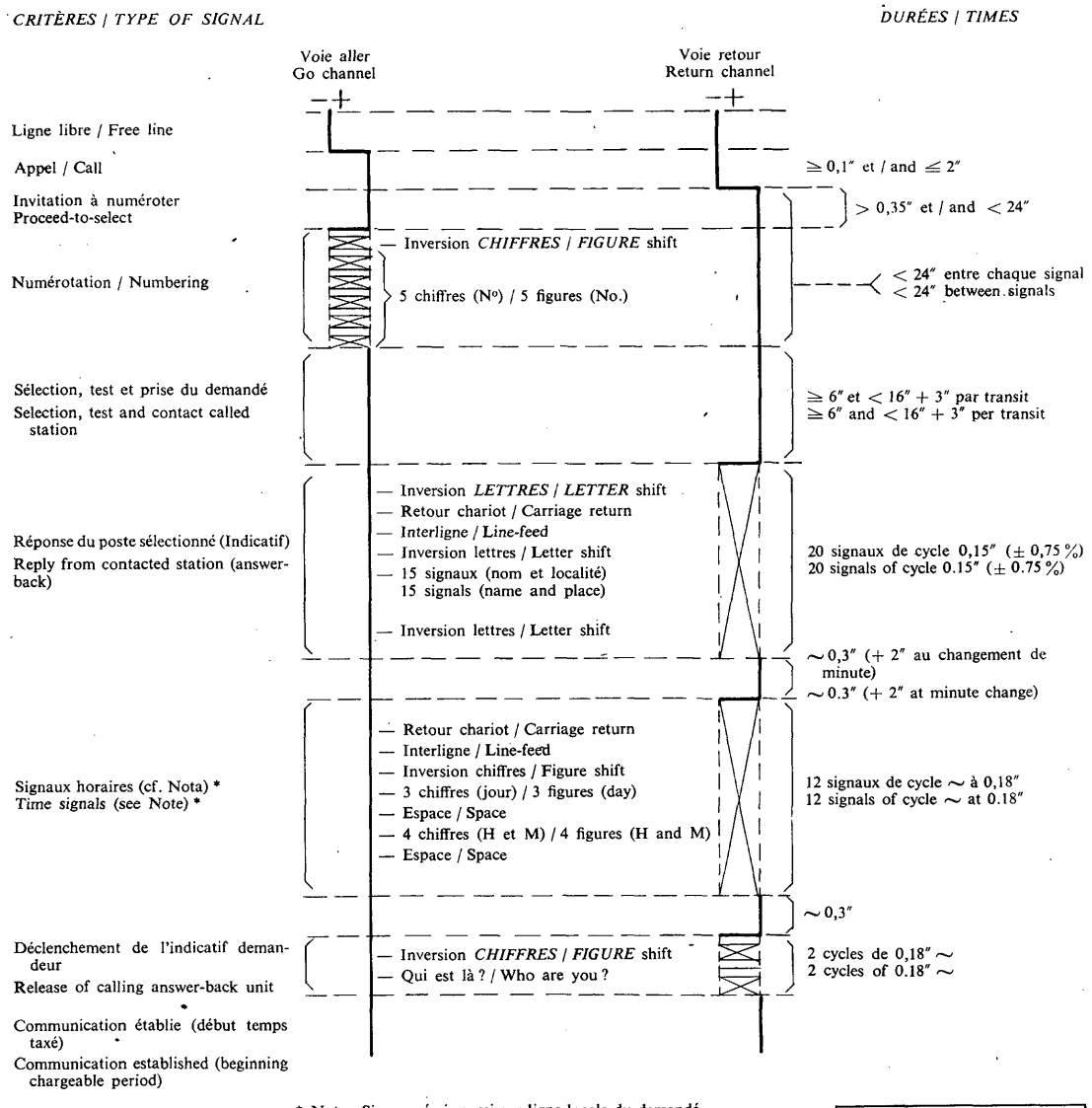
Some comments on the diagrams are contained in the Annex below.

P. PELLE,

D. J. P. FAUGERAS,

French rapporteurs, Study Group VII

Circuit international Télex / International Telex circuit



* Nota : Signaux émis aussi sur ligne locale du demandé.
* Note : Signals also sent on called subscriber's local line.

Commutation télégraphique
Telegraph switching

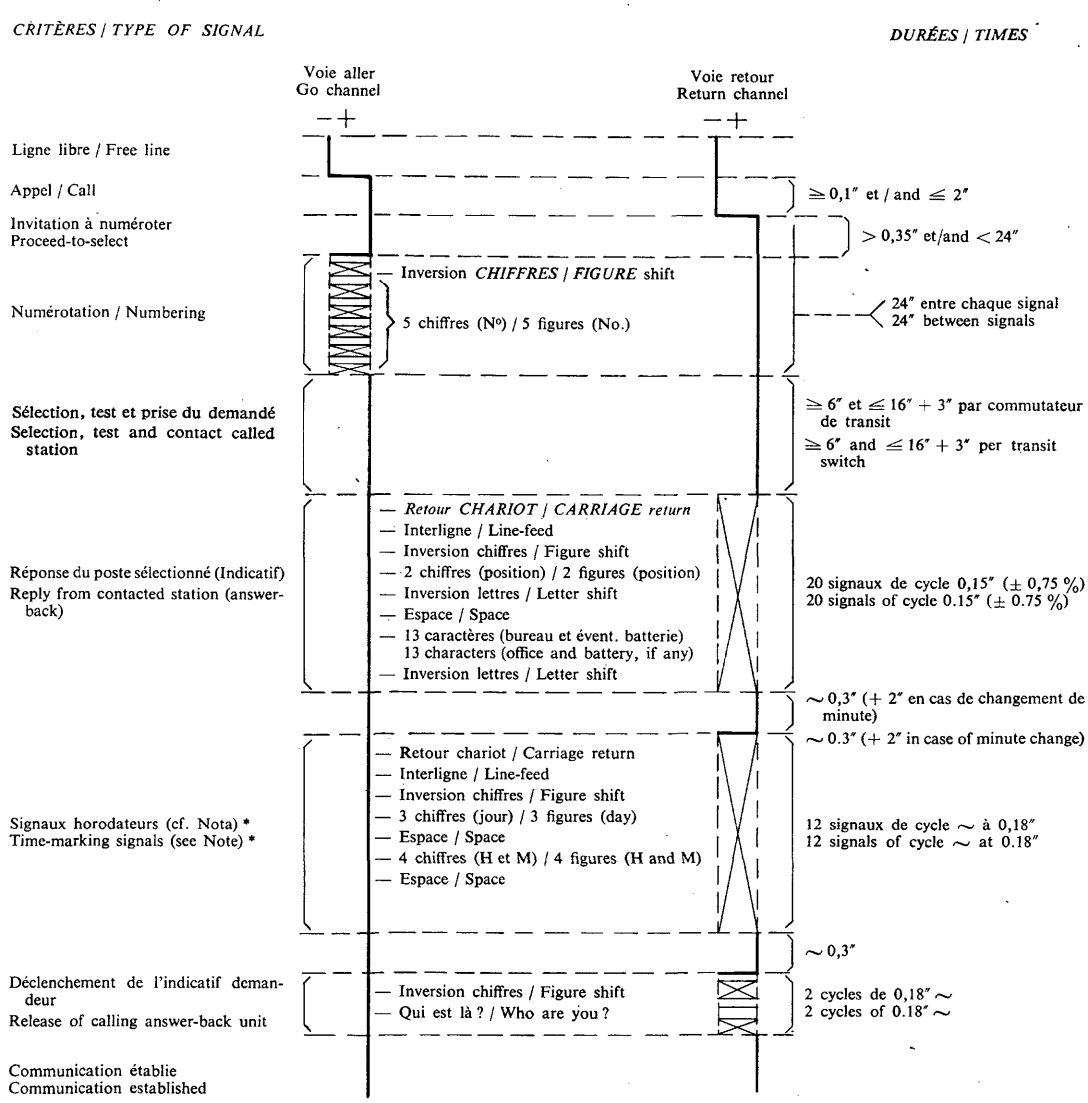
Critères sur un circuit international entrant
Signalling for incoming international circuit

Communication établie avec abonné Télex
Communication established with Telex subscriber

C.C.I.T. 103/1 E
S.G. VII/32
Edition 1 Nov. 56

N° H - 250

Circuit public international (spécialisé) / International public circuit (specialized)



* Nota : Signaux émis aussi dans le sens ALLER sur ligne locale du demandé.

* Note : Signals also sent in GO direction on called subscriber's local line.

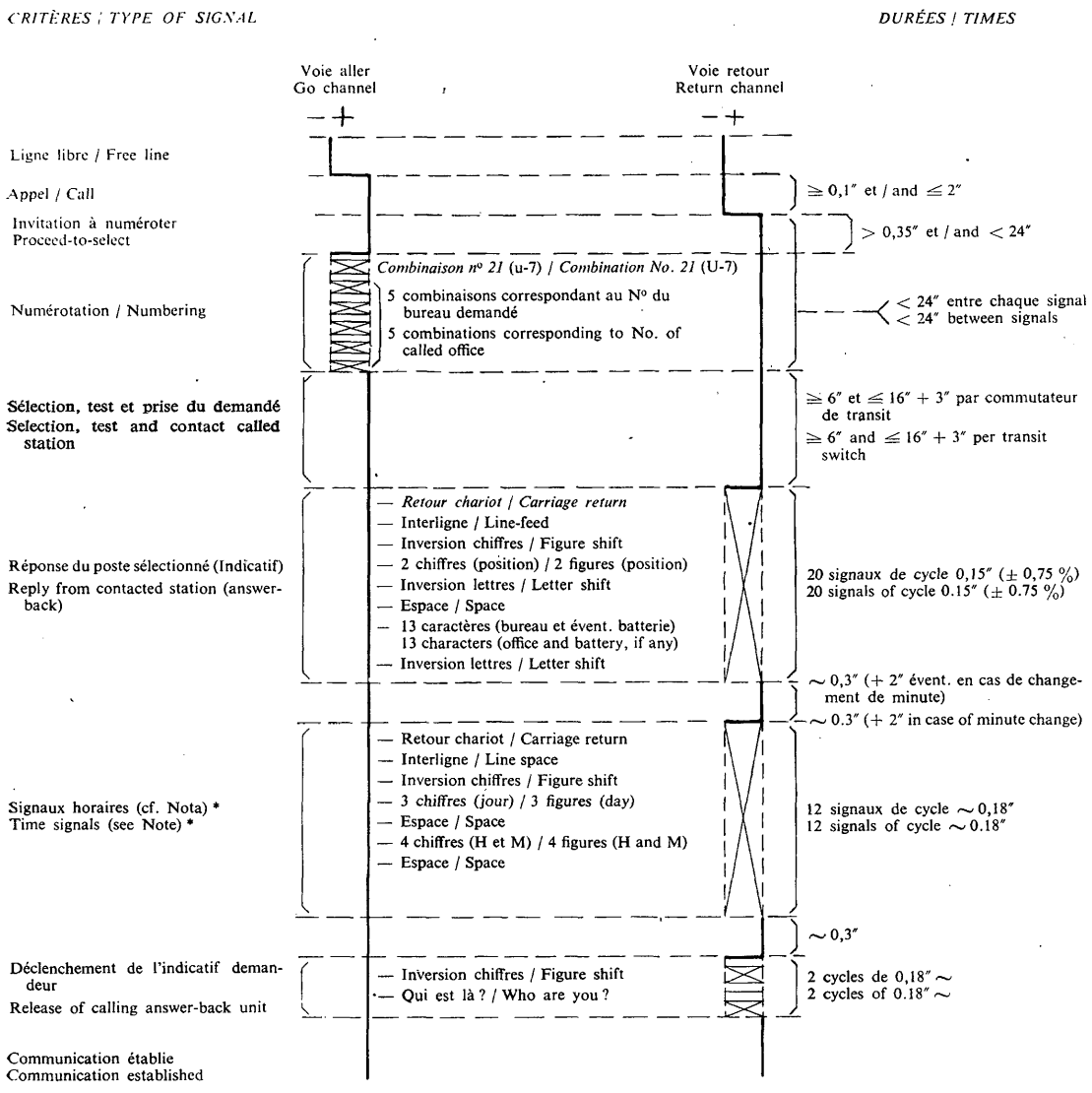
Commutation télégraphique
Telegraph switching

Critères sur circuit international public spécialisé
Signalling for specialized international public circuit

Communication établie avec abonné public
Communication established with public subscriber

C.C.I.T. 103/2 E
S.G. VII/32
Edition 1 Nov. 56
N° H - 251

Circuit international banalisé / International circuit for common use



* Nota : Signaux émis aussi dans le sens ALLER sur ligne locale du bureau demandé.

* Note : Signals sent also in the GO direction on the called office's local line.

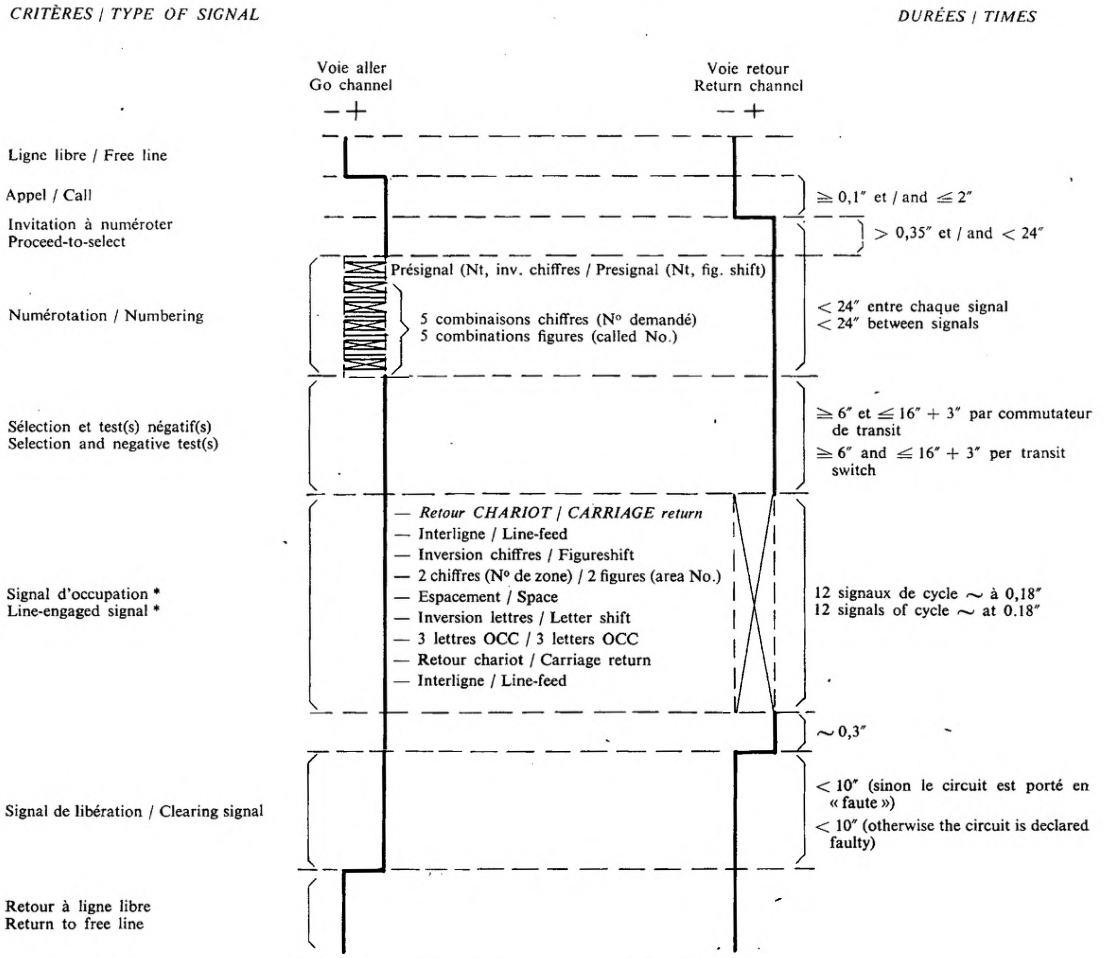
Commutation télégraphique
Telegraph switching

Critères sur circuit international banalisé
Signalling on international circuit for common use

Communication établie avec abonné public (avec interdiction)
Communication established with public subscriber (with prohibition)

C.C.I.T. 103/3 E
S.G. VII/32
Edition 1 Nov. 56
Nº H - 252

Circuit international / International circuit



* Nota : Dans le cas d'un appel destiné à un bureau public français, cette signalisation n'est donnée au demandeur que si toutes les positions de débordement locales sont occupées.

* Note : In the case of a call to a French public office, this signalling is not given to the caller unless all the local overflow positions are engaged.

Commutation télégraphique
Telegraph switching

Critères sur circuit international entrant
Signalling on incoming international circuit

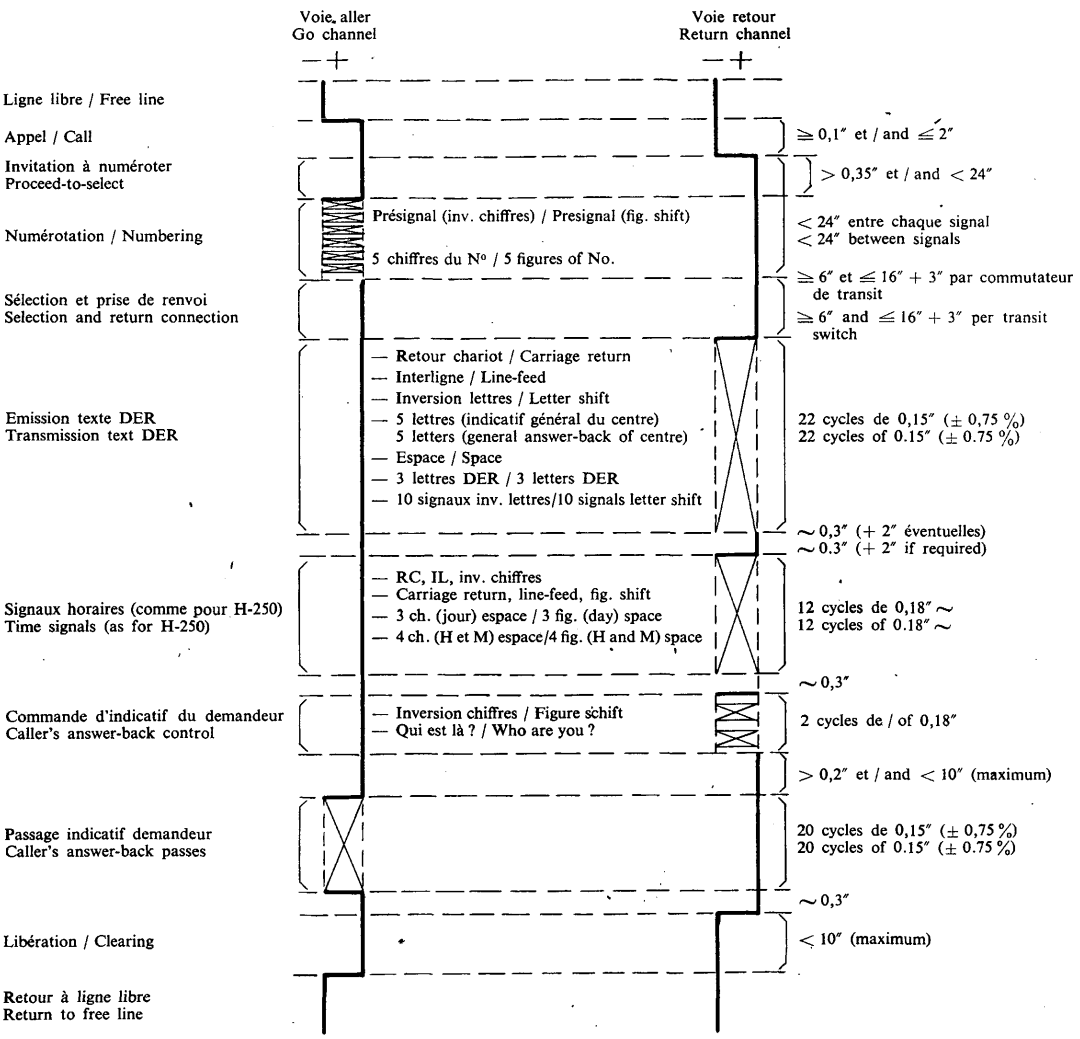
Occupation de l'abonné demandé
Called subscriber engaged

C.C.I.T. 103/4 E
S.G. VII/32
Edition 1 Nov. 56

N° H - 253

Circuit international / International circuit

CRITÈRES / TYPE OF SIGNAL — *DURÉES / TIMES*



Nota : Le demandeur a toute latitude de couper dès réception des signaux DER.

Note : The caller is free to cut off as soon as he receives the DER signals.

Commutation télégraphique
Telegraph switching

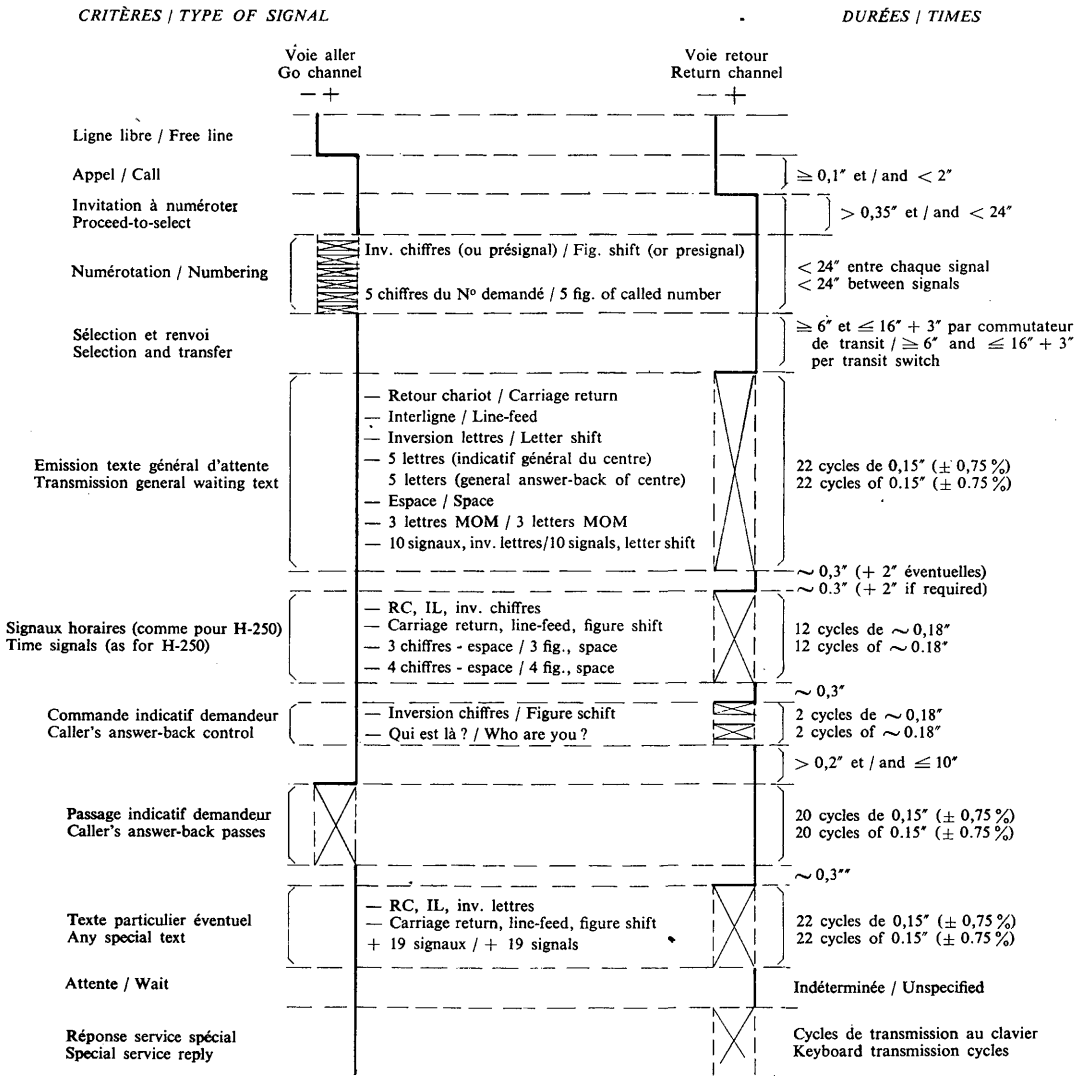
Critères sur un circuit international entrant
Signalling on incoming international circuit

Demandé signalé en dérangement
Called station signalled as out of order

C.C.I.T. 103/5 E
S.G. VII/32
Edition 1 Nov. 56

N° H - 254

Circuit international / International circuit



Commutation télégraphique
Telegraph switching

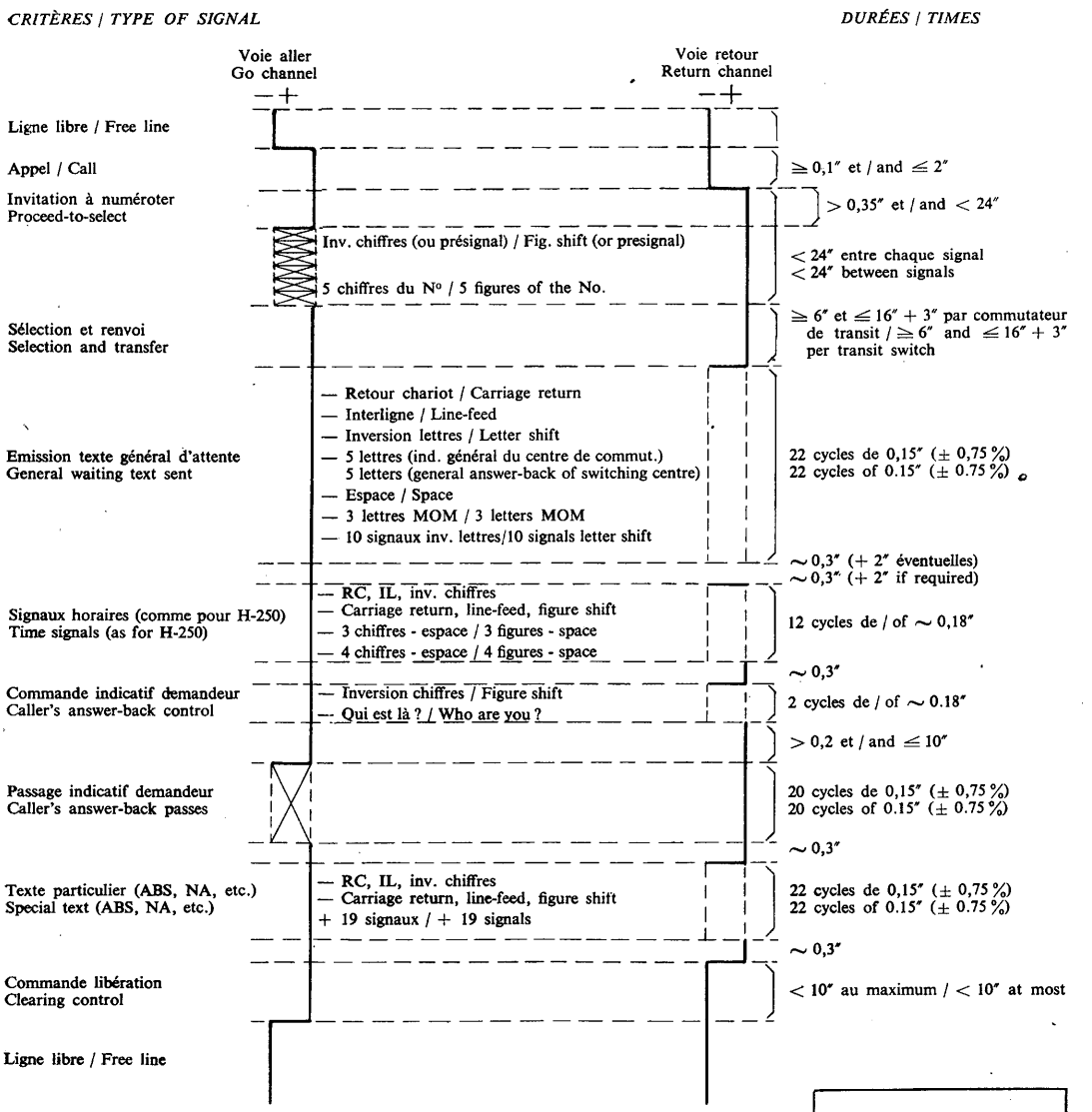
Critères sur un circuit international entrant
Signalling on incoming international circuit

Renvoi sur texte d'attente
Transfer to waiting text

C.C.I.T. 103/6 E
S.G. VII/32
Edition 1 Nov. 56

N° H - 255

Circuit international / International circuit



Commutation télégraphique
Telegraph switching

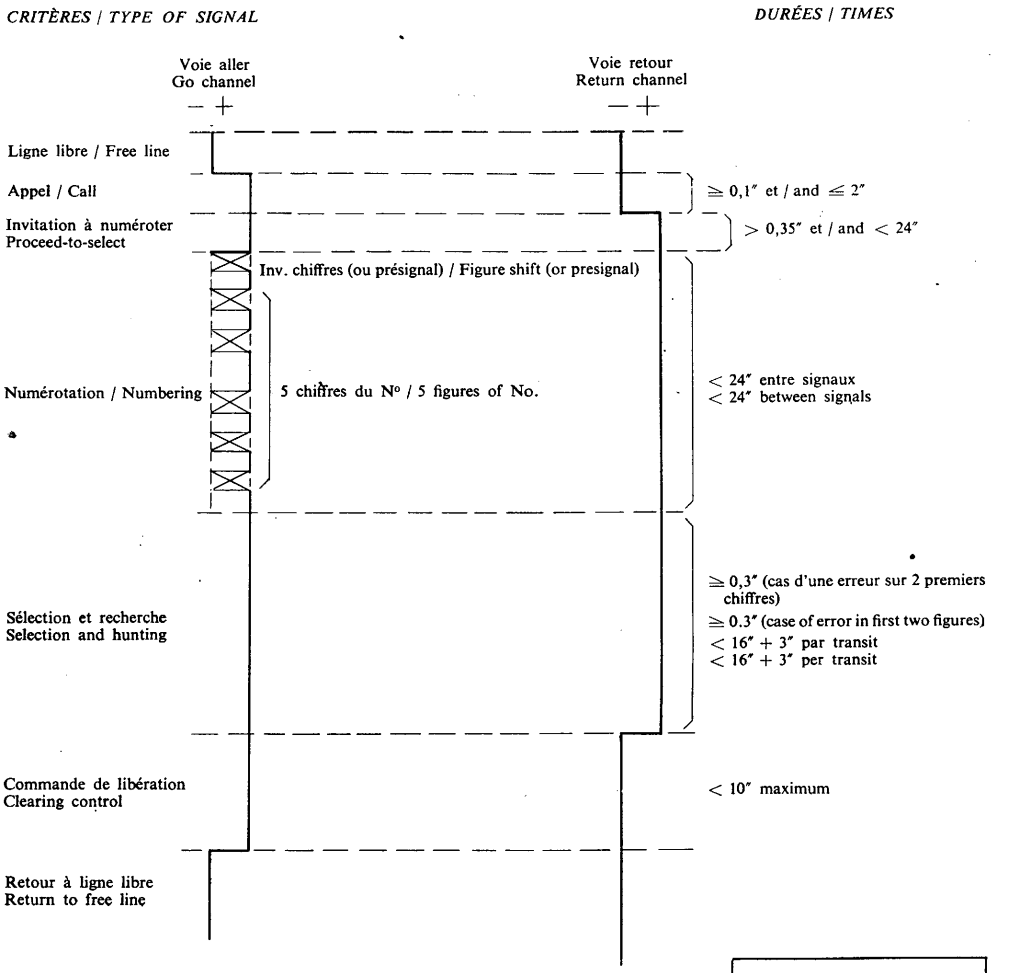
Critères sur un circuit international entrant
Signalling on incoming international circuit

Renvoi sur texte avec libération
Transfer to text with clearing

C.C.I.T. 103/7 E
S.G. VII/32
Edition 1 Nov. 56

N° H - 256

Circuit international / International circuit



Commutation télégraphique
Telegraph switching

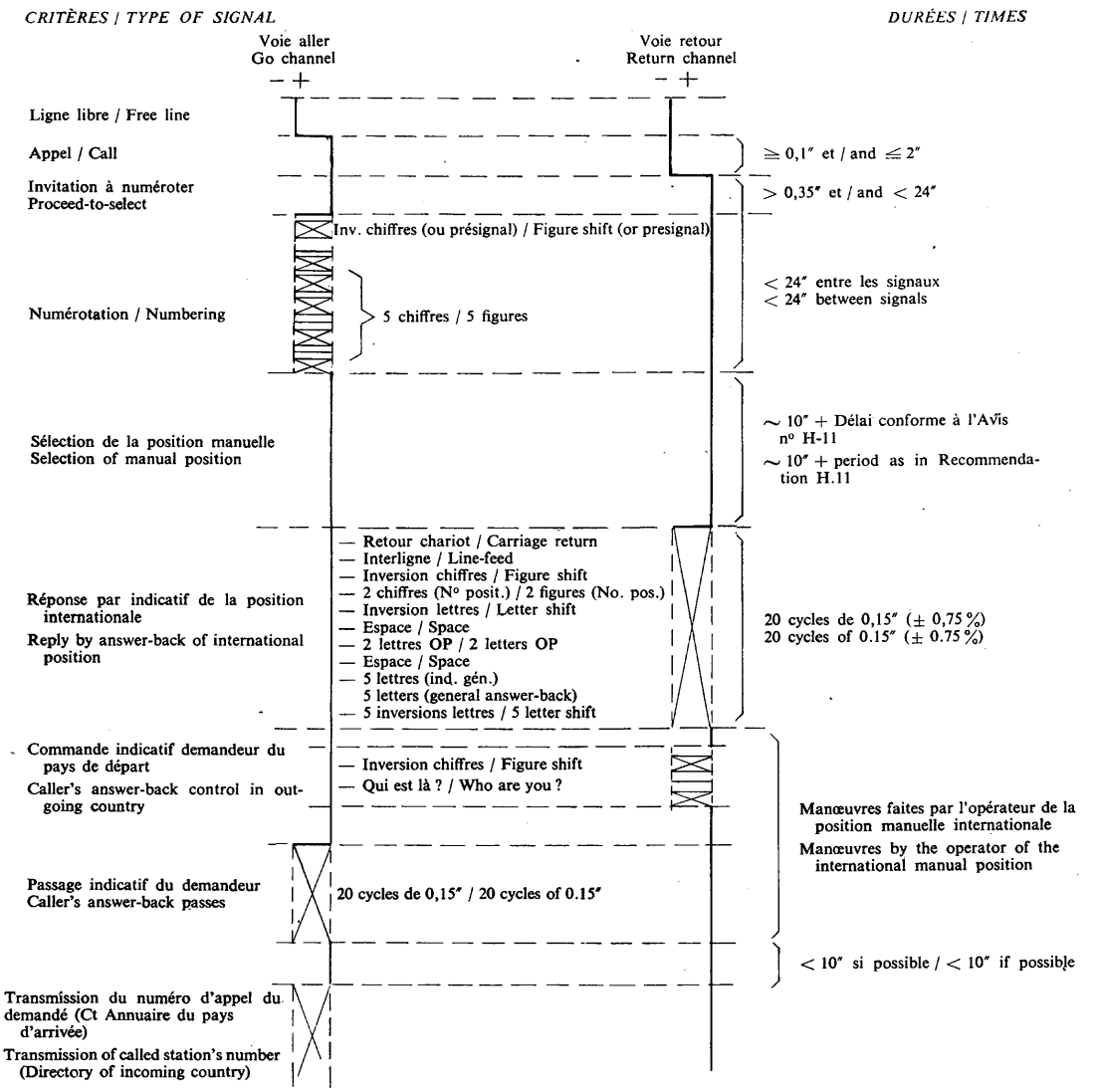
Critères sur un circuit international entrant
Signalling on incoming international circuit

Appel sur numéro inexistant
Call to number which does not exist

C.C.I.T. 103/8 E
S.G. VII/32
Edition 1 Nov. 56

N° H - 257

Circuit international / International circuit



Commutation télégraphique
Telegraph switching

Critères sur un circuit international entrant
Signalling on incoming international circuit

Appel d'une position transit international
Calling an international transit position

C.C.I.T. 103/9 E
S.G. VII/32
Edition 1 Nov. 56

Nº H - 258

Annex

Diagram H. 250 (C.C.I.T. No. 103/1)

1. Equipment and registers for incoming international circuits are fitted with the device for rejecting false calls, described in the French contribution to C.C.I.T. Study Group VII (Doc. SG VII/16, issued 5 December, 1955—Question 54).

2. The times indicated for the proceed-to-select signal should be increased by the addition of the " forward and backward " group delay of the corresponding signals in the international circuit.

When this delay has been deducted :

(a) If the proceed-to-select signal arrives less than 100 milliseconds after the call polarity has been sent, the proceed-to-select signal should not be considered valid. This can only mean that there is a false idling pulse arising at random in the circuit.

(b) If the proceed-to-select does not arrive within two seconds after the call has been sent, there may be a register failure in the incoming centre. But this is so unlikely that it may be assumed rather that the circuit is faulty, and the maintenance service should be informed.

3. The actual selection time is always more than six seconds after the last digit of the number has been received. This lower limit corresponds mainly (four seconds of it) to the time left by the register after the test and the occupation of the line requested, so as to allow the motor to get up to its normal speed.

The maximum selection time of 16″ is to be increased by 3″ for every French switching centre traversed, in addition to the centre to which the called party is connected.

4. All answer-backs of French Telex subscribers begin systematically by the letter-shift combination (No. 29), in accordance with C.C.I.T. recommendation C.9.

The presence of this combination at the head of a series of 20 signals transmitted at the automatic 7.5-unit cycle rate is used for starting up the charging device in the French inland system. Precautions are taken to avoid the faulty working (or breakdown) of the charging device, which could be caused by disturbing pulses, by different and incorrect combinations and by signals transmitted manually over the return path.

5. Two seconds are sometimes provided before the time-signals are sent, when warranted by the following circumstances :

Every minute, the combining device which makes up polarity combinations receives a pulse denoting a change in time from the electric clock. If registers are connected to the combining device at this moment, the device keeps the pulse in reserve and begins to modify the signals only after all the registers previously engaged have finished transmitting time-signals.

During this waiting period, new registers are made to wait and they cannot be connected to the polarity combiner until the time has been put right.

6. The cycles of the time-signals and of the signals for releasing the answer-back are sent by a telegraph emitter attached to each register. These cycles include a 3-unit stop pulse. Although it would not have been very expensive to modify the emitting device, with a view to obtaining a standardized cycle of 7.5 units, it would have caused complications in the lay-out and maintenance. Such a modification was therefore considered undesirable.

7. After sending the " Who are you ? " signal to the caller, the register of the centre to which the called subscriber is attached controls the connection and then stops, without waiting for the passage of the caller's answer-back.

It is therefore possible to add further signals over the international circuit after this moment, as long as they do not break the communication. It is however desirable to limit such signals to a minimum, to avoid confusing the called subscriber in the French network by any unusual procedure.

Diagram H. 251 (C.C.I.T. No. 103/2)

1. This diagram applies to those cases where circuits, different from those in the Telex network, are specially used for international public service in the international relation under consideration.

The distinction between " Telex " and " public telegram " communications should therefore be made in the outgoing country. The latter may use a common switching network or two totally different networks, as it wishes. But it seems that a differentiation between the two types of traffic can be made only according to the origin of the call, and not according to the called number in the French network.

2. The pre-signal transmitted over the international circuit towards France (a combination of the start-stop alphabet preceding the five digits) is not fixed *in this case*. However, it is preferable to use figure shift over the international circuit, irrespective of the type of communication (whether public or Telex). This facilitates the supervision of selections by a control teleprinter or reperforator. The pre-signal is in fact introduced automatically after the first French switch has been traversed. This modification of the pre-signal is controlled in the switch by the type of international circuit over which the call arrives.

3. Bearing in mind the above distinction, it is planned to allow public calls only to public offices open to public traffic of the European network.

This restriction could be eased, if necessary, by allowing such calls to :

— all public offices of the French telegraph network,
— later on (if tariff arrangements allow) to all Telex subscribers.

4. The remarks concerning Diagram H. 250 also apply to Diagram H. 251, with the exception of remark 4.

The answer-backs of all French public stations and of all services, generally accepting calls that are not chargeable, always begin by the combination " carriage return ".

Diagram H. 252 (C.C.I.T. No. 103/3)

1. This signalling diagram is for cases where the outgoing country cannot (or does not want to) use different international circuits for Telex and for public traffic, and where the Administration of such a country nevertheless wishes to exclude access to Telex subscribers by public traffic, and to public offices for calls originating from their Telex subscribers.

2. Since calls entering France on the same circuit can thus be of varying origin, it is necessary to indicate calls that are intended for telegraph offices by a special pre-signal. Such calls must include combination No. 21 (letter U—figure 7) instead of the figure shift combination, which would then be reserved only for calls originating from Telex subscribers. It is obviously the concern of the Administration of the outgoing country to take steps to ensure emission of the correct pre-signal, taking into account the type of the calling station in its network (and not of the called number).

3. If the call should reach a station belonging to a prohibited category, the prohibiting signal is transmitted to the caller by the special NA signal shown in Diagram H. 256. This signal is produced in the last switch passed in France by a comparison between the pre-signals received (No. 21 or 30) and the type of line tested on the last selection stage.

Diagram No. H. 253 (C.C.I.T. 103/4)

1. This signalling applies to the three cases in Diagrams H. 250, 251 and 252, when the call cannot be passed because the line is busy. It is recalled, nevertheless, that transfer to an overflow position is always provided for in the case of public traffic calls (Cf. Note to Diagram).

2. The 12 line-engaged signals are emitted by the transmitter attached to each register. For the same reason as above these signals therefore correspond to cycles of about 9 units (0.18″).

3. The line-engaged signals of this Diagram (H. 253) are also transmitted to the caller when, owing to exceptional circumstances, there are not enough circuits on the French inland system, or if all the junctions between two selection stages of the same switch are engaged.

They are also sent to the caller when the called line is out of order while selection is in progress. From this moment the line is declared to be faulty (see H. 254 below).

4. At the end of this line-engaged signalling, the switch supervises the return of the clearing signal over the forward path. If this return is not effected within 10 seconds after the emission of the clearing polarity in the opposite direction, the international circuit is reported as faulty at the patching position and the maintenance service of the centre is informed. Nevertheless, if the circuit is cleared rather late, a new call from the outgoing network is dealt with in the normal manner and the signalling of the fault is deleted.

Diagram No. H. 254 (C.C.I.T. 103/5)

1. This signalling is for cases where a fault has been noted in advance on the called subscriber's line, the staff at the centre having made return manœuvres.

2. The call reaches an equipment emitting 22 signals, as soon as the register has operated the release of the answer-back of the connected line. These 22 signals are considered by the register as an actual answer-back.

3. The register then concludes the series of connecting operations by sending the time-signals and " who are you ? " signals to the caller, clearing itself by connecting up.

4. The special return equipment supervises (and, if necessary, registers) the passage of the answer-back of the calling subscriber and then immediately operates clearing.

5. The return of the clearing signal over the forward path of the incoming international circuit is supervised in the same conditions as above (H. 253, remark 4).

Diagram No. H. 255 (C.C.I.T. 103/6)

1. The return signalling is appreciably the same as in the preceding case, but the caller is switched to a text combiner which supplies, after the general answer-back of the centre, MOM waiting signals.

2. After the register has been connected and cleared, the caller is connected to a jack fitted with a call lamp, on a special position. The line is set aside with a stop polarity, but the caller is capable of clearing himself by means of the key on his unit.

3. In some special cases the subscriber may receive, before the reply of the special service operator whom he has called, a second signal sequence denoting the service to which his call has been directed (queries, information, etc.). It is planned to use this procedure for subscribers who are absent for a long time and who would agree to subscribe to special contracts.

Diagram No. H. 256 (C.C.I.T. 103/7)

1. The arrangement of signals is almost the same as for the preceding diagram, but :

(a) after connection by the register and passage of his answer-back over the forward path, the caller always receives a special text.

(b) after this text has been transmitted, clearing is operated and supervised as was the case for H. 253.

2. This signalling process is used systematically for sending the NA prohibiting signals, and for sending the ABS signalling, in cases where the called station has not subscribed to a special contract for registering the traffic sent to him in his absence (which is usually the case).

This provision with preliminary transfer to the waiting answer-back (MOM) is designed to avoid complications in the registers. The latter are arranged to deal by themselves only with cases where the line is engaged or the number unconnected (Cf. below).

Diagram H. 257 (C.C.I.T. 103/8)

1. In cases where the call number is not connected, the signalling adopted is designed to be as simple as possible. The register, noting that there is no line marked under the number desired, simply gives the clearing signal.

The return to text for emission of the abbreviation " N.P. " to the caller did not appear to be necessary.

2. Even if the caller has started selecting by the first two characteristic figures of a switching area that is not in service, the register still awaits reception of the sixth signal (fifth actual figure of the No.) before clearing. The same occurs when the caller does not transmit the correct pre-signal, which is always the figure-shift combination for a normal subscriber.

3. If this provision were difficult to interpret in actual practice, it would be possible to have recourse later on to a return to text N.P. analogous to the signalling for H. 256. But this provision seems rather complicated for the result in view, and would be adopted only where absolutely necessary.

Diagram H. 258 (C.C.I.T. 103/9)

1. Telex centres which continue to be operated manually for international calls leaving France will be considered as actual automatic switches to which special areas are attributed.

Calls arriving at these manual switches are received in simplified registers which restrict themselves to retransmitting the characteristic number (in the French Directory) of the country desired on the operator's teleprinter.

2. Under these arrangements, the end of selection on the French network involves an exchange of answer-backs between the international manual position which is going to take charge of the call and the calling subscriber.

The latter does not therefore receive indications in the form of time-signals. Reception of such signals would be only of scant interest in any case, since the time indicated would not correspond to the moment of connection with the called subscriber.

3. *A fortiori*, if such a manual international Telex position in France receives a call proceeding from an international circuit entering through an automatic switch, this would still be a transit case, and it is most desirable to obtain the greatest simplification of the signalling received by the calling subscriber while selecting.

4. The case of transit through the medium of a device at the French outgoing end for fully-automatic subscriber-to-subscriber traffic has not been dealt with, the French Administration still considering the question to be premature. Tariff arrangements will first have to be settled before calls originating abroad can be offered access to these devices.

PROTECTION AGAINST FALSE CALLS

(C.C.I.T. Question 54)

FEDERAL GERMAN REPUBLIC

Document S.G. VII/6
14 March 1955

Protection against false calling signals in switching technique

Question 54

What improvements can be made in switching technique to eliminate false calling signals ?

Reply

For the Telex service, the Federal German Administration of Posts and Telecommunications uses a switching system which, as regards criteria, corresponds to the system B mentioned in the annex to C.C.I.T. Recommendation E.1. If, in a network where this system is used, a voice-frequency telegraph channel suffers a fault whereby the receiving organ is brought into the " stop polarity " position, by which a false call is sent off in this direction, the following operations take place :

The group selector or the final selector at the receiving end of this direction of transmission is set off and sends back a " call confirmation signal ", consisting of a stop polarity pulse lasting 25 ms. If the circuit is arranged for two-way traffic, it will automatically be blocked, by the false signal, against a call in the opposite direction, so that, as long as the fault lasts, no selector can obtain it. The " call confirmation " signal sent towards the other extremity of the circuit, does not mean that the circuit is taken up at that end, since the direction of transmission in question returns, after the short polarity pulse of the signal, to the condition of the permanent start polarity. Hence the circuit appears free at this extremity and can be seized in the direction of transmission in which the fault has occurred. When the false call lasts more than four to five minutes, it sets off a breakdown signal and warns the office staff to take the faulty circuit out of service by use of a blocking key. When, as will usually happen, the breadkown lasts for a shorter period, and disappears before the staff have been aroused by the breakdown signal and have had time to intervene, there are two possibilities to be distinguished in the course of operations, according as to whether the circuit has remained free at the extremity which can be occupied throughout the duration of the breakdown or has been occupied by a hunting selector.

In the first case, as soon as the breakdown is over, the permanent start polarity sent over the circuit from the free extremity, once more arrives at the far extremity, eliminates the false call, frees the engaged selector, and clears away the blocking of the circuit. In the second case, the hunting selector has been unable to set off the call confirmation signal again because of the circuit breakdown. The absence of this signal then shows that there is a breakdown at the departure extremity, so that the call arriving from the hunting selector is automatically rejected, the circuit

is also blocked at this extremity against a new occupation, and a so-called blocking signal is applied in the faulty sense of transmission. This signal consists of a stop polarity current, interrupted at one-minute intervals by a start polarity current lasting 1.2 ms. After the circuit breakdown is over, this start polarity current makes it certain that the circuit will automatically be freed in both directions in at most one minute after the end of the breakdown.

As explained above, the switching system used by the Federal German Administration for the Telex service meets the following conditions in case of breakdowns bringing the receiving organ of a junction circuit into the position corresponding to the stop polarity:

1. The breakdown is at once evident in the form of a call in the switching equipment, and blocks the circuit against seizure in the opposite direction. This is an advantage, since it avoids a selector uselessly occupying the faulty circuit in this direction.

2. When the receiving organ of the circuit is not brought, by other breakdowns of short duration, from the position corresponding to the stop polarity (in which it is, further to the breakdown) to the position corresponding to the start polarity, thus simulating selecting pulses, the occupation resulting from the breakdown remains limited to the selector allocated to the circuit. Other parts of the switching equipment are not affected. The false call merely deprives the circuit of an organ (this selector) which would anyway be unusable because of the circuit fault, even if the fault produced no false call. Hence the occupation of the selector is really no disadvantage.

3. When the breakdown has not lasted long enough for an intervention by the office staff, the circuit automatically returns, together with the circuit terminal equipment at both ends, to the free line condition (start polarity in both directions of transmission), after the end of the breakdown, and this return takes place immediately when the circuit has not been occupied by a hunting selector during the breakdown, which happens only rarely if the breakdown is short.

As explained in paragraphs 2 and 3 above, with the switching technique of the type employed by the Federal German Administration for the Telex service, the trouble caused by circuit faults is hardly increased by the fact that these faults give rise to false signals. Hence the Federal German Administration sees no need, in the case of such systems, for special precautions designed to prevent faults giving rise to false calls. When circuit faults occur so often that they seriously disturb operations, the situation can be remedied, not by a change in the switching equipment, but only by getting rid of the real causes of the faults on the transmission channels.

Conditions are different for the systems to which the criteria of system A, described in the annex to Recommendation E.1 apply. Since in this case provision has been made for a permanent stop polarity signal as call confirmation signal, a false call entails a permanent stop-polarity current in the opposite direction, and this, in its turn, gives rise to a permanent stop-polarity current in the faulty direction, so that the circuit and its equipment remain for some time longer in this state after the fault is over, and are unusable for a period longer than the duration of the breakdown. It would seem difficult to do away with this risk entirely. Hence the criteria of system A should not be applied unless absolutely necessary.

Other difficulties may arise in systems which entail, in putting through the call, the temporary connection of selection pulse registers at the arrival extremities of the junction circuits. In this case, there is a danger that false calls will also occupy the registers, and prevent them being used for regular calls, at least for some time, thus gravely lowering the quality of service. For systems using registers of this type, consideration should be given to the question of how circuit breakdowns might be prevented from causing false calls. Nevertheless all existing possibilities seem inadequate,

since they are effective only for short breakdowns. Hence the Federal German Administration is of opinion that as regards register systems, too, the only way in which an attempt should be made to eliminate false calls on junction circuits is by trying to get rid of the circuit breakdowns themselves.

FRANCE

Extracts from Document S.G. VII/16-E
5 December 1955

Reply to question 54

What improvements can be made in switching technique to eliminate false calling signals ?

Reply

False calling signals are in practice due to spurious impulses arising in the channels, or in their special equipment. Their suppression is not within the province of switching technique. Recommendation B.42 and Questions 17 and 18, referred to Study Group II, show that this problem of false calling signals, that may be interpreted as actual calling signals by the switching equipments, comes within the field of telegraph transmission specialists.

Strictly from the point of view of switching, all that one can do is to facilitate solution of the problem by seeking to lessen the effects of these false impulses. In practice, this means specifying the minimum delay required for the passage from the free line condition to the call condition in a given direction to be recognized as an actual call at the reception end.

At the input to the switching equipment, the inertia of the calling devices may vary considerably, according as to whether the call operates a pre-selector directly, through a simple relay, or causes a register to come into action, through a distribution circuit. Obviously, it is simpler to introduce a delaying element in a common starting circuit than in each individual line-connection equipment or in the trunk circuits linked to the switching equipment.

However, it would be well not to set too high a value for this minimum delay required to recognize the call as genuine, since it entails a corresponding increase in the time required for selection between the two switching centres as it must be inserted between the instant of arrival of the call polarity and that of despatch of the reply by the next switching equipment on the communication chain. This reply may be either Signal No. 3 (call confirmation) or Signal No. 4 (proceed to select), as interpreted in Recommendation E.1.

In addition, a false impulse may occur in a line ending, not in a switching equipment, but in a subscriber's equipment connected through an intermediate circuit. In such circumstances, which normally throw the subscriber's set into the " called " condition, the control-unit of this set, generally, rapidly responds to this polarity, for the teleprinter motor must reach its operating speed as quickly as possible. Even if the false impulse which has started the mechanism is relatively short (20 to 30 milliseconds), a false call is then returned back to the switching equipment, and

will last throughout the time it takes for the control-unit of the subscriber's set to be cleared, i.e., about 300 milliseconds. Even with Type B signalling systems (see the table annexed to Recommendation E.1), it would seem that this drawback, occurring when a false signal reaches a subscriber's set, cannot be completely circumvented.

For information, it might be useful, we feel, to describe the arrangements now made in our automatic network to avoid the drawbacks of false impulses. This network uses Type A signalling as shewn in the table annexed to Recommendation E.1.

1. First of all, the calls arriving in the automatic switching equipment are transmitted to a starting circuit, with a delay of some 60 milliseconds, which chooses a register. Then this register controls the search for the calling line or the incoming trunk circuit. Should the impulse corresponding to the call polarity be fugitive, lasting less than about 100 milliseconds, the register is cleared forthwith.

2. All the trunk circuits between two automatic switching centres have a specialized direction of selection. This avoids the retransmission of false call signals in the opposite direction. This is not, be it said in passing, the main reason for adoption of specialized directions of selection.

3. All registers are equipped with a device for rejecting false call signals of long duration. When a register gets a call, and the call number has not been received after 12 seconds, the register itself returns a clearing signal to the line or trunk circuit, and checks that the clearance has been properly effected.

One of two things will happen :

a) if the clearing signal arrives back in the direction which was previously the calling direction, the register is cleared ;

b) should the calling polarity persist more than 15 seconds, the register brings the line or circuit to a " false-call " condition by a device controlling a special fault relay in the line equipment. A fault signal is then set off in the exchange and the register is cleared.

A line or incoming circuit, marked as faulty by the attraction of its individual equipment relay, remains thus marked, even if the call polarity disappears for a long enough time to cause normal clearance. But if, after this return to the line-free polarity, a new call reaches the switching equipment, this call is once more handled normally by a register. Hence there is automatic suppression of the false call, but if the false call has lasted a long time, the fault signalling remains marked long enough for the maintenance staff to get some idea of how frequent incidents of this nature are on the various lines or circuits and to take the necessary action.

UNITED KINGDOM

Extracts from Document S.G. VII/21
10 January 1956

Observations on question 54

Question 54

What improvements can be made in switching technique to eliminate false calling signals ?

Reply

The United Kingdom Administration in an earlier reply to this question (Document A.P. VII/8-E, March 1953) [1] stated—" considering now the question of false calling signals occurring in International Telex Trunk Circuits, these will in the main cause the switching equipment to be falsely seized, resulting in unnecessary wear, and loss of availability for carrying genuine traffic. The seriousness of this effect depends naturally on the number of false calling signals received in a given period, but subject to the achievement of a satisfactory standard of maintenance of the line transmission equipment, it is the experience of the United Kingdom Administration (using existing types of M.C.V.F. equipment) that these effects are insignificant and can be ignored. "

The experience in the United Kingdom since this date confirms that provided suitable maintenance procedures (Ref. recommendation B.42) are applied, the effects of false calling signals are insignificant.

U.S.S.R.

Document S.G. VII/24-E
13 February 1956

Elimination of false calling signals

Study Group VII has decided to reply as follows to Question 54, which is also of concern to Study Group II :

" While for international Telex circuits there is a need to reduce the number of false calls, and while this could be done theoretically by appropriate switching technique, it would be impracticable to apply this technique to most existing equipment. Thus, the only course possible at present is to secure improvement in the standard of transmission channels in order to reduce the number of interruptions. "

1. The Telegraph and Telephone Administration of the Ministry of Postal and Electrical Communications agrees that the most effective action in the campaign against false calling signals would be action taken on voice-frequency telegraph equipments themselves.

In particular, the use of frequency-modulation voice-frequency equipment creates more favourable conditions for the operation of automatic switching devices.

When amplitude-modulation voice-frequency telegraphy is used for Telex purposes, and when there is no connection between Telex subscribers, there is no carrier in the voice-frequency telegraph channel. In such circumstances, the voice-frequency system has no protection against abrupt changes in level on the high-frequency telephone channels, and hence abrupt variations in the level of the voice-frequency telegraph channel become more numerous.

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[1] Supplements to the Documents of the VIIth Plenary Assembly — Volume II, page 528.

When frequency-modulation voice-frequency telegraphy is used for Telex purposes, the protection of the channel against interference of all kinds considerably increases.

As shown by measurements of the number of mutilated signals, the quality of the frequency-modulation voice-frequency channels (with a deviation of ± 30 c/s) in relation to the amplitude-modulation channels, increases 11.6 times (the tests were carried out on an overhead line, 3,000 km long).

2. Allowance is made for the fact that a good many amplitude-modulation voice-frequency telegraph systems are still used in the international as well as the national networks. Certain measures in the realm of switching technique could usefully be applied on such circuits to limit the possibility of false call signals appearing to cases in which there are numerous abrupt variations in level. Numerous measurements on the long overhead line showed that most abrupt variations in level (73.5 %) lasted up to 80 milliseconds (see the figure in Drawing No. 80).

The inquiries effected show that one way of guarding against false calling signals is to modify the wiring diagrams of the calling relay on the line terminal equipment in the automatic Telex station. This modification consists in increasing the delay for operation of the calling relay so that it no longer replies to false calling signals, provided that this relay works, if the duration of the actual call is greater than that of most of the false calling signals.

The maximum duration of the calling signal is determined by the period represented by the difference between the minimum time separating the trains of dialling impulses and the time required for the free rotation of the brushes of the output selector (at the transmitting station) and for the slow disengagement of the test relay.

Bearing in mind that the minimum time between trains of dialling impulses is 625 milliseconds, and that the time for clearing the test relay is 100-120 milliseconds, with the time required for operation of the selector brushes being 250-285 milliseconds, the minimum time remaining will be $625 - (120 + 285) = 220$ milliseconds.

If we also make allowance for the time required for the relay to work in the line equipment, and for operation of the selector (some 50 milliseconds), it is possible to determine the delay of the calling relay so that it does not exceed 150 milliseconds. As shown by the figure in Drawing No. 80, almost 73.5 % of abrupt variations in level last less than 80 milliseconds.

Thus, if the calling relay has an 80 millisecond delay, this will provide a fairly effective protection of the Telex system against false calling signals.

Bearing in mind that at certain moments the calling relay must work fast during the operation of the terminal equipment (for example, for receipt of the call-confirmation impulse lasting 25 milliseconds) the delay in the operation of this relay during the call is achieved by shunting its winding by a condenser which is automatically disconnected at the necessary times, with the aid of the respective relay contacts.

* * *

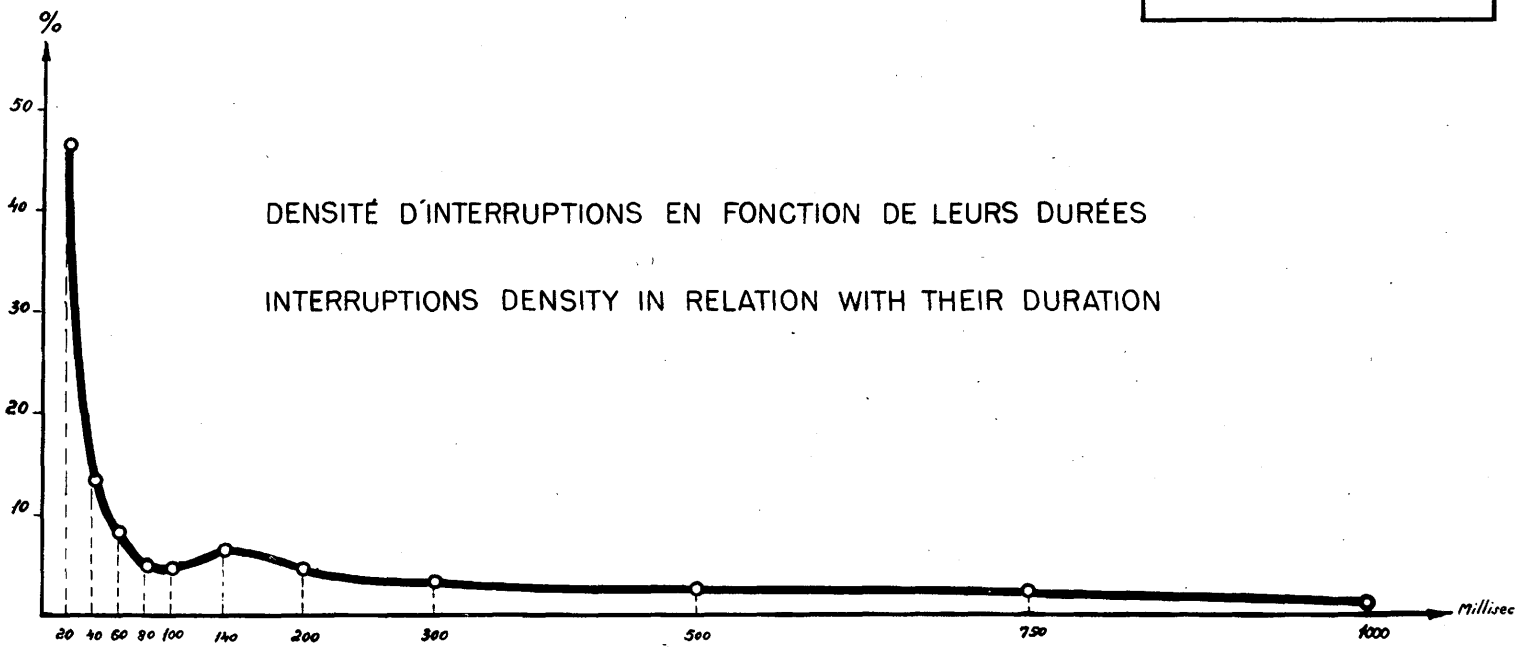
C.C.I.T. N°80 E/F

SGVII/24

EDITION 1 13-11-56

DENSITÉ D'INTERRUPTIONS EN FONCTION DE LEURS DURÉES

INTERRUPTIONS DENSITY IN RELATION WITH THEIR DURATION



EUROPEAN SWITCHED NETWORK FOR THE GENERAL PUBLIC SERVICE

(C.C.I.T. Question 57)

THE CHAIRMAN
OF STUDY GROUP No. VIII

Extracts from C.C.I.T. Document A.P. VIII/7-E
6 June 1956

Preliminary report on the work of study group No. VIII

The following are the terms of reference of Study Group No. VIII (C.C.I.T. Question No. 57) :

" Study of a European switched network for the public service, using start-stop teleprinters. "

The Study Group was asked to base its deliberations on the assumption that switching would be automatic and that the answer-back device would be used.

* * *

The Study Group met in Geneva from 26 to 28 October, 1955.

The Dutch Administration had recommended that no separate network should be set up to carry public telegraph traffic, and that efforts should be made to bring about the automation of the public telegraph service in Europe by interconnection of national networks. That meant an attempt to obtain interconnection of national networks. In addition, the Netherlands recommended that as many offices as possible should be reached by switching, so as to eliminate retransmissions almost entirely. (See Annex 1, i.e. Document S.G. VIII/11.)

To clarify the matter, the following table was prepared, classifying the various possibilities :

A = complete separation for all countries (European network completely separated)	1. By using international Telex circuits 2. By using special international circuits
B = Interconnection of national networks	1. By using international Telex circuits 2. By using special international circuits
C = Mixed : complete separation in some countries + interconnection of national networks in some countries	1. By using international Telex circuits 2. By using special international circuits

The Study Group therefore had to decide whether it would choose A, B, or C as a basis for further study.

After some discussion, it was found that alternative A was not acceptable. No unanimity could be reached with regard to B. Hence only C was left.

The Study Group therefore prepared the draft recommendation VIII/1, now C.C.I.T. Recommendation F.11.

* * *

The meeting showed that :

1. all the countries represented would benefit if a switched network were available for the general public service ;

2. all countries, although their telegraph equipment may be far from uniform, have already adopted, or intend to adopt, the automatic switched system, either by means of their national networks, or by means of a separate network ;

3. two different signalling system groups would be used : systems A and B, in accordance with Arnhem Recommendation E.1 ;

4. interconnection between these two groups of systems would be effected by means of methods already used by the Telex service ;

5. no further statistics would be drawn up.

* * *

Having consulted Administrations by a questionnaire, Study Group No. VIII met in Geneva from 30 May to 2 June, 1956 ; after the meeting, it suggested the following replies.

Question 1

If you intend to take part in the general international switched telegraph service, will you use :

— a network in which the operating sets, the lines and the switching equipment used for international communication in your country are separate from the sets, lines and switching equipment used in the inland service in your country ;

or

— a network in which the operating sets, the lines and the switching equipment used for the international service in your country can also be used for the inland service in your country ?

Reply

The Study Group considered the factual situation which would result if some countries made use of a separate network for the purposes of the international switched general telegraph service while others participated in the service by means of a network used also for their own national service.

The list of countries using *a)* separate networks, or *b)* common networks, is given in Annex 2.

Question 2

List the offices which would be connected to the general international switched network.

Reply

The list of telegraph offices which the countries concerned propose to connect, at the outset, to the switched network for the general public service is given in Annex 3. Austria, the Netherlands, the Federal German Republic, Switzerland and the F.P.R. of Yugoslavia are already operating a switched network for the general service. The United Kingdom has also started such traffic with the Republic of Ireland.

Question 3

If you do not possess an automatic-switched network, but expect to have one, do you wish to take part, in the meantime, in the international network by means of manual switching?

Reply

None of the Administrations represented was in favour of manual switching.

Question 4

In the case of incoming calls, do you accept overflow in your own territory?

Reply

The Study Group proposes that every country should be free to decide whether or not it would accept overflow in its territory. Nevertheless, the operator in the country of departure would have to be clearly informed of the fact that his communication would go to an overflow position. The answer-back signals of the overflow station would have to give the necessary indication. However, since agreement has not yet been reached on the standardization of answer-back signals, the Study Group should leave the question of the composition of answer-back signals for overflow positions for further study.

Question 5

Where will your switching centres be?

Reply

The siting of the international terminal switching centres, as originally planned, is given in Annex 3, on the basis of information supplied by the Administrations in May, 1956.

Question 6

What, within the limits of twenty signals, is the composition of the answer-back signals you intend to adopt?

Reply

It was agreed that uniformity in answer-back codes is desirable.

Study Group No. VIII agreed that the answer-back code of an office of the general service should begin with the combinations " carriage return " and " line feed ". It was noted that for certain types of teleprinters the 20th combination of the answer-back must be " letter shift ".

A group of members wanted to use the remaining 17 combinations for:

a) " figure shift ";

b) two digits indicating the number of the country;

c) combination No. 1 (" — ");

d) digits indicating the national number of the office;

e) " letter shift ";

f) two letters indicating the operating position in the office;

g) " space " ;

h) the abbreviated name of the office ;

i) " space " ;

j) the abbreviated name of the country (1 or 2 letters).

This group of members admitted, however, that it would be difficult for certain Administrations to give all this information with the 17 available combinations.

Another group of members wanted to use the remaining 17 combinations for :

a) " figure shift " ;

b) two figures indicating the operating position of the office ;

c) " letter shift " ;

d) as far as possible the unabbreviated name of the office.

There was support for the view of the first group that the office number in the answer-back was of primary importance ; but the second group thought the name of the office in the answer-back was of more importance.

In the short time available no compromise could be reached. Study Group No. VIII is leaving Question 6 for further study.

The arguments for each proposal are described in the contributions by France (Document S.G. VIII/23, Annex 4) and by the Federal German Republic (Document S.G. VIII/24, Annex 5).

Question 7

a) On the assumption that there will be an exchange of answer-back signals at the beginning and end of the transmission of each telegram, do you think that an acknowledgement of receipt is necessary ?

b) If so, should it be reserved for certain categories of telegrams ?

c) Should it be given immediately or by recalling the transmitting station ?

Reply

The Study Group proposes that the acknowledgement of receipt should be restricted to SVH, S, F and Mdt telegrams. (Italy reserved its position on the use of the acknowledgement of receipt for ordinary telegrams.)

Except for such telegrams, the correct receipt of the receiving station's answer-back signals at the beginning and end of the transmission of each telegram should take the place of the acknowledgement of receipt for the calling station.

For SVH, S, F, and Mdt telegrams, the acknowledgement of receipt should be given immediately after the receipt of the telegram. If, after 30 seconds, the transmitting station has not had the acknowledgement of receipt, it should proceed to transmit the next telegram or clear the line if the series of telegrams to be transmitted is finished. The acknowledgement of receipt would then be given in the form of an ordinary service notice by recalling the transmitting office.

Question 8

Do you intend to connect to the general international switched network only offices which are always open ? If not, how would you give notice that an office not always open would be disconnected from the network (state the arrangements to be made when there is *(a)* no provision for overflow working and *(b)* arrangements are made for overflow working to an office always open in your country) ?

Reply

Administrations and Recognized Private Operating Agencies may also give access to the switched network to offices with restricted service hours, provided they give the Administrations and Private Operating Agencies concerned all the necessary information regarding the routing of telegrams intended for those offices.

Moreover, these Administrations and Recognized Private Operating Agencies shall so arrange that any change in the routing of telegrams intended for their offices with restricted service should take place at the same time for all such offices, so that offices in a country of departure would always be able to send their telegrams to an office with a more extended service in the country of destination.

Offices to which traffic for offices with a restricted service should be addressed will be as few as possible.

Question 9

How do you indicate that a teleprinter is temporarily out of service (paper failure, out of order, etc.) ?

Reply

The Study Group reached the conclusion that 2 different cases should be considered :

a) faults during the transmission of a telegram ;

b) faults on a station line or teleprinter set when a call is offered.

Case a)

The Study Group is of the opinion that the correct reception of the answer-back code at the beginning and at the end of a telegram should safeguard the correct transmission of the telegram.

Faults during the transmission of a telegram should be signalled as far as possible by the automatic transmission of a clearing signal. It was admitted that it would be impossible to signal all faults that may occur on an established connection. However, the Study Group agreed that it is essential that absence of paper on a receiving teleprinter should be signalled by the clearing signal.

Since the receiving Administration is responsible for the receipt of the telegram when the answer-back signals have been correctly exchanged, it is responsible for making the necessary arrangements to ensure security of operation (for example, if the band should break or become jammed).

Case b)

There are two possibilities :

i) the called office has only one line ;

ii) the called office has a group of lines.

i) In this case existing automatic switching networks provide one or more of the following signalling conditions : no "call-connected" signal, "busy" signal, service code "DER" or no return of answer-back. All these signalling conditions ensure that a telegram is not transmitted over a faulty connection.

There was a discussion whether the service code "DER" should be given in the case of a fault of short duration or in the case of a fault of long duration. The opinion was that this problem will probably be discussed by Study Group No. VII and that Study Group No. VII will no doubt give a recommendation in due course.

ii) In the case of a faulty station line out of an office group it is essential that the faulty line should be busied as quickly as possible so that traffic may be offered automatically to all the other lines in the group.

Question 10

Before announcing that a called office is engaged, do you think that it is desirable to have a waiting period? How long should it be?

Reply

Administrations and Recognized Private Operating Agencies may, when a called station is engaged, allow a waiting period before sending out the " busy " signal. This waiting period might be from 30 to 60 seconds, and would be signalled to the sending office by the code word " MOM ".

Question 11

Would you have any objections to the preparation of a service code to facilitate operations between operators speaking different languages?

Reply

The Study Group proposes that a service code be prepared for the European switched network for the general service.

It requests the Administrations and Recognized Private Operating Agencies participating in the work of Study Group No. VIII to prepare proposals, in time for the meetings which will precede the VIIIth Plenary Assembly of the C.C.I.T., regarding a service code which should take into account the following principles:

a) this code must be composed, if possible, of code words taken from the Telegraph Regulations, Appendix No. 1, and Article 26 of C.C.I.T. Recommendation H.1;

b) if necessary, it can include new code words, but the sense of the existing code words must not be changed.

These proposals should serve as a basis for a draft code to be prepared by Study Group No. VIII, which should then be studied jointly with Study Group No. IX.

Question 12

Do you think it would be well if, in the Official List of Telegraph Offices open for International Traffic, there should appear, opposite each office, the call number of the office connected to the international public switching network through which the former office is served?

Reply

The Study Group considered that no useful purpose would be served at present in adding the office numbers to the " Official List of Telegraph Offices ". The List was due to be republished very soon; it was already difficult for reference; and it included all the telegraph offices of the world while the switching network was restricted to European countries only.

It was envisaged that, at the outset, each country would prepare a list for routing purposes and send it to the other countries; at a later stage the lists would be collated in a comprehensive document issued by the I.T.U.

These lists would not include all the offices in the country, but only those which constantly handle international traffic.

They should include the following information :

a) in the first column, an alphabetical list of the offices concerned ;

b) in the second column, the call number and in the third column, the answer-back signals of the offices connected to the international switching system for the general telegraph service or of the office which serves an office not connected to the international switching system for the general telegraph service ;

c) a fourth column should be reserved for service information in which the Administrations and Recognized Private Operating Agencies will put in detail, if necessary, a reference to a general note concerning offices with restricted service and giving the necessary information about the routing of telegrams intended for such offices ;

d) the list should be preceded by a general note regarding the routing of telegrams intended for offices other than those mentioned in the list.

The Study Group recommends that these lists should be on forms size A 4.

Question 13

Do you not think that the principle now obtaining in the Telex service, whereby the country of departure adapts its signalling to that practiced in the network of the country of arrival, should apply to the international public switching network ?

Reply

The Study Group proposes that :

a) Study Group No. VII should also study the problem of fully automatic working in the international general telegraph service. Study Group No. VII should be asked to modify recommendations E.1 and E.2 to cover the special conditions for the general telegraph service ;

b) pending the recommendations of Study Group No. VII, Administrations desiring to introduce fully automatic working in the international general telegraph service should provisionally adapt their outgoing equipment to the signalling conditions encountered in the foreign network (except in the case of special arrangements between Administrations) ;

c) Study Group No. VII should be asked to pursue as a matter of urgency the further standardization of signalling conditions in order to achieve as much uniformity as possible for the different switching systems.

Question 14

Should there be any limit on the number of digits in the call number ? If so, what, in your opinion, should be the maximum number ?

Reply

The call number in the international service of an office connected to the international switching system for the general telegraph service can consist of :

a) a prefix denoting international traffic for the country of departure ;

b) a second prefix denoting the called country ;

c) a national call number based on a numbering plan appropriate to the called country.

Administrations need henceforth to gauge the maximum capacity of the registers which they may have to construct, and bear in mind the numbering plans and size of the various national networks ; for these reasons, the Study Group has agreed that the number of digits in the national call number of a public office should be limited to a maximum of 8.

The Study Group discussed the advisability of preparing a standard international numbering plan for type *b)* prefixes. The suggestion was made that such a numbering plan should be the same for the Telex service and the general telegraph service.

As this problem is closely connected to the difficult problems of international transit by switching, and the problem of automatic re-routing, it was not possible to solve it after a short study, and the Study Group proposes to ask the Plenary Assembly of the C.C.I.T. to put the following new question :

Question Q VIII/1

Is it necessary to have a standard international numbering plan for prefixes denoting the country requested in the general automatic telegraph service ? If so, what numbering plan should be recommended ? Should it be the same as that for the Telex service ?

Note : In this study it would be advisable to examine the corresponding plan advocated by the C.C.I.F. for the telephone service.

Question 15

Do you consider that steps should be taken to prevent :

a) a Telex subscriber in your country from having access to an office connected to the switched network and in another country ?

b) an office connected to the switched network and in another country from having access to a subscriber on your Telex network ?

c) If so, how would you do this ?

Should such action be taken in the country of departure, the country of arrival or in both ?

Reply

The Study Group recommends that :

a) Administrations and Recognized Private Operating Agencies should prohibit by means of administrative regulations and, if possible by technical means, the use of teleprinters by Telex subscribers for sending telegrams to public telegraph offices in another country ;

b) Administrations and Recognized Private Operating Agencies should prohibit their offices connected to the general switched network from transmitting telegrams direct to Telex subscribers in another country.

Note regarding a)

In particular, Administrations and Recognized Private Operating Agencies should forbid their public stations connected to the general switched network to accept any telegram deposited by means of a foreign Telex subscriber's teleprinter.

In addition, Administrations and Recognized Private Operating Agencies should, as far as possible and if necessary by bilateral agreements, take such technical precautions as are compatible with the structure of their inland network.

In the matter of technical prohibition, Study Group VII, which is studying a question concerning prohibitions in the Telex service, will be considering problems concerning prohibitions between the Telex service and the general switched service.

Question 16

Do you not think it would be necessary to make the use of tape-printing teleprinters obligatory?

Reply

The Study Group considers that for the time being, and in accordance with custom in the international telegraph service, tape-printing teleprinters should be used for the general switched network.

Question 17

What arrangements would you make to suppress metering in the case where international circuits form part of networks used jointly with the Telex service?

Reply

Administrations and Recognized Private Operating Agencies should make arrangements for the suppression of metering in their countries during the transmission of general traffic on international circuits, when the circuits form part of links used jointly with the Telex service.

Question 18

Do you not consider that the probability of groups of circuits on individual routes in the international public switching network being engaged, should be the same as that used in the Telex service?

Reply

The Study Group proposes that for international trunks for the general service a grade of service of 1 in 50 would be adopted.

The question of the grade of service to be used on station lines was discussed, but it was agreed that this could not be separated from the question of the grades of service used for the switching equipment and trunk lines of national systems connected to the general international network. A further point for consideration is the use of overflow and suspense facilities. The important factor from the standpoint of international cooperation is the overall grade of service offered by a national network to incoming international calls. It was pointed out that overflow would relieve the sending operator from the need to make fresh calls and thus overflowed calls could not be regarded as lost.

Question K of the Arnhem Programme

An operational procedure must be drawn up.

Reply

The Study Group considered only the main headings under which the regulations should be drawn up. With this in mind, it has prepared the attached list of the main headings of the draft regulations.

PRINCIPAL PROVISIONS TO BE INCLUDED IN THE DRAFT REGULATIONS

Chapter I — General

Basic documents
Definitions
Call number and answer-back signal
Equipment for positions in telegraph offices

Chapter II — Operational procedure

Responsibility of transmitting and receiving stations
Operations preceding transmission
Actual transmission of telegrams
Operations following the transmission of telegrams

Chapter III — Transmission Incidents

Incidents before transmission
Incidents during transmission

Chapter IV — Routing

Establishment and exchange of routing lists between Administrations and Recognized Private Operating Agencies
Telegrams intended for offices with restricted service
Overflow
Telegrams intended for offices not connected to the international switching system for the general telegraph service
Misrouted telegrams
Auxiliary and emergency routes

Chapter V — Service Messages

Chapter VI — Telegrams with Acknowledgement of Receipt

Classes of telegrams
Operational procedure

Chapter VII — Accounting

Chapter VIII — Miscellaneous

Annexes

1 Code for the telegraph service in the international switching system for the general telegraph service

Question L of the Arnhem Programme

The accounting procedure must be organized.

Reply

Study Group VIII considering :

— that by the operation of the international switching system for the general telegraph service a greater number of telegraph offices are required to collect the data necessary for international accounts :

— that the delivery of the telegrams to the addressee obliges all these offices to keep a special check on the international telegrams received ;

expresses the opinion that in general, and for the needs of the operation of the international switching system for the general telegraph service in particular, the accounting between Administrations and Recognized Private Operating Agencies should be prepared on the basis of the outgoing traffic.

This opinion will be forwarded to Study Group X.

Question M of the Arnhem Programme

The routing of lines and the location of regenerative repeaters must be examined.

Reply

It was agreed that because of the adoption of Plan C (Draft Recommendation VIII/1) the question of routing of international lines is a matter for agreement between the Administrations concerned. It was noted that the question of the location of regenerative repeaters was under consideration by Study Group II and therefore further consideration by Study Group VIII was unnecessary.

2 June 1955. WENINGER, Chairman.

Annexes : 5

Annex 1
(Extract from C.C.I.T. document S.G. VIII/11)

SOURCE : THE NETHERLANDS

TITLE : **Proposals for the setting-up of the European general teleprinter network with switching**

. . . . . .

5. In theory, automation of the European public telegraph traffic would present the following advantages :

a) possibility of reaching, direct, those countries for which point-to-point circuits would not be economical ;

b) direct routing of traffic between the offices of handing-in and delivery for which point-to-point circuits would not be profitable.

This means a reduction in the number of retransmissions, i.e., a quicker service for the public and less expense for Administrations as far as the routing of traffic is concerned.

6. As regards the Netherlands, 92 % of European traffic is transmitted directly to the country of destination, only 8 % going through a transit country.

Hence the advantage of automation mentioned under 5 *a)* only applies to about 8 % of traffic in the Netherlands. Very probably this percentage will be much the same in other countries.

Although the swifter transmission of telegrams and the reduction in the number of retransmissions are doubtless important, too, for the 8 % of the traffic, it would not be worth while setting up an automatic network for that reason alone.

7. The advantage mentioned under 5 *b)* will become more important as more and more offices participate in the automatic routing of international traffic.

Unhappily only a few Administrations, hitherto, have indicated the offices which will pass international traffic. It seems that there is a general tendency to restrict the number of such offices to a minimum. The Administration of the Federal German Republic, alone, wishes to designate nine offices.

8. It is impossible to bring about the ideal situation in which all telegrams are despatched direct by the office of handing-in to the office of delivery abroad. In every country, there are many small offices which, for financial reasons, cannot have telegraph equipment and hence have to pass this traffic by telephone, which inevitably entails retransmissions.

In the Netherlands, for example, only 80 offices out of the 2,000 which accept telegrams have telegraph apparatus.

However, it would be perfectly possible to arrange for all offices having telegraph equipment to pass international traffic too. This would reduce the number of retransmissions necessary in international traffic to the absolute minimum.

9. We have endeavoured to find out the extent to which this ideal would be brought about if the routing of international traffic were restricted to a few offices. To this end we have assumed that only the Dutch offices at Amsterdam, Rotterdam and the Hague, which already pass international traffic, will take part in the future automatic traffic. At the present time the number of European telegrams handed in at these three offices or sent in by telephone from other Dutch offices and despatched abroad direct amounts to 67 % of the European outgoing telegraph traffic. Hence, for the remaining 33 %, a retransmission in the Netherlands is necessary, although in theory it could be avoided.

If the three afore-mentioned offices were connected to a European switched network, as a result of which they would all three have the possibility of communicating directly with all countries in Europe, 25 % of European outgoing telegrams would still need a retransmission in the Netherlands which in theory could be avoided.

We may reasonably suppose that the same figures would be applicable to incoming traffic.

If the automatic handling of international traffic were to be restricted to the three major offices, the number of retransmissions in the Netherlands would suffer only a fairly small reduction, whereas the ideal situation would be brought about only to the extent of 75 %.

The remaining 25 % might be reduced by connecting more offices to the network. In view of the large number of telegrams in question (some 2,500 a day), this action would be well worth while.

10. In other countries the position will perhaps be somewhat different. However, we are very probably justified in concluding that automation of the European public service will lead to a considerable reduction in the number of retransmissions only if in all countries far more offices than is now the case are designated for dealing with automatic international traffic.

To avoid misunderstanding it should be observed that each Administration may, if it so desires, reduce to a minimum these costly retransmissions by arranging for as many offices as possible in its country to participate in international traffic. Such action would not be influenced by any decisions that might be taken by foreign Administrations in favour of restricting the number of offices sharing in international traffic.

It will be clear that the transmission time of telegrams depends largely on the number of foreign offices which can be reached directly.

11. Summarizing the conclusions reached in paragraphs 6 and 10, we may say :

a) that reduction in the number of retransmissions obtainable by automation of the general public telegraph service in Europe will be slight in so far as it derives from the possibility of reaching, directly, certain countries with which direct circuits cannot now be operated ;

b) that such a reduction is more important in that it entails the possibility of reaching, directly, considerably more offices than is now the case.

Hence it is evident that we should aim more at an inter-connection of national automatic networks with as many offices as possible sharing in international traffic, rather than at the establishment of a separate international automatic network to which would be connected only a few offices in each of the participating countries.

12. This conclusion, in favour of an inter-connection of national automatic networks, leads us to the question of whether cooperation with the Telex service, which pursues the same ends, would not be a suitable solution. This question forces itself upon our attention because the volume of international Telex traffic in certain Western European countries already exceeds that of the international general public telegraph traffic.

In support of the above we would point out that Dutch Telex subscribers can already dial German, Austrian and Belgian subscribers direct and that before the end of the year they will be able to do the same for Denmark, Sweden and Switzerland. At the moment there are 255 circuits in service for international Telex traffic, while international automatic telegraph traffic for the general public service would require only about 40.

Telex traffic from Belgium to Switzerland is already automatic and shortly Western Germany, too, will begin fully automatic operation in several directions. It is very probable that before many years are past most of the European Telex traffic will be fully automatic.

13. In our view, it would be logical if for the automatic handling of international public traffic, international Telex trunk circuits already in existence or shortly to be laid down were used. This holds good more especially of countries where the same automatic network is or will be used both for national public traffic and for Telex traffic (according to the information at our disposal, there will be Belgium, Denmark, France, the Netherlands, and Sweden).

However, the countries which have separate national networks for general public and Telex services could also save on switching equipment and circuits by passing international public traffic and international Telex traffic over the same international systems.

In such a system, care would have to be taken to avoid Telex subscribers being connected with foreign telegraph offices. This problem could doubtless be solved by appropriate technical action.

14. It should be observed, in this connection, that the Austrian and Dutch Administrations have agreed to automatize public telegraph traffic between their two countries and to use for that purpose the automatic junction circuit envisaged for the Telex service.

Austria has a separate automatic exchange for international public traffic to which, all in all, six offices are connected. For the moment, the Netherlands still have a separate automatic network for the public telegraph service. Very shortly, however, the public telegraph offices will be connected to the same exchanges as the Telex subscribers.

To pass public traffic between Austria and the Netherlands, the Austrian automatic exchange will have access to the Telex circuits to the Netherlands. The Austrian register sends an identification signal (a single 5-unit signal) which, for Telex service calling subscribers, will be different from that for the public service calling offices. Thus the Netherlands register will be able to prevent Austrian Telex subscribers from calling Dutch telegraph offices.

For public traffic from the Netherlands to Austria, the group selector at which the Netherlands incoming circuits end will give access, via the series "8", to the automatic exchange for Austrian international public traffic. Certain technical devices in the Netherlands register will guarantee that only offices of the general service can select Austrian numbers beginning with the figure "8". Thus Dutch Telex subscribers will be unable to reach Austrian telegraph offices.

15. The great advantage offered by automation of the European public telegraph service by inter-connection of already existing national networks, whether or not the same equipment and circuits as those used by the Telex service be employed, lies in the fact that by means of bilateral agreements the plan could be speedily implemented.

The scheme for establishing a separate international switched network dates from 1946. All the evidence would lead us to suppose that a long time must elapse before the C.C.I.T. reaches agreement on the numerous problems set forth in Question 57, and that thereafter another long period must go by before switching equipments can really be brought into use.

Hence we think it exceedingly important that Study Group VIII should decide whether study of a separate automatic network for the European public telegraph service should continue, or whether efforts should not rather be made to automatize the European public telegraph service by inter-connection of national networks.

16. Should the Study Group decide to continue its studies in this latter sense, the following points in the C.C.I.T. Study Plan could be deleted : A, B, C, D, E, G (except the plan for composition of answer-back codes), H, I, J (the instructions could be in conformity with those of the Telex service), M and N.

Reference : No. 691
The Hague, 14 October, 1955.

B. A. HARTEVELD, A. C. JANSEN,
Rapporteurs

Annex 2

Countries wishing to have a separate network :

Austria
Poland
Federal German Republic
United Kingdom of Great Britain and Northern Ireland (at least at the outset)
Switzerland
U.S.S.R.
F.P.R. of Yugoslavia

Countries wishing to have á common network :

Denmark
France
Netherlands
Turkey

Countries which reserve their position :

Italy

Annex 3

LIST OF TELEGRAPH OFFICES WHICH ADMINISTRATIONS INTEND, AT THE OUTSET, TO CONNECT TO THE EUROPEAN SWITCHED NETWORK, WITH NAMES OF THE INTERNATIONAL TERMINAL SWITCHING CENTRES

The offices so connected are shown in the right-hand column, and the international terminal switching centres in the left-hand column.

Austria		
	Wien	Wien
		Bregenz
		Graz
		Innsbruck
		Klagenfurt
		Linz
		Salzburg
Denmark		
	Köbenhavn	Köbenhavn
France		
		Bordeaux
		Clermont-Ferrand
		Dijon
		Lille
		Lyon
		Nantes
		Marseille
		Montpellier
		Nancy

		Nice
		Paris
		Reims
		Rennes
		Rouen
		Strasbourg
		Toulouse
		Tours
Italy		
	Milano	Milano
	Roma	Roma
The Netherlands		
	Amsterdam	Aalsmeer
		Alkmaar
		Almelo
		Amersfoort
		Amsterdam
		Apeldoorn
		Arnhem
		Assen
		Baarn
		Bergen op Zoom
		Beverwijk
		Bilthoven
		Breda
		Brunssum
		Bussum
		Delft
		Delfzijl
		Deventer
		Sittard
		Soest Utrecht
		Terneuzen
		Tilburg
		Utrecht
		Valkenburg
		Velp Gelderland
		Venlo
		Doetinchem
		Dordrecht
		Ede
		Eindhoven
		Enschede
		Geleen
		Gorinchem
		Groningen
		Goes
		Gouda Zuid Holland
		's-Gravenhage
		Haarlem
		Heerlen
		Helder (den)
		Helmond
		Hengelo Overijssel
		's-Hertogenbosch
		Hillegom
		Vlaardingen
		Vlissingen
		Voorburg
		Vught
		Waalwijk
		Wageningen
		Wassenaar

	Weert
	Hilversum
	Hoensbroek-Treebeek
	Kampen Overijssel
	Kerkrade
	Laren Noord-Holland
	Leuwarden
	Leiden
	Maastricht
	Middelburg
	Nijmegen
	Oss
	Roermond
	Roosendaal
	Rotterdam
	Rijswijk Zuid-Holland
	Scheveningen Radio
	Schiedam
	Sneek
	Wormerveer
	IJmuiden
	Zaandam
	Zeist
	Zutphen
	Zwolle
Poland	
Warszawa	Warszawa
Federal German Republic	
Dusseldorf (this office will be the switching centre, but it is not certain that it will be an international terminal switching centre)	Dusseldorf Aachen Bochum Bonn Dortmund Duisburg Essen Hagen Krefeld Köln München-Gladbach Wüppertal
Frankfurt (Main)	Frankfurt (Main) Augsburg Darmstadt Freiburg Heidelberg Kassel Karlsruhe Ludwigshafen Mainz Mannheim München Nürnberg Pforzheim Stuttgart Ulm Wiesbaden
Hamburg	Hamburg Bielefeld Berlin (West) Braunschweig

		Bremen
		Bremerhaven
		Hannover
		Kiel
		Lübeck
United Kingdom of Great Britain and Northern Ireland		
	London	London
		Birmingham
		Bradford
		Glasgow
		Hull
		Liverpool
		Manchester
		Newcastle
Switzerland		
	Zürich	Zürich
		Basel
		Bern
		Genève
Turkey		
		Adana
		Ankara
		Istanbul
		Dijarbakir
F.P.R. of Yugoslavia		
	Beograd	Beograd
	Zagreb	Zagreb
		Ljubljana
		Novi Sad
		Rijeka
		Sarajevo
		Skoplje

COMPOSITION OF ANSWER-BACK CODE IN THE " GENTEX " SERVICE

(C.C.I.T. Question 57-6 — C.C.I.T.T. Question 15/21)

FRANCE

Document S.G. VIII/23
2 June 1956

Contribution regarding the composition of answer-back code for the European switched network

The questionnaire of Study Group VIII includes the following Question 6 :

" What, within the limits of twenty signals, is the composition of the answer-back signals you intend to adopt ? "

The French P.T.T. Administration suggests that the answer-back signals should be composed as follows :

1	Carriage return.
2	Line feed.
3	Figure shift.
4 } 5	2 figures indicating the position.
6	Space.
7	Letter shift.
8 } 9 } 10 } 11 } 12 } 13 } 14 } 15 } 16 } 17 } 18 } 19	12 letters indicating the office.
20	Letter shift.

The French P.T.T. Administration means that the 12 letters indicating the office should include the particulars of a station such as :

Overflow position.
Special outgoing position.
Special incoming position.
Special position for information.
Etc.

The arguments advanced by the French P.T.T. Administration in support of its proposal are given below.

I. 1. It is essential that the answer-back code should give correct information on the number of the position in the exchange :

a) so that the apparatus and operator can be traced if the telegram has not been correctly received ;

b) in case the acknowledgement of receipt of a telegram, requiring an acknowledgement of receipt, is not immediately received ;

c) to decide the responsibility for a transmission that is regarded as irregular.

2. Information regarding the special nature (if any) of the position is also essential, especially in the case of an overflow position.

Without such information, two situations might arise which it would be preferable to avoid :

a) the operator in the calling office, receiving an answer-back code which is not that of the office called, wrongly thinks that there has been a wrong selection ;

b) in the event of actual false selection, the operator may this time think that there is an overflow. This is a particularly serious case.

Information regarding the special nature, if any, of the position takes at least two signals (one space and one letter) in its most reduced form.

II. This leaves a *maximum* of 10 signals to designate the name of the office as comprehensibly as possible.

The question then arises : what is the best way of using these 10 signals ?

1. The representatives of some countries think that these 10 signals must, above all, include the call number of the office.

However, this call number may consist of as many as 8 figures, as the Study Group has admitted.

This leaves only 2 signals, and since one of them is required to mark a separation, only one letter is left to identify the office.

That, obviously, is an extreme case, but in any case if the call number is to be included in the answer-back signals, the number of signals left to indicate the name of the office is still very limited.

The following disadvantages result :

a) The very limited number of signals available (which vary, moreover, according to the number of figures in the call number) leads to such contractions that the abbreviated name only faintly resembles the real name of the office.

b) If need be, such contractions can be used in a national service, or even in an international service which is limited to a few offices.

They are not admissible, however, in a service extending over a large number of countries and offices.

For example, the abbreviation AAN for Aachen (Aix-la-Chapelle) is really meaningless to a French operator.

Hence we are led to regard these abbreviations as a veritable code, in letters, of the name of the office, which duplicates the code used for the call number of the same office.

c) The shortage of signals available makes it impossible to show even a very abbreviated form of the name of the country to which the office belongs.

The code of abbreviations should therefore be the subject of international agreements.

d) Even assuming the operator recognizes that the abbreviated name he is receiving resembles the name of the office he is calling, he could not recognize the name of the office to which his call goes in the event of overflow (a name he was not expecting) without consulting the list of abbreviations.

e) Faced with the difficulty of remembering a large number of abbreviations, the complications involved in consulting a list and the risk of errors resulting from slight differences in the various abbreviations (in view of the inevitable similarity of some of them) it is to be feared that the operators would end by overlooking the letter-section of the answer-back code and concentrating all their attention on the call number of the office.

Consequently the telegram would be transmitted in a wrong direction:

— if the operator misread the number and if the selection was correctly made;

— if, although the operator dialled the correct number, a wrong selection switched the communication to an office whose number resembled the one dialled (for example: 36685 for 36885).

f) If, by chance, reception of the end of the answer-back signals is spoiled, the operator receives something incoherent which, since it resembles an abbreviation, does not attract his attention.

This operator thus risks transmitting a telegram the good reception of which cannot be guaranteed.

2. The French P.T.T. Administration, on the other hand, considers it most desirable to indicate the name of the office as comprehensibly as possible.

For this reason it proposes using all the 10 available signals for this purpose.

Hence the call number of the office would not appear in the answer-back code.

With such a proposal:

a) Many names are not abbreviated.

Those which are abbreviated are still recognizable, even by an operator in a foreign country.

b) A list of abbreviations is only rarely consulted.

c) It is permissible to give the name of the country in abbreviated form, for example to avoid homonyms.

d) In the event of overflow, the operator is immediately and clearly informed of the office to which the communication has gone.

e) In the absence of any other indication, the operator is obliged to concentrate his attention on the letter-section included in the answer-back signals, in order to know which office he is connected to.

Hence, he knows for certain that he has not obtained the office he wants:

— if he has misread the call number;

— if, in spite of having dialled the correct number, a wrong selection has switched the call to another office.

Indeed, there would be very little risk that an error in dialling, or a wrong selection, would switch the call to an office whose abbreviated name resembles that of the called office to the point of confusion (whereas such confusion is more likely with figures).

3. The composition of answer-back signals for Telex subscribers is specified in Article 27 of Recommendation H.1.

According to this specification, 15 signals are reserved for the subscriber's name. There is no mention of including the latter's call number in it, and no doubt the authors of Recommendation H.1 had their reasons for this.

The composition of the answer-back code of a public station, such as that proposed by the French Administration, does not appear to differ fundamentally from that of a private subscriber's Telex station.

This undoubtedly makes it easier to interconnect Telex subscribers and public stations on the national network of countries which permit this interconnection, as is the case with France.

Since some countries have not, *a priori*, abandoned the idea of interconnecting the Telex subscribers of one country with public offices in another country at some future date, the same arrangement would obviously facilitate this interconnection.

FEDERAL GERMAN REPUBLIC

Document S.G. VIII/24-E
5 June 1956

Contribution regarding the composition of answer-back code for teleprinters connected to the switched network for the international general telegraph service

The answer-back signals should include all the indications necessary to define the corresponding telegraph station in a perfectly clear manner. These indications can be given in three ways, namely :

(1) by figures indicating the number of the country where the telegraph station is situated (if a uniform numbering system for the countries is adopted) and the call number of the telegraph office to which are added one or two letters to indicate the telegraph set if the telegraph office has several sets in the international telegraph service ;

(2) by letters indicating the name of the telegraph office to which are added, if need be, the letter or letters designating the telegraph station and the name of the country where necessary ;

(3) by a combination of (1) and (2), indicating the number of the country, the call number of the telegraph office, the letter or letters corresponding to the telegraph station, the name of the office and the name of the country ; the last two indications would be in abbreviated form, taking into account that the number of signals available for the answer-back is limited.

The German delegation is in favour of solution (3) for the answer-back signals. This would enable the receiving station to recognize the office responsible for transmitting the telegram even if either the number or letter portion of the answer-back signal were not received correctly.

Furthermore, solution (3) offers the following basic advantages when compared with solution (2) :

A) In order to speed up traffic at offices comprising several telegraph stations, it is essential to record all the necessary information for the correct routing of telegrams on the forms of telegrams to be transmitted ; such information includes the number of the country of destination, the number of the telegraph office to which the telegram is to be transmitted and the name of the office, this name being given in the same way as in the answer-back signal of the telegraph station or stations of the office. Since the name must be given in full in the answer-back signal under solution (2), the length of the indication and the time necessary is greater than under solution (3), where an abbreviated designation of the office is used.

B) It is important to insert the call number in the answer-back signals to enable the operator at the receiving station immediately to recognize the call number of the transmitting office and to call it where necessary, without having to consult the list of call numbers of the international network. The need for such calls arises in the following cases :

a) When the receiving operator detects a mistake in the telegram after having disconnected, she must then address an RQ message to the transmitting station in order to explain the mistake.

b) SVH, S, F and Mdt telegrams require acknowledgement of receipt. The transmitting operator in such cases must disconnect if she has not received the acknowledgement of receipt within a maximum time-limit of 30 seconds. This means that the receiving operator is obliged to make a return call to the transmitting office in order to give the acknowledgement of receipt.

c) To ensure the service for Mdt telegrams, it might be necessary to instruct the operator having received such a telegram to call the transmitting office after disconnection and in this way to ascertain the identity of the office concerned.

For the above-mentioned reasons, the German delegation recommends that solution (3) should be adopted with regard to the constitution of the answer-back code. It is true that call numbers could not be inserted very conveniently in existing answer-back signals if the call numbers consist of many figures, and such cases would call for the introduction of answer-back unit of greater capacity. However, it appears that the answer-back code will have to be lengthened in any case in the future in order to satisfy the needs of intercontinental switched telegraph traffic.

NETHERLANDS

Document S.G. VIII/26-E
12 September 1956

A contribution to the study of question 6 in the questionnaire attached to document S.G. VIII/14 (Make-up of answer-back signals)

When Study Group VIII met from 30 May to 2 June last, there was some discussion on the make-up ot answer-back signals in the general telegraph service. No agreement was reached as to whether the name of the office (not abbreviated, if possible) or the call number was to be considered the kernel of the answer-back signal. We should like to make a contribution towards the elucidation of this problem.

Although Recommendation H.1 (27, (8)), leaves Administrations considerable latitude as regards the composition of answer-back codes in the Telex service, the general custom is to include in the answer-back only an abbreviated name indicating the subscriber required, followed by the name of the place. The abbreviated name designating the subscriber is considered as more important than the call number, because if there is a mistake with the number, the name reveals the wrong call. Although in general it would be well to include the call number too, such inclusion has to be forgone, because the twenty signals of the answer-back device are not usually sufficient.

At first sight, the name of the office would seem more important for the general service than the call number, for that same reason. But there are the following differences between the Telex and the general services:

1. In the Telex service, a call is put through to the subscriber to which the message is addressed. But in the general service, the telegram can in many cases not be transmitted direct to the office of destination, because only a few offices are linked to the international network. In such cases, it follows that the name of the place in which the addressee is and the name of the receiving office are not the same. Generally, the operator in the international service does not perceive the relationship between the two place names.

2. In general, a Telex operator will himself consult the directory, so that he will know the call number and answer-back code of the called correspondent, or will know these data as a result of previous correspondence. But in the large offices of the general service which transmit most international telegrams, the operator will not himself consult the list of offices ; the routing official will mark the call number on the telegram form. Should the call number not be in the answer-back of the receiving office, this official must, too, mark the full answer-back code on the telegram form.

Hence, for the general service, the arguments in favour of including the name are less convincing than for the Telex service. On the other hand, inclusion of the call number in the answer-back signals considerably simplifies the task of the general service. The operator can then do no more than check whether the call number in the answer-back corresponds to the number dialled, and the routing clerk merely has to make the call number on the telegram form. Hence we consider that it is exceedingly important for the general service that the call number be included in the answer-back code.

In general, the twenty signals available will render it impossible to include the unabbreviated office name as well as the call number. We shall have, then, to make-do with the call number alone. At the most, the answer-back signals could include some indication of the office name, limited to a few letters. Such an indication, however, would in our opinion be of little use in international traffic.

Exceptional will doubtless be the cases when, because of mistakes in numbers, telegrams are sent to offices other than those desired. This has occurred in Dutch traffic to Germany and Austria, in which a check is made only of the conformity of the number dialled with that shown in the answer-back.

It is essential, we feel, that the answer-back signals should contain some indication of country. As long as study is still continuing of the introduction of uniform international prefixes, we shall have to make-do with an abbreviation in letters. Two letters, at the most, should suffice.

For many Administrations, it is also very important that the position be indicated. In some cases, this will entail the allocation of two letters or figures.

So that the signals available may be used as economically as possible, the indication of the position, in letters, might be shown, without spacing, after the call number.

In our opinion, the international standardization of answer-back codes might be restricted to the following essential points :

a) the preamble : carriage return, line feed and figure shift ;

b) national call number, followed, without spacing, by ;

c) indication of the position, in letters, followed, with spacing, by ;

d) an indication of the country, in letters.

The remaining signals could then be reserved for Administrations, to indicate, for example, the name of the office in abbreviated form. This might be useful in the international service.

An answer-back code made up thus would contain the following :

1. Carriage return.
2. Line feed.
3. Figure shift.
4. ⎫
5. ⎪
6. ⎬ The national call number (eight figures at the most).
7. ⎭

8. }
9. } The national call number (eight figures at the most).
10. }
11. }
12. Letter shift.
13. } Indication of the position (two letters at the most).
14. }
15. A space.
16. } Indication of the country (two letters at the most).
17. }
18. } Available.
19. }
20. (For certain kinds of answer-back devices invariably letter shift.)

The above arrangement would offer another advantage, in that the beginning in figures ensures that a clear distinction is made between these and Telex answer-back codes.

An overflow position could be marked by a special letter replacing the first letter used to indicate the position (for example, D). If necessary, a distinction might be made between transmission, reception, and mixed positions, for example, by use of the letters T, R, and M respectively.

AUSTRIA

Document S.G. VIII/31-E
26 November 1956

Contribution by the Austrian Administration on question 6 of the working programme of Study Group VIII (answer-backs)

1. The proposals by Germany, France and the Netherlands on the make-up of the answer-back (referring to Question 6 of the internal working programme of Study Group VIII) coincide entirely for some of the signals available (code combinations placed on stations 1, 2, 3 and 20) and differ only as to the number of the station for six other code combinations denoting the position and the country or ensuring letter shift and a space. With regard to the serial number of the position, this might be indicated by a letter, and the type of position by a second letter (overflow, transmission, reception).

2. Having reduced the 20 combinations of the answer-back by those mentioned above under 1., we can use ten combinations to indicate the call number and/or the name of the office.

As to the use that should be made of these ten code combinations, we should like to draw attention to the following points:

(a) The answer-back could be composed in such a way as to limit it alternatively to an indication of the call number or of the name of the office. In telephony it is usually sufficient for the called subscriber to reply by mentioning either the number or the name. It might, consequently, be sufficient for telegraphy also to give preference to one or the other of these two characteristics.

(b) To find the right answer, the question should be considered from the point of view of the transmitting office.

Assuming that all the offices in a country are connected to the international general switched telegraph network, the transmitting operator would be informed of the identity of the office of destination by means of the address of the telegram to be transmitted by the answer-back appearing on his teleprinter. But, as in most countries there are less offices connected to the international general switched telegraph network than there are unconnected to this network, the return answer-back received will often not indicate the name of the office of destination but that of the office connected to the IGSTN which serves the office of destination. The above-mentioned advantage is therefore lost and the name of the office received by means of the answer-back will not be essential for a correct selection by the operator. The operator can only select characteristic figures and never the names of offices. He can only select the call number of the office connected to the IGSTN serving the office of destination. It is this call number which will have to be recorded by the operator or by the routing service on the telegram form to be transmitted ; it is this number which is indispensable before starting the transmission. It seems more advisable to ensure that the operator will find this call number in the answer-back as confirmation of correct selection rather than a name which may mean nothing to him, as we have explained above.

It is to be assumed that countries preferring keyboard selection would be particularly in favour of using the call number to denote the office of destination, since in keyboard selection the selected number is written out with next to it the answer-back received, including the same number ; control of selection is thus greatly facilitated.

(c) If, in accordance with the French proposal, the answer-back only included the name of the office, the routing service should record the call-number on the telegram, otherwise the operator would not be able to select ; it should also record the name of the office of destination for the operator's information. The routing service thus has additional work and the operator is obliged to pay more attention. Recording the complete name, which for the country of origin is usually in a foreign language, would be a considerable responsibility. It is true that agreement between the name recorded on the telegram and that appearing in the answer-back would assure the operator that the routing service has recorded the name and the answer-back correctly (and that he could return the telegram to the routing service if this were not so) ; but, if the routing service recorded a wrong number *and* the corresponding wrong name, the transmitting operator would not notice the error.

(d) If the answer-back included only the call-number and if this number were incorrectly recorded on the telegram form, there should be no difficulty in transmitting the telegram to another office, provided it is in the same country and therefore easily able to transit a telegram that has been misrouted by accident. In any case the call-number is absolutely essential for operational purposes, whereas the name is of secondary importance.

Summary

The Austrian Administration is of opinion that it is essential to incorporate in the answer-back, by means of available code combinations, the whole call-number of the corresponding office connected to the general switched network. Even if 8 code combinations were really necessary to reproduce the call-number, there would still be two free combinations available which could be used to increase the number of combinations indicating the name of the country ; the transmitting operator would thus avoid the risk of misunderstanding the name of the country of destination.

The Austrian Administration therefore supports in principle the Netherlands proposal. If the other Administrations should likewise agree, it would be easy to determine by common agreement the order of other signallings.

Annexe

COMPOSITION DE L'INDICATIF / ANSWER-BACK SIGNALS

Document C.C.I.T.
S.G. VIII/31 - F/E

	France *France*	*République fédérale d'Allemagne* *Federal German Republic*	*Pays-Bas* *Netherlands*	*Autriche* *Austria*
1	Retour chariot / carriage return	Retour chariot / carriage return	Retour chariot / carriage return	Retour chariot / carriage return
2	Changement de ligne / line feed	Changement de ligne / line feed	Changement de ligne / line feed	Changement de ligne / line feed
3	Inversion chiffres / figure shift	Inversion chiffres / figure shift	Inversion chiffres / figure shift	Inversion chiffres / figure shift
4	2 chiffres caractéristiques de la position	2 lettres pour le pays		
5	Indication of the position (two letters)	2 letters of the country		Numéro d'appel national (3 chiffres pour l'Autriche)
6	Espace / a space	Trait de liaison/hyphen		The national call number (3 figures for Austria)
7	Inversion lettres / letter shift		Numéro d'appel national (8 chiffres au maximum)	Inversion lettres / letter shift
8	2 lettres pour le pays	Numéro d'appel national	The national call number (8 figures at the most)	Indication de la position
9	2 letters of the country	The national call number		Indication of the position
10				Espace / a space
11				Indication du pays
12		Inversion lettres / letter shift	Inversion lettres / letter shift	Indication of the country
13		Espace / a space	Indication de la position (2 lettres au maximum)	
14			Indication of the position (2 letters at the most)	
15	10 lettres caractéristiques du bureau		Espace / a space	
16	10 letters indicating the office	6 lettres caractéristiques du bureau	Indication du pays	A disposition / available
17		6 letters indicating the office	Indication of the country	
18			A disposition	
19			Available	
20	Inversion lettres / letter shift	Inversion lettres / letter shift	Inversion lettres / letter shift	Inversion lettres / letter shift

OPERATING RULES FOR THE "GENTEX" SERVICE

(C.C.I.T. Question 57-K — C.C.I.T.T. Question 14/21)

FEDERAL GERMAN REPUBLIC

Document S.G. VIII/30
19 November 1956

Regulations for the operation of the European switched telegraph network for the public service

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CHAPTER I

General

Article 1

Basic document

The provisions to be applied are those of the Telegraph Regulations (Paris Revision, 1949), except where a specific indication to the contrary is made in these Regulations.

Article 2

Definitions

§ 1. The European switched network for the general telegraph service is composed of telegraph offices of European countries, switching centres for the telegraph service, and telegraph channels interconnecting the offices and centres.

Note : Administrations may connect all/or some of their telegraph offices equipped with teleprinters to the switched network.

§ 2. Operational procedure for the European switched network service is as follows : the telegraph offices of European countries connected to the network establish communications between each other through the European switched network, i.e. without the intervention of an operator.

Note : Outgoing telegraph offices may give the necessary information for the establishment of communications by means of dial pulses or of figures of the start-stop code, according to the type of switching equipment used.

§ 3. A switching centre of the European general service is a centre within the European telegraph network to which are connected the telegraph offices taking part in the European switched service and which is the terminal point of telegraph lines leading to one or more countries.

§ 4. A telegraph office for the European general service is an office which can be directly connected, by means of switching, to any other telegraph office attached to the European switched telegraph network.

Article 3

Call number and answer back

§ 1. The call number of a telegraph office taking part in the European switched telegraph service is composed of one or two digits characteristic of the country in which the telegraph office is located and the call number itself, which may comprise up to 8 digits.

§ 2. The answer-back of the stations in the telegraph office should include the following information whenever possible :

(1) carriage return, line-feed, figure shift,

(2) the one or two digits characteristic of the country,

(3) the call number proper of the telegraph office, separated by a hyphen from the one or two digits characteristic of the country,

(4) not more than 2 characteristic letters denoting the station in the telegraph office,

(5) an abbreviation of the name of the telegraph office, separated by a space from the characteristic letters of the station,

(6) an abbreviation of the name of the country made up of not more than two letters and separated by a space from the designation of the telegraph office,

(7) the last signal should be letter shift.

§ 3. The answer-back of an overflow position (see Chapter IV, Article 17) should include the following information, whenever possible :

(1) carriage return, line-feed, letter shift,

(2) the code expression "DEB" (overflow) and a space,

(3) the one or two digits characteristic of the country,

(4) the call number of the overflow position, separated by a hyphen from the one or two digits characteristic of the country,

(5) letter shift, a space and an abbreviation of the name of the country made up of not more than two letters,

(6) the last signal should be letter shift.

§ 4. When the answer-back device is inadequate to give all the above information, the information mentioned under § 2 (2) and § 2 (5) or § 3 (3) can be omitted.

Article 4

Equipment for positions in telegraph offices

§ 1. Sending and receiving stations should be equipped with tape teleprinters which use the international telegraph alphabet No. 2, possess an answer-back device and can work in simplex with a monitoring tape.

§ 2. Positions should be equipped with apparatus for establishing and clearing communications, and for signalling possible service conditions during a communication.

§ 3. If the paper in a station teleprinter engaged in a communication runs out, the communication should be cut off automatically. In the case of a new incoming call, the calling telegraph office should be informed that the station has broken down or is engaged. Similar information would be desirable when the station breaks down for other reasons, especially when there is a breakdown in the paper feed.

§ 4. (1) When not more than two teleprinters in a telegraph office are connected to the European switched network, these should be installed for service in both directions. When there are more than two teleprinters in a telegraph office, different sets should be used for transmission and reception.

(2) When a telegraph office possesses several receiving sets or several sets operated in both directions, their call numbers should be combined into a single collective number. When one of these sets is engaged or has a breakdown, incoming calls should be routed to the free set having the following call number.

CHAPTER II

Operational procedure

Article 5

Responsibility of transmitting and receiving stations

§ 1. The complete and accurate transmission of telegrams is in the first place the responsibility of the operator in the sending station. If a telegram does not arrive or if the text is mutilated, he should prove that he has followed the regulations.

Note : He can supply this proof by showing the original of the telegram and the control tape together with the acknowledgment of receipt or the answer-back of the receiving station if this has been received without mistake, this answer-back then serving as a simplified acknowledgment of receipt.

§ 2. The operator in the receiving station is responsible for seeing that there is enough paper in the receiving apparatus, and that the apparatus is switched to " engaged " while the ribbon and the paper are being replaced, thus avoiding loss of telegrams. The incoming operator is also responsible for correcting errors which he may notice in telegrams received, if necessary after sending a request to the sending station.

§ 3. In special circumstances, note should be taken in the telegraph offices of lost, delayed or mutilated telegrams for which charges have been reimbursed. Such notes should describe causes of irregularities, e.g., faulty installations, omissions from the service instructions or non-observance of service instructions.

Article 6

Operations preceding transmission

§ 1. A mention of the route, in the form of the answer-back of the telegraph office to be called (without the characteristic letters denoting the telegraph station reached in this office), is entered on the telegram with the help of routing lists (see Chapter IV).

§ 2. In the sending station, telegrams are arranged in the order in which they are to be transmitted and according to the time when they were handed in. They should bear serial numbers, which are transmitted at the beginning of the preamble and serve as additional information about the telegram in case of enquiry.

§ 3. Communication with the called telegraph office is established by dialling the one or two digits characteristic of the country and the call number shown in the routing mention.

§ 4. As soon as the communication has been established, the operator in the sending station brings into action the answer-back device of the receiving station in the called office and his own station, when these two operations are not done automatically by the equipment in the sending or receiving country. The operator in the sending station compares the answer-back of the receiving station which he receives with the information shown on the routing mention of the telegram. If the information tallies, then he is sure that the desired office has been reached.

§ 5. If the answer-back of the receiving station received by the operator in the calling station differs from the routing mention, distinction should be made between the three following cases :

(1) The answer-back is mutilated ; the communication is not therefore in good operational conditions. In this case the answer-back device of the receiving apparatus should be brought into action for a second time. If the answer-back is once again mutilated or if it is not transmitted, then a breakdown has occurred (see Chapter III).

(2) The answer-back belongs to an overflow position. In this case, the communication is established with an overflow position which is ready to receive the telegram.

(3) The answer-back does not belong to the telegraph office desired, but to another. In this case the operator in the calling station immediately cuts off the existing communication and dials again.

§ 6. If the calling station receives the busy signal when dialling has finished, the call is repeated after about two minutes. If the second call is likewise unsuccessful, a third call is made after about two further minutes. Should the telegraph office still be engaged, then priority and full-rate telegrams are deviated to a telegraph office in the country of destination competent to accept them (see Chapter IV). In the case of letter telegrams, further attempts are made at longer intervals, before transmitting them by an alternative route after four hours.

Note : Immediate redialling of the call number of the called telegraph office when the letter is busy is not permissible.

§ 7. (1) SVH, S, F, MDT and urgent telegrams are announced by the operator in the sending station by the quadruple ringing signal and are transmitted immediately afterwards.

(2) Telegrams having a long or difficult text should be announced by a ringing signal before being transmitted. In addition, when more than five telegrams having the same text are to be transmitted, transmission should be preceded by the code expression TM ..... (number of telegrams) and the ringing signal. These telegrams are transmitted as soon as the operator in the receiving station has replied with the signal " OK ", or else not later than one minute afterwards.

Note : The operator in the receiving station thus has time to switch his apparatus to perforated tape reception.

Article 7

Actual transmission of telegrams

§ 1. Once the communication with the called telegraph office has been established, the telegram is transmitted in the manner prescribed in the Telegraph Regulations (Paris Revision, 1949). The prescribed routine repetition of different parts or of the whole of the telegram should in each case be carried out by the operator in the sending station.

§ 2. If the communication has been interrupted by accident, then transmission of the telegram is repeated immediately. If the receiving station, during transmission (of the telegram), informs by means of return signals, the code expression " DER " and interruption of the communication, that reception is bad, then transmission of the telegram should be repeated after 2 minutes.

Article 8

Operations following transmission of telegrams

§ 1. When transmission of the telegram has been completed, the operator in the sending station brings into action the answer-back device first of all in the distant receiving apparatus, in order to be sure that the communication still exists, and then in his own apparatus.

Note : With a view to limiting responsibility, it is desirable, before bringing into action the answer-back device in his own apparatus, to transmit the time of transmission and the abbreviation in letters of the name of the operator in the sending station. If the characteristic digit of a person is used, it should be separated from the time by a fraction bar.

While the answer-back device of his own apparatus is working, the operator in the sending station examines the control tape for any obvious mutilations.

§ 2. If this examination of the control tape reveals no fault, the sending operator cuts off the communication, if there are no more telegrams in the station intended for the called telegraph office or if the telegram transmitted is not an SVH, S, F, or MDT (see Chapter VI).

§ 3. If the sending operator notices mutilations on examining the control tape, he gives two ringing signals and transmits the code expression " COR ", standing for " Please correct... " (see Annex), adds the serial number and the one or two characteristic letters of the sending apparatus, and repeats the mutilated words. In this case, the receiving station of the called office must confirm reception.

Article 9

Collective transmission

§ 1. When there are several telegrams intended for the same telegraph office, they are transmitted one after the other, bearing in mind the provisions of Articles 6 and 8 above. In this case, the sending operator brings into action the answer-back device of the receiving apparatus and that of his own apparatus after each telegram.

Article 10

Receipt of telegrams

§ 1. The receiving operator checks telegrams received according to the provisions of the Telegraph Regulations and compares the number of words and the routine repetition. If he notices any mistakes which he cannot himself correct, he should send a request by RQ to the office of origin (see Chapter V).

§ 2. If the receiving operator notices that the writing is becoming uncertain during reception of the telegram or that reception is becoming bad, he transmits return signals (e.g. alternate " figure " and " letter " signals or alternate " figure " and " ringing " signals), inviting the sending operator to suspend transmission. He then sends the code expression " DER " and interrupts the communication. In this case, and in the case of accidental interruption of the communication, the receiving operator has nothing more to do, for the sending operator repeats the transmission of the telegram.

§ 3. When a long or difficult telegram is announced by the ringing signal, the receiving operator connects up a receiving perforator and then informs the sending station, by means of the code expression "OK", that he is ready to receive. The sending station starts transmitting not later than one minute after receiving this announcement.

§ 4. If the sending station has communicated by two ringing signals that mutilations have occurred in the transmission and if it repeats the mutilated words or groups of words after the code expression " COR " (please correct...) (see Annex), the operator must, in such exceptional cases, confirm the regular arrival of the telegram at the sending station in the following way : " Serial number/characteristic letter or letters of the sending apparatus, R, time of transmission and abbreviation of the name of the receiving operator."

§ 5. When telegrams requiring acknowledgement of receipt are announced by repeated ringing signals, the receiving station should be engaged immediately, so that reception may be confirmed as soon as transmission is over (see Chapter VI).

CHAPTER III

Transmission incidents

Article 11

Incidents before transmission

§ 1. If the sending operator notices any irregularities due to faulty equipment while establishing the communication, he should interrupt the communication and try to call again after about two minutes. If the second attempt and a third attempt, repeated after about 10 minutes, are likewise unsuccessful, the sending operator makes an appropriate note on the telegram. The telegram is sent by an alternative route (see Chapter IV). A notice of breakdown should be sent to the breakdown service shown in the routing list.

Article 12

Incidents during transmission
(see also Article 7, § 2.)

§ 1. When a receiving apparatus receives a completely mutilated text and the communication has already been cut, the printed tape should be stuck onto a telegram form, on which should be indicated the receiving station, the time of transmission and the abbreviation of the name of the receiving operator. The telegram is kept for further investigation. Since in such cases the receiving station cannot transmit a request to the sending station, the loss of a telegram is inevitable if the sending station does not notice the incident. The operational condition of the receiving apparatus and of the connection should be immediately checked, and the result of this check-up noted.

§ 2. If the sending operator notices that the answer-back of the receiving apparatus and /or the text of the telegram are several times badly mutilated on the control tape, he informs the position competent in breakdown matters of the breakdown in the communication ; this competent position then sees that the communication is checked and the breakdown located. The communication subsists until the position competent in breakdown matters clears it.

Note : This operational procedure is intended to facilitate the investigation of tempory breakdown in junction lines.

§ 3. If the clearance notice takes more than 15 minutes to come through, the sending station can cut off the faulty communication if it fears an accumulation of telegrams or a delay in the transmission of priority telegrams.

Article 13

Other incidents

§ 1. When the receiving part of a teleprinter is in operation for a long time without there being any transmission or reception, the apparatus should be stopped by cutting off the power supply ; the position competent in breakdown matters should then be advised. The plugs connecting the mains and the apparatus should not be removed for other reasons, for example at the end of service of a telegraph office.

§ 2. All incidents mentioned under Articles 12 and 13 should be noted together with the time at which they occured.

Article 14

Checking operational conditions

§ 1. In order to check the operational condition of apparatus and station and junction lines in the European switched network for the general telegraph service, central control transmitters located in the switching centres of the European switched network can be chosen. These transmitters automatically transmit a test text with or without distortion. For more detailed tests, the reference distortion measuring position of the above mentioned centres should be selected. Call numbers for getting into contact with central control transmitters and reference distortion measuring positions are shown in the routing lists (see Chapter IV).

§ 2. No telegrams should be transmitted or received over apparatus and lines which are not in good operating conditions.

CHAPTER IV

Routing

Article 15

Establishment of routing lists and their exchange between Administrations and Recognized Private Operating Agencies

§ 1. All Administrations and Recognized Private Operating Agencies taking part in the European switched telegraph service are to establish routing lists showing their telegraph offices connected to the European switched telegraph network and, where necessary, also a limited number of telegraph offices served by the telegraph offices connected to the European switched network, and which thus belong to their terminal areas.

§ 2. Routing lists should be of the A 4 size (210 × 297 mm) and they should contain the following information :

a) in the first column : the names of the telegraph offices in alphabetical order ;

b) in the second and third columns : the call number and answer-back (with the characteristic letter or letters of the telegraph stations) of the telegraph office if it is connected to the European switched telegraph network, in other cases the call number and answer-back of the telegraph office connected to the switched network which serves the telegraph office shown in column 1 ;

c) in the fourth column, set aside for restricted service telegraph offices connected to the European switched telegraph network : service hours and instructions on the routing of telegrams after service hours.

Routing lists should also mention how telegrams should be routed if there is a breakdown in the telegraph offices or for telegraph offices not given on the routing list. Furthermore, they should give the call numbers for reaching special positions such as information positions, reference distortion measurement positions, breakdown positions, central control transmitters for sending texts with distortion and central observation transmitters for sending texts without distortion.

§ 3. Administrations and Recognized Private Operating Agencies taking part in the European switched network are to exchange copies of their routing lists between each other.

§ 4. (1) Telegrams transmitted to the telegraph office prescribed in the routing lists are considered to be transmitted " by normal route ".

(2) Telegrams which, because this telegraph office is engaged or because of a breakdown, are transmitted to another telegraph office in the country of destination connected to the European switched network, are considered to be alternatively routed when they bear the service mention " détourné " and mis-directed in other cases.

Article 16

Telegrams to offices with restricted service

§ 1. The routing list should give, for each restricted service telegraph office connected to the European switched service, a permanent-service telegraph office, to which telegrams are routed on behalf of the telegraph office mentioned in the first place at times when the latter is closed.

Note : It is desirable that telegrams to restricted service telegraph offices should be transmitted, when such offices are closed, to as few permanent-service offices in each country as possible, preferably to only one of them ; this will simplify consultation of routing lists.

§ 2. Administrations and Recognized Private Operating Agencies should ensure that the change in route for telegrams to restricted service telegraph offices takes place simultaneously for all such telegraph offices.

Article 17

Overflow

§ 1. Administrations and Recognized Private Operating Agencies may take preventive measures so that when all the station lines of a telegraph office are busy, calls may be routed immediately or not later than after 1 minute afterwards by automatic means to an overflow position. If this deviation is made after some delay, the calling telegraph office should be immediately informed by return transmission of the code expression " MOM ".

§ 2. The routing list of a country making use of overflow positions should mention in column 4 the answerbacks of the overflow positions and all other relevant information, especially information about the possible waiting time.

Article 18

Telegrams to offices not connected to the European switched telegraph network

§ 1. Telegrams to telegraph offices which are not connected to the European switched network and which are not given in the routing list should as far as possible be transmitted in the case of each country only to one telegraph office connected to the European switched telegraph network, which should be specially indicated in the routing list.

Note : Routing of such telegrams is thus simplified. Any other solution would involve the risk that the advantages of the European switched telegraph service might be offset by the extra time taken to route the telegrams.

§ 2. If a country should opt for a routing procedure different from that indicated under § 1 for telegrams to telegraph offices that are not connected to the European switched telegraph network, it must supply all Administrations and Recognized Private Operating Agencies with routing information, such routing to be economical and unequivocal.

Article 19

Misdirected telegrams

§ 1. If the receiving operator notices that a telegram has been misdirected during the communication, he should immediately draw the attention of the sending operator to the error.

§ 2. If the fact that the telegram has been misdirected is noticed only after the communication has been cut, the receiving telegraph office should retransmit the telegram, without delay and with priority over other telegrams in the same category, to the right telegraph office, even when the latter is in another country.

Article 20

Auxiliary and emergency routes

§ 1. When there is a breakdown in all the stations of a telegraph office connected to the European switching network, telegrams are alternatively routed to the telegraph office indicated for such cases in the routing list of the country concerned.

§ 2. When all the lines of the European switched network leading into a country are busy, telegrams intended for such countries are routed via the alternative route of a neighbouring country taking part in the European switched telegraph service.

CHAPTER V

Requests and service advices

Article 21

Requests

§ 1. In the operational procedure envisaged, the communication is in general already interrupted when errors are noticed in the course of checking the telegram. The appropriate request (RQ) is transmitted to the outgoing office. This office establishes a new communication and transmits the reply (BQ).

§ 2. Except where special circumstances justify it, communications should not be continued until the outgoing telegraph office has replied to the request. They should, on the contrary, be interrupted immediately after the request (RQ) or the reply (BQ).

§ 3. Requests should be made only when they are absolutely essential. Where there are obvious errors, the receiving operator should correct them on the forms to be delivered to the addressee by pasting over printed strips with the corrected version. For transit telegrams corrections are made in pencil.

§ 4. When the request or reply communication has been established, the answer-back devices of the sending and receiving apparatus should first of all be brought into action. Requests should start with RQ, and replies to them should start with BQ. Then follows the designation of the reference telegram with the serial number and the characteristic letter or letters of the sending station. Next, the reason for the request or reply and last of all the time of transmission and the abbreviation of the name of the sending operator. The communication is then immediately interrupted without this time bringing into action the answer-back device.

§ 5. If a reply to the request is not received within 20 minutes, RQ must be transmitted a second time to the outgoing telegraph office. If a reply is thereupon received within 10 minutes, the telegram is retransmitted with the mention " CTF " and an indication of the type of correction. The same applies to cases where it is obvious from the start that an explanation of the error will take a fairly long time (for example, after the closing time of the telegraph office).

Article 22

Service advices

§ 1. When a telegram is retransmitted with the mention CTF, due to a long delayed reply (BQ) to a request, the outgoing telegraph office should be informed of the fact by a service advice. The outgoing office is at the same time asked to send the reply direct to the telegraph office of destination.

§ 2. Requests which are necessary one or more days after the telegram has been received should always be made by means of service advices (AVIS).

§ 3. Requests and service advices should make use of the code expressions listed in the Annex below.

CHAPTER VI

Telegrams with acknowledgment of receipt

Article 23

Categories of telegrams

§ 1. The receiving station must give an acknowledgment of receipt to the sending station upon reception of SVH, S, F and MDT telegrams.

Article 24

Operational procedure

§ 1. If possible, the acknowledgement of receipt is given immediately after the telegram has been received. If the sending station does not receive the acknowledgment within 30 seconds, it breaks the communication or starts transmitting the following telegram if it still has other telegrams to transmit to the called telegraph station. In this case the transmitting telegraph office then requests the receiving office by means of an ordinary service advice to send it the acknowledgment of receipt.

§ 2. Telegrams requiring acknowledgment of receipt should be announced by a quadruple ringing signal. The sending operator should ask the receiving operator to notify that the telegram has been received; this can be done immediately after the telegram has been transmitted and the answer-back device brought into action in the following way, for example : " SVP RECU 456/A ". The reference telegram should bear the serial number and the characteristic letters of the transmitting station.

§ 3. Since in general the receiving operator has not yet stuck anything onto the form nor checked the telegram received, he only acknowledges receipt of the telegram in the following way : " 456/A ETAT R 1430 RGR ", in which 456 stands for the serial number, A for the characteristic letter of the sending station, ETAT for the telegram category, R for receipt, 1430 for the time and RGR for the abbreviation of the name of the receiving operator. The communication is cut off by the operator in the sending station after he has received the acknowledgment of receipt. If telegrams received give rise to complaints for any reason whatsoever, the errors should be corrected in conformity with the provisions of Chapter V.

§ 4. If the telegram received is an MDT telegram, the operator in the receiving station should, as soon as transmission is over, bring into action the answer-back device of the sending apparatus and check to see whether this answer-back corresponds to the one received.

CHAPTER VII

Accounting

Article 25

Method of drawing up accounts

§ 1. Administrations and Recognized Private Operating Agencies taking part in the European switched telegraph service settle accounts every three months for telegrams exchanged over the European switched network, on the basis of monthly accounts established for outgoing traffic.

Article 26

Transit charges and average cost of telegrams

§ 1. The transit charge for the European switched telegraph network will be much lower than the charge usual at present in the case of point-to-point connections.

§ 2. The accounts will be based on the average cost for a given telegram for a week every three months, according to the number of incoming and outgoing telegrams as well as to their make-up (number of words, category of telegram, special services). The week selected for this accounting is to be fixed by agreement between the countries concerned. The average cost calculated will have to be mutually accepted by the Administrations.

Article 27

Monthly accounts

§ 1. The amount of the monthly account will be calculed by multiplying the number of telegrams transmitted during the month by the average cost of one telegram.

Article 28

Alternatively routed and misrouted telegrams

§ 1. Telegrams routed alternatively through a third country, and misrouted telegrams, are only included in the accounts when there are many such cases.

§ 2. Where telegrams have been alternatively routed through a third country taking part in the European switched telegraph network, the transit country establishes the accounts as if the telegram had been handed in at an office in the transit country.

Article 29

Applicability of the method of settling accounts

§ 1. The simplified accounting procedure described under Articles 25, 26, 27 and 28, is only applicable to telegrams in the European system. In the case of telegrams of the extra-European system transmitted over the European switched network, accounts will be settled in the usual manner by means of individual monthly accounts.

Article 30

Competence in case of disagreement

§ 1. When disagreement arises in connection with Articles 25 to 29, the opinion of the outgoing country is final.

CHAPTER VIII

Miscellaneous

Article 31

Telegrams misdirected in the country of destination

§ 1. If telegrams are transmitted by the outgoing country to a telegraph office in the country of destination connected to the European switched network, but not competent according to the official routing lists, the Administration of the country of destination can claim the refund of expenses for all telegrams that have been misdirected to this telegraph office, in view of the increased telegraph expense, on condition that telegrams misdirected to this telegraph office are 10 % more than its daily traffic.

§ 2. The additional telegraph expense for one telegram is 1 gold franc.

Article 32

Statistics

§ 1. Since statistics are only established on a small scale, as a result of the simplification of the settling of accounts for telegrams, Administrations and Recognized Private Operating Agencies must arrange between themselves the exchange of statistics relating to the European switched telegraph service.

Annexe : 1

Annex

CODE FOR THE EUROPEAN SWITCHED TELEGRAPH NETWORK FOR THE PUBLIC SERVICE

Code Expression	Meaning
	I. Transmission of telegrams
ADS	Address
ANH	Congestion
BK	I cut off
BQ	Reply to a request (RQ)
CK	Number of words
COL	Collation
COR	Please correct... (designation of mutilated words or word groups)
CRV	How do you receive ?
DER *	Out of order, the communication is not in operational condition, I am cutting off
DÉTOURNÉ	Telegram routed by another telegraph office in the country of destination, owing to a breakdown, the fact that the line is busy or because it is after closing time.
DTE	Date of handing in
E E E	Error
GA	You may transmit
MOM	Wait, waiting
O/D	Telegraph office of destination

* If necessary, the transmission in progress must be interrupted by the alternate transmission of « Bu » (letter shift) and « Zi » (figure shift) signals.

Code Expression	Meaning
O/O	Telegraph office of handing in
OK	Agreed, it is correct, right
PAP	Paper trouble
PBL	Preamble
PFX	Chargeable service mention
R	Received
RE	Reference to...
RPTAA	Repeat all after....
RPTAL	Repeat everything you have transmitted
RPTBN	Repeat everything between ... and ...
RPTWA	Repeat word after...
RQ	Designation of a request
SIG	Signature
SVP	Please
TEL	Telegram
TEST SVP *	Please send the test message
TEXW	... word of the text
TM	Announcement of several telegrams having the same text (for example TM 6) by a quadruple ringing signal
W	Words
+?	Invitation to transmit ; have you still a telegram ?
	II. Advice of non-delivery
OPWIG	Undelivered, refused by addressee
ORDAD	Undelivered, addressee not on board
ORJOB	Undelivered, collect redirection charges ... gold francs
RACYB	Still undelivered
RAFIS	Undelivered, not called for
RAFUJ	Undelivered, addressee absent
RAFYZ	Undelivered, addressee left
RAHOT	Undelivered, addressee left, forwarded by post to ...
RAJAJ	Undelivered, addressee unknown
RAJEV	Undelivered, addressee left for
RAJFU	Undelivered, addressee left without leaving address
RAJGO	Undelivered, addressee not arrived
RAJIF	Undelivered, addressee not at hotel
REGAD	Undelivered, several persons of the same name
REJAB	Undelivered, ship out of range
REKEG	Undelivered, address insufficient
RESIN	Undelivered, address insufficient without number of house
RICOD	Undelivered, address no longer registered
RIHUB	Undelivered, hotel unknown
RIJAG	Undelivered, address not registered
RIKEN	Undelivered, place (building, district, etc.) unknown
RISOB	Undelivered, no house of the number
ROCOG	Undelivered, street (square) unknown
ROFAB	Undelivered, not claimed on board
ROFER	Undelivered, ship already left
ROFJO	Undelivered, ship did not communicate
RUCMU	Undelivered, telephone number given in the address does not correspond with the name of the addressee
RUCOS	Undelivered, hotel, house, firm, etc., no longer exists
RUCXO	Undelivered, refused, the telegram does not concern the addressee
RUCYD	Undelivered, tried on train without success

* The following tests messages should be used :

a) in the case of transmission by an operator :
either " VOYEZ LE BRICK GEANT QUE J'EXAMINE PRÈS DU WHARF "
or " THE QUICK BROWN FOX JUMPS OVER THE LAZY DOG "

b) in the case of automatic transmission by a central observation transmitter :
either of the messages mentioned under *a)*,
or " KAUFEN SIE JEDE WOCHE VIER GUTE BEQUEME PELZE X Y 1 2 3 4 5 6 7 8 9 0 "

Code Expression	Meaning
RUCZA	Undelivered, train already left
RUFAJ	Undelivered, ship already sailed. Could be reached by radiotelegram
RUFKU	Undelivered, ship not yet arrived
RUFMO	Undelivered, addressee already disembarked from ship
	III. Various service advices
ATHAS	State name and address of sender
AZGUN	Cancel for abstract and accounting purposes
AZJEW	Cancel, error of service
AZKEG	Cancel our number ...
AZWET	Cancel ... for abstract purposes. Misrouted, now reforwarded correct route
BABSO	Message cancelled
BACYS	Please blank numbers
BINZA	Administration does not admit this class of traffic
CODUN	Read number of words in ... as ...
DADRO	Reply by wire ... (or sector ...); congestion here
JAJAR	Can you now deliver?
JIFAG	Delivered to registered ...
JOKID	State date and time of delivery
JUFAR	... is a reply to your ... Can you now deliver?
JYBAG	Now delivered, called for
JYDOT	Now delivered to and accepted by ... (complete address)
MAHVU	Your No. ... received here addressed: ... If address on original copy differs notify us immediately
MANAG	Forwarding by mail
MAWET	Message contains two destinations. Say for which intended
MIDUN	Have cancelled duplicate copy (copies)
NACBA	... we are enquiring, will reply as soon as possible?
NEDIB	Place of destination incomplete, several; please advise
NEFAT	Error of service
NEKLO	Place of origin not in List: please advise
NEMYD	Place of destination unknown; we forward to ...; correct if necessary
NIGYC	Received twice; have cancelled one transmission
NOVEF	Telephone error
OHBIN	Telephonic notification of delivery (CR) not received
PASCA	Transmitted twice; cancel second transmission
PATOS	Registration lapsed
PIPKU	Awaiting reply from connecting ... (Administration or Recognized Private Operating Agency). Reminders sent
PITUG	Sender's confirmation
POFIH	Correct if necessary
POHCO	Correction made by sender
POMDU	Delete CTF in service instructions
POSAG	Consult sender
PUFOB	Is this message still " Subject to correction "?
PYHOP	Our copy ... If this agrees with original consult sender
PYSAT	Delivered subsequently, or claimed: cancel advice of nondelivery
TIBOH	Can you assist to ...?
WAPUC	Please reply urgently
WEFXU	Waiting reply to our service advice
WEJOD	Place of destination not in List; please advise
WEJYV	Reference incorrect; give number, date, time of handing in, and say by which wire sent
XESCU	When and by what wire was telegram in question received?
XESLA	When and by what wire did you transmit the telegram in question?

SWITZERLAND

Document S.G. VIII/27-E
25 October 1956

Service code for the international switched general telegraph service

ALPHABETICAL LIST OF ABBREVIATIONS FOR USE BETWEEN OPERATORS IN THE INTERNATIONAL SWITCHED GENERAL TELEGRAPH NETWORK

A. *Abbreviations taken from Article 26 of C.C.I.T. Recommendation H.1 :*	*Meaning*
BK	I cut off
CFM	Confirm (or : I confirm)
COL	Collation
CRV	How do you receive ?
DER	Out of order
G	You may transmit
MNS	Minutes
MOM	Wait waiting
OCC	Engaged
OK	Agreed
P * (or figure 0)	Stop your transmission
QOK	Do you agree ?
R	Received
RAP	I will call you again
RPT	Repeat (or : I will repeat) (or : Repeat ...)
SVP	Please
Test SVP	Please send a test message

* To be repeated until the transmission is brought to a stop.

B. *Abbreviations taken from Appendix No. 1 of the Telegraph Regulations*	*Meaning*
ANH	Congestion
BQ	Reply to RQ
DX	Duplex
LR	Up to what point (word or telegram) have you received ? We have received up to...
RQ	Designation of a request
SX	Simplex

AA	Everything after ...
AB	Everything before ...
ADS	Address
AL	Everything
APP	Start-stop apparatus
BN	Everything between ... and ...
CAL	Call Number (or : call ...) (or : what is the call number of ... office ?)
Circ	Circuit
CL	We are closing (or : we are closing at ...) (or : this office is closed)
DBLE	Double word(s)
DEB	Overflow position or station
DEST	Office of destination
DET	Divert to ... (or : I am diverting to ...) (or : diversion route)
DIF	Different
FIG	Figure(s)
IND	Answer-back device
LTR	Letter(s)
MEME TXT	Same text (or : ... telegrams same texts)
MUT	Mutilated
NOR	Not received
TG NR	Number of telegram ...
OMI	Omitted
ORIG	Office of origin
PBL	Preamble of telegram ...
PPR TBLE	Paper trouble
QG	May I transmit ?
READ	Please read...
REC	Reception
RECT	Correct (or : I am correcting) (or : correcting)
REPER	Prepare your reperforator
Route	Route via ... (or : I am routing via ...) (or : route ?)
SIG	Signature
(Acoustic signal)	Attention
SRL NR	Serial number of telegram ...
SVC	Service advice
TFC	Telegraph correspondence
TG	Telegram
TREBLE	Triple word(s)
TXT	Text
W	Word(s) (or : group(s))
WA	Word after ...
WB	Word before ...
WTG	We are waiting (or : I am waiting)

" MESSAGE SEPARATION " SIGNAL

(C.C.I.T. Question 60-2 — C.C.I.T.T. Question 4/8)

ICAO (Note presented by France)

Extracts from Document S.G. IX/34
23 February 1955

Preliminary study

of

— Choice of End-of-message signal (EOM)
— Choice of Start-of-message signal (SOM)
(Ref : Recommendation 44, Report of Fifth Session COM) [1]

1. *Preliminary Proposals*

1.1 Since perforated tape transmitters are not equipped with a shift device, technical modifications would be required to distinguish at the keying head between the signals of the two cases of telegraphic alphabet No. 2, and to make a selection from among the 58 different combinations which can be distinguished by printing receivers. Therefore, only the 32 combinations of the alphabet can be considered and there is no possibility of distinguishing the appropriate case for printing the selected combination.

1.2 Only two signals of the alphabet are simple enough to be coded and translated by a sufficiently wide variety of simple and inexpensive types of equipment. These signals are No. 29 (Letters) and No. 32 (Blank).

When transmitted continuously (and automatically), these two signals are formed respectively of :

— 1 start element repeated, in time, every 7.4 to 7.5 Letters units.
— 1.4 to 1.5 stop elements repeated, in time, every 7.4 to 7.5 Blank units.

Owing to the odd number (7) of elements forming the signals and the additional length of the stop element, no other signal of the alphabet can be " symmetrically " formed, i.e. be formed of elements regularly spaced in time when transmitted in series. For this reason, coding and translation of the 30 other signals of the code require more complex electro-mechanical equipment. Signals Nos. 29 and 32, however, are very simple to distinguish and translate. Furthermore, the Letters signal is correctly translated, irrespective of the time interval between the start elements, provided the latter interval is of at least 6 elements.

1.3 In operation, the reliability of an EOM signal is controlled by :

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[1] Note by the C.C.I.T. Secretariat : This Recommandation 44 invites ICAO Contracting States to standardize the " end-of-message " signal.

1.3.1 The fact that the signal always appears at the end of the message and can readily be reconstituted by the originating station, in the event of its omission or of accidental mutilation of the tape.

1.3.2 The fact that the signal should not appear in any part of the message itself, in order to avoid any accidental mutilation of the latter.

The choice of an EOM signal is therefore governed by the above proposals.

2. *Determination of the number of combinations to be used for the EOM Signal*

2.1 Signal composed of one single combination.

It would be possible to use a single " Blank " signal as EOM signal since this combination of the five-unit alphabet is not used at present. This does not appear to be acceptable, however, since it would definitively assign the " Blank " signal to this exclusive function, whereas, owing to its simplicity, it should be possible to use this signal for various non-conflicting functions.

2.2 Signal composed of two consecutive combinations.

Out of the 1024 (32^2) possible combinations, all those corresponding to a printed character must be eliminated as being incompatible with proposal 1.3.2 above. As regards the non-typing combinations, all these must be excluded, except the combination

Figures - Letters

which might lead to a possible solution.

2.2.1 The reverse combinations Letters - Figures, like any other combination using a Figures signal not followed by Letters, must be excluded since it would have the disadvantage of leaving the correspondent's receiver set at the Figures case.

Note : Some numbering machines (tape) require that the receiver be set at the Letters case in order to record correctly the first characters of the circuit message number. The use of an EOM signal formed of the combination Figures not followed by the Letters combination would require modification of such equipment.

Such modification is undesirable for the following reasons :

a) The circuit message number must be followed by a Letters signal to shift the receiver back to the Letters case. If the Letters signal is also used to stop the numbering operation, it is possible to avoid the use of an additional signal which otherwise would be necessary.

b) The only simple signal which might be put forward as a substitute would be the Blank signal. However, it would be difficult to avoid this Blank signal (following the circuit message number for stop purpose) being sent over the circuit by the Numbering device. As long as the Blank signal has not been defined internationally, it is preferable to avoid any use of it which might involve its transmission over outgoing circuits.

c) Use of the Blank signal would involve the necessity of preparing the numbering machine tapes on a perforating keyboard having a special key for encoding this signal. This would involve modification of the keyboards of equipment which does not provide for this at present.

2.2.2 This two-character combination does not appear to be particularly useful nor sufficiently reliable. Moreover, it brings us back to the difficulty mentioned in paragraph 1.1.

2.3 Signal formed of three consecutive combinations (32768 possible combinations).

2.3.1 This seemingly large number of combinations might provide a solution to the problem. However, a signal composed of three combinations does not appear to be sufficiently reliable and it seems preferable to form the signal of at least four consecutive combinations.

2.4 Signal composed of four consecutive combinations.

2.4.1 Since there are more than a million possible combinations, it seems preferable and simpler to limit the choice to a series composed of four identical characters.

2.4.2 Taking into account proposals 1.1 and 1.3.2 above, it is mainly the Figure or punctuation characters which are normally liable to be transmitted in series in some part of the message. These should therefore be excluded.

This involves, first of all, the exclusion of:

— the Figure series (Q, W, E, R, T, Y, U, I, O, P);

— the period and fraction sign series (M and X);

— the series for the audible signal and the signal which operates the automatic answer-back unit (J, S and D).

If it is desired to permit transmission of diagrams (illustrated New Year greetings are often sent for amusement in this manner), a possibility which might have applications in the future, it would seem preferable to exclude the series which can be used for this purpose (A, C, L, K, V and Z).

The series Z (+ + +) should also be excluded in view of the action likely to be taken in this connection for transmission of meteorological messages (see Question 40 in the Arnhem C.C.I.T. Document 1953, page 213). Finally, the series F, G, H should be avoided, since its function on the Figures case has not been laid down internationally.

2.4.3 In the circumstances, from among the printed character combinations, the choice should be limited to either one of the series

BBBB or NNNN

2.4.4 It should be noted that on teletypewriter networks using page printers, these characters, when transmitted following the series of interline signals used to separate messages, will be printed not at the end of the message, but on the first line of the next message. Consequently, there is no particular use in taking a printed character combination for the EOM signal, and such characters have the disadvantage—a slight one, admittedly—of introducing at the beginning of the printed message characters which have nothing to do with the message.

2.4.5 Reviewing the non-typing combinations, we find that:

— the Space series must be excluded;

— the Carriage Return series must be reserved for other functions (end of line switching);

— the Line Feed series must be excluded. It would require more than four signals (8 under the I.C.A.O. procedures). Furthermore, Line Feed signals may occur in series in the body of a message, particularly before any final text;

— the Blank series should be reserved for other functions such as tape feeding in internal switching with automatic erasure of the signals.

Neither of these two functions would be incompatible with the use of a series of four Blank signals as EOM signal. However, the series would then obviously have to be transmitted on the outgoing circuits. For the reasons given earlier under 2.2.2, it is preferable, for the present, at least, to avoid any use of the Blank signal which would involve the necessity of its transmission.

— The Figures series must be eliminated for the reasons given under 2.2.2.

— The Letters series must be eliminated since it is currently incompatible with 1.3.2. However, in view of the usefulness of this signal, it will be reserved for more detailed consideration later.

2.4.6 The choice is therefore finally limited to the series B, N and Letters, the position being as follows:

Comments

Series B, N } Nil.

Letter series: could be used, subject to the elimination of certain objections.

3. *Consideration of the operational requirements*

3.1 In the following paragraphs, the provisional definitions, adopted by the Fifth Session of the COM Division for the three methods of operating tape relay stations, have been used.

3.2 *Manual system* [1]:

3.2.1 In this system, each message must be followed by a series of additional signals, in order that messages may be separated by cutting the tape. The series currently used is formed of 16 Letters signals. In view of the characteristics of this signal (the tape is cut when fully perforated), it is considered to be neither useful nor desirable to modify the specification.

3.2.2 An additional series of signals should also be provided to feed the tape out of the reperforator, on receipt of a single message or at the end of a series of messages.

The signals used for this purpose are generally Space signals (approximately 20 are used). They are not transmitted over the circuit, but are produced locally by a manually controlled (push-button) or automatic (time system) device which temporarily connects the reperforator relay with the negative (—) battery terminal. This device, incidentally, must conform to the requirements of paragraph 1.2.7.2 in Recommendation 10 of the Report of the Fifth Session of the COM Division.

This series must be erased from subsequent retransmissions either by cutting out that portion of the tape which is free of code perforations, or by means of an automatic device which disconnects the circuit from the transmitter whenever Blank signals appear in series at the keying head. It appears neither useful nor desirable to modify these specifications.

Note: Some manual or semi-automatic systems use the Letters signal and not the Blank signal for tape feeding and automatic erasing. This use of the Letters signal as a substitute for the Blank signal is not incompatible with its use as EOM signal. In this case, only the first four characters of the Letters series separating the messages should be retransmitted to form the EOM signal, the end of the series being erased from subsequent retransmissions.

3.2.3 Equipment used in manual systems is generally simple, so that any complication would increase costs substantially at stations where it is applied and could represent a considerable proportion of the total equipment cost.

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[1] In the C.C.I.T. draft List of Definitions = torn tape relay.

3.2.4 With this system, an end-of-message signal is not essential. However, once such a signal has been defined, some manual centres may consider its use desirable in order to be able to select, at will, the following different forms of transmission:

a) communication with a tributary station:

The transmitter is stopped immediately after transmission of the EOM signal.

No transmission of additional Letters signals is required in this case.

b) communication with an automatic or semi-automatic centre:

Same method of operation.

c) communication with a manual centre:

Transmission of the EOM signal is followed by a series of 16 Letters signals, even if this series does not appear on the perforated tape.

3.2.5 Such improvements in a manual station are justified only if the signal selected is such that the cost of the additional equipment required does not represent too great a proportion of the total equipment cost.

3.3 *Semi-automatic system* [1]

3.3.1 With this system it is not necessary to separate messages by means of a series of additional Letters signals. However, the additional series of Blank (or Letters) signals should be appreciably longer (approximately 60) for end of series messages, owing to the spacing required between the reperforator and the transmitter, in order that the addresses may be easily read and the whole tape transferred without cutting.

3.3.2 In this case, automatic stopping of the transmitter at the end of the message, automatic provision of Blank (or Letters) signals and their automatic erasure at the keying head are *fundamental and mandatory* characteristic requirements of the system.

Methods of transmission *a)*, *b)* and *c)* listed in paragraph 3.2.4 would also be desirable.

3.3.3 With this system, since an end of message signal is mandatory, it is necessary to decide upon the signal to be used and to determine the equipment it necessitates in order to study and estimate the cost of the installations required.

In view of the fact that, in the case of an average centre, the cost of such equipment is about the same as or slightly higher than the cost of a manual system, the use of complicated devices may lead, in this case also, to additional costs representing an appreciable proportion of the total installation cost.

3.3.4 In fact, the development of semi-automatic systems in the AFTN is entirely dependent on the definition of the EOM signal. If it is not possible to adopt a simple signal, it is not worth while pursuing investigation of the possibility of converting equipment so that any combination of signals ultimately selected can be used on such systems.

3.3.5 It is therefore urgently necessary to decide upon an EOM signal and it is desirable that the signal selected be suitable for use with simple equipment. It would be desirable for AFTN stations to be able to adopt a semi-automatic system wherever a manual system is considered to be inadequate and where a fully automatic system would not be justified for some time to come.

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[1] In the C.C.I.T. draft List of Definitions = Semi-automatic reperforator switching.

3.4 *Automatic system* [1]

In this system, many functions in addition to those so far mentioned must be performed automatically. Consequently, the complexity—and the cost—of the equipment is normally much greater than in the case of the two other systems.

In this case, the choice of one of the previously mentioned signals is a matter of relatively minor importance. It is even likely that most fully automatic systems could be adapted indifferently to any series from among the five unit code combinations.

3.5 With automatic systems, the number of possible EOM signal combinations appears to be greater and the complexity of the equipment seems to be more directly related to the number of the signals than to their nature.

Consequently, the Line feed series, which would require 8 consecutive signals instead of 4, would appear to be unsuitable, since it involves further complication of the equipment.

4. *Advantages and drawbacks of the various combinations considered as likely to be suitable*

4.1 For the reasons indicated above, selection of the Letters series, undeniably simpler than a choice between the B or N series, is much more worth considering for manual and semi-automatic systems than for fully automatic systems, the choice being probably immaterial for the latter.

4.2 Because of the special formation of this signal, which is excellent from the telegraphic point of view, it has been selected :

— as stop signal for numbering devices using tape reels ;

— as an additional end-of-message signal in procedures suitable for manual systems.

4.3 Its use as EOM signal, previously proposed by France in COM V-WP/4, would merely represent an extension of current practice. Although technical decisions should not be subordinated to merely procedural aspects which can always be modified, it is nevertheless recognized that adoption of the Letters series would best fit in with current practice and would cause less disturbance of the acquired habits of operators.

4.4 If this series were to be used, messages should end with a series of Letters signals which would always have to be a multiple of 4, i.e. :

4 signals, in the case of semi- or fully automatic operation ;

16 signals, in the case of manual operation.

4.5 This signal can be coded and translated by simple mechanical, electro-mechanical or electronic devices.

In particular, restoration of tape which has been mutilated at the end of a message and the method of operation indicated in paragraph 3.2.4 *c)* can be achieved very easily on a manual system. Perforated tape transmitters are normally designed to stop when the end of the tape is reached and to switch the circuit to a second transmitter on which the next message has just been set up (flip flop system). It would be extremely simple to delay for a given period the stopping of the transmitter, which can then send the missing or desired Letters signals while running empty.

Use of the series N or B, on the other hand, would make it necessary to transmit an abnormally coded or mutilated message either with a pilot tape or from a special position with some device capable of coding the EOM signal. In either case, the operation is more complicated and considerably less automatic than when the Letters series is used.

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[1] In the C.C.I.T. draft List of Definitions = Fully automatic reperforator switching.

4.6 At the Fifth Session of the COM Division, France outlined in the Appendix to COMV-WP/3 the general characteristics of a semi-automatic system fulfilling all the functions required of such a system, i.e. stopping the transmitter on the Letters series which currently ends ICAO messages, sending Blank signals after the last of a series of messages and erasure of the Blank signals at the keying head.

This system, which is entirely electronic and particularly simple (5 tubes), can readily be adapted to obtain one of the following three types of transmission :

1. stop of the transmitter on the 4th Letters signal ;
2. preparation to stop on the 4th signal and continuation of transmission of Letters signals in series, the actual stop occurring on the next character (in accordance with prior arrangements) ;
3. stop on the 4th signal and switch on of a time mechanism which sends 12 additional Letters signals.

4.7 It should be noted that an electronic time mechanism sending Letters signals (i.e. a 20 millisecond positive impulse every 150 milliseconds) is an extremely simple device.

4.8 There appear to be four possible objections to the use of the Letters signal as EOM signal :

4.8.1 *Superfluous signals*

It has frequently been noted that some operators have the bad habit of (and even a mania for) introducing unnecessary Letters signals when typing messages. Tapes perforated in this manner would thus be liable to be mutilated.

If semi—or fully automatic systems could not accept such messages without setting off an alarm alerting the supervisor, and if each alarm led to the imposition of some sanction on the employee concerned, the choice of the Letters series would prove to be rather a fortunate one since it might result in the elimination of a bad habit.

4.8.2 *Wear of tape*

When a tape will not feed into the keying head as a result of deterioration of the tape feeding perforations, the signal transmitted is generally that which happens to be under the pins of the transmitter. In most cases the pins move more or less rapidly across the immobilized tape so that the transmitter sends Letters signals.

Several questions then arise : Is it preferable for this to cause the transmitter to stop ? Should it disconnect the outgoing circuit or not ? Is it necessary or not for the whole message to be repeated after the tape has been repaired ?

Although various views may be held on these points, it appears to be more of an advantage than a drawback for an accidental EOM to appear when this happens, its appearance having several effects (stopping of the transmitter, disconnection of the circuit, inability to resume transmission of the tape without setting off the monitoring alarm).

Here again, it is the Letters series that is most likely to cause such accidental EOMs.

4.8.3 *Correction of errors on tapes*

According to paragraph 4.4.4.10.1 of Annex 10, Chad tapes can be corrected by backspacing the tape and operating the LTRS key over the incorrect characters. However, there are already so many restrictions on this procedure, that it could be eliminated without great difficulty. A proposal to this effect, made by France at the Fifth Session of the COM Division, was supported by several other States. With

automatic systems, this procedure cannot be used on the priority prefix and routing lines, and it cannot be used with printing perforators or with reperforators (printing or otherwise) or with manual transmission systems.

In the A.F.T.N., the trend is more towards the use of remote control reperforation, so that the procedure referred to is gradually being forgotten by operators. However, if it is desired to retain the procedure, it would only be necessary to add another restriction to those already imposed, to the effect that the procedure should be followed only for correction of two consecutive characters.

This would cover 99 % of the typing errors which could be committed, since the most frequent errors, by far, are the single incorrect character which is immediately noted, or the case of two consecutive characters typed in the wrong order.

In the relatively rare case where it is necessary to correct whole words, the procedure might provide for the elimination of the excess Letters signals, by cutting and re-joining the tape.

This seemingly basic objection to the use of the Letters signal as EOM signal can therefore readily be eliminated.

4.8.4 *Presence of Letters signals between the various parts of the message*

Under the I.C.A.O. procedures, the characters preceding the circuit message number as well as those separating the circuit message number from the message heading are formed of a series of Space signals, and the Letters signal appears only at the end of the message.

When this matter was discussed at the Fifth Session, it appeared that some services which might be connected with the A.F.T.N. would perhaps have procedures or equipment with which Letters signals and not Space signals would be used in these two parts of the message.

The services concerned should clarify this point, with a view to determining whether it is possible to extend the I.C.A.O. procedures to cover all services likely to send messages over the A.F.T.N., and what physical difficulties would be involved in replacing any such Letters signals by the series of Space signals normally prescribed.

However, as regards the series of Space signals preceding the circuit message number, it is felt that this procedure should be modified for the reasons indicated below (6.4).

5. *EOM Signal—Conclusions*

To sum up—the French authorities are of the opinion that an EOM signal formed of a series of Letters signals (4, for instance) from the possibly longer series of additional signals required in manual operation, has all the advantages of simplicity, economy and reliability, directly attributable to its special telegraphic formation.

It appears that the objections which might be raised against its use can readily be eliminated.

No alternative signal should be chosen without a careful technical study of the requirements, not only of automatic systems, but also (and this is even more important), of all systems. In any event, any proposal to use some other signal should include particulars of the equipment it requires.

A carefully chosen EOM signal may bring about a substantial improvement in the operation of A.F.T.N. stations, irrespective of the present or future system applied or the type of equipment used.

Note : The above proposals are based solely on considerations of telegraphy technique and the desire to attain the objective aimed at, by the simplest means, irrespective of the type of equipment used.

No account has been taken of the fact that a prototype semi-automatic system has been developed in France, for which the Letters series has been used as EOM signal.

This system comprises transmitters (type M 14) on which the 5 signal coding contacts are independent and issue from the machine through separate conductors. Consequently, replacement of the Letters series by some other series (e.g. NNNN) would require only minor modification of the wiring. This would not be the case with transmitters in which it is not possible to isolate separately the 5 units forming the signal.

6. *Start of message signal (SOM)*

6.1 As this signal is used only between stations and is automatically replaced and then reproduced, at the same time as the message circuit number; in subsequent transmissions, it does not require to be specified internationally.

6.2 Nevertheless, it is desirable to fix the *number* of combinations to be used for this signal.

6.3 It may also be considered desirable that circuits terminating at the same station should not require different combinations for this signal; so that it is obviously desirable to establish an international specification for the signal.

6.4 Annex 10 at present provides (paragraph 4.4.4.15.5) that 5 Spaces shall be used before the transmission identification. From the telegraphic point of view, the choice of this signal is unfortunate, when the receivers used are of the type in which the motor stops during periods of non-utilization of the circuit.

6.4.1 Only two out of the seven units in the Space signal are positive (third impulse and stop). As long as the receiver has not reached its synchronized operation speed, the third impulse of this signal may be received as a false stop, delaying to that extent correct synchronization.

The false signals introduced during this period are generally characters with only one positive unit (E, T, LF and CR).

In certain circumstances, a receiver receiving a series of Space signals can even synchronize itself indefinitely on the third unit as stop. The series received is then a series of false signals (generally " I "s), followed by a garbled reception of the first characters following the series, until such time as the receiver has resumed correct synchronization.

Furthermore, when the first line consists of 69 actual characters, the introduction of such false signals generally causes a further mutilation at the end of the line (garbled overline).

6.4.2 In order that the receiver may reach synchronization as rapidly as possible, it is preferable to use, for the series of signals preceding the transmission identification, signals having an adequate number of consecutive positive units.

The letters signal would be more suitable from this point of view and its use would not be in conflict with the proposals made above concerning the EOM signal. It is incompatible, however, with numbering devices using perforated tape, for the reasons indicated in paragraph 2.3.2.

6.4.3 It appears preferable for this reason to use the signal " V " which consists of 4 positive impulses followed by a stop. This signal is therefore almost equivalent to the Letters

signal, from the telegraphic point of view. The fact that it also represents the letter " V " is also an argument in its favour, since a series of " V "s are already used at the beginning of certain transmissions in Morse or RTT (paragraph 4.3.2.2 of Annex 10).

A series of 3 " V " signals is certainly adequate to permit correct synchronization in all cases. However, for consistency with the proposals made at the Fifth Session of the COM Division, the number to be used could be fixed at 4. These signals would be followed by a Space signal. These " V " signals are intended merely to replace the 5 Space signals at present required by paragraph 4.4.4.15.5. They should precede the SOM signal, but cannot replace it.

6.5 The SOM signal must fulfil two separate functions :

a) serve as a receiver test ;

b) establish the sequence of operations, particularly for automatic monitoring of the message circuit number.

6.5.1 For testing the receiver, the series of signals RYRY could be chosen, since this is the most conventional series used for this function.

It is well known, however, that in the event of complex distortion, selection errors generally affect the last two units of the signal, so that a fairly large number of the 5 unit code signals are almost equally satisfactory for test purposes. Normally, all that is required is to select two alternating signals such that one has its 4th unit positive and its 5th unit negative, and the other has the reverse.

Sixteen signals of the 5 unit code can be combined thus in twos, which gives a choice of 64 possible combinations.

The series ZCZC proposed at the Fifth Session of the COM Division naturally meets the requirement, and, if there is no objection to it, we would propose that it be definitively adopted for this purpose.

6.6 In view of the foregoing, the information contained on page IV-60 of the Report of the Fifth Session of the COM Division should be replaced by the following, insofar as the beginning of the message is concerned :

$$\text{VVVV} - \overline{\text{ZCZC}}\ \text{X}\ \overline{\text{NLAO33}}$$
$$\qquad\quad\ \overline{\text{A}}\ \ \text{A}_1\ \ \overline{\text{B}}$$

6.7 Should this proposal be considered unacceptable, as involving too many characters on the numbering device, it would appear that two solutions could be considered, to cover all cases which might arise at A.F.T.N. stations. The choice as to which of these two solutions should be used could be left to the receiving station, by mutual agreement with its correspondent.

Solution 1

$$\overline{\text{ZCZC}}\ \text{X}\ \text{ or }\ \overline{\text{ZCZC}} -$$
$$\overline{\text{A}}\ \ \text{A}_1\qquad\quad \overline{\text{A}}\ \ \text{A}_1$$

This solution could be used when the receiving station is provided with an automatic system (the A_1 signal being a Space on ordinary duplex circuits and a Letter on multipoint circuits).

Solution 2

$$\overline{\text{VVVV}}\ \text{X}\ \text{ or }\ \overline{\text{VVVV}} -$$
$$\overline{\text{A}}\ \ \text{A}_1\qquad\quad \overline{\text{A}}\ \ \text{A}_1$$

This solution could be used when the receiving station is provided with a manual or semi-automatic system which does not use the signal ZCZC.

6.8 With either proposal 6.6 or 6.7, the series of five Space signals at present indicated in the procedures would obviously have to be eliminated.

Note : The above proposals relate only to the series of Space signals which precede the transmission identification, and not to the series (increased to 8 by the Fifth Session) which precedes pilot tapes or the start of the message (4.4.4.14 of Annex 10).

However, in order to avoid any difficulty in transmitting messages over networks which do not use a circuit message number (particularly networks with manual or automatic switching), it would be desirable to insert a Letters signal between this series of Spaces and the Carriage return and Line feed signals which follow.

This would require amendment of Annex 10, paragraph 4.4.4.14 as follows :

" .....

a) Messages shall be preceded by :

i) at least 5 spaces (8 spaces shall be perforated in preparing the tape and at least 5 spaces shall be retained in subsequent relay).

ii) 1 LTRS.

iii) 2 carriage returns.

iv) 1 line feed. "

The Letters signal is included to ensure proper reception of the Carriage return and Line feed signals, in cases where the receiver is accidentally desynchronized on the Space signals, which would cause mutilation of signals at the end of the line.

This amendment would be in accord with Recommendation 10 (paragraph 1.2.7.1) of the Report of the Fifth Session.

ABBREVIATIONS

A.F.T.N.	= Aeronautical Fixed Telecommunication Network
RTT	= Start-Stop Radio Teleprinter
COM Division	= I.C.A.O. Communications Division
Annex 10	= Annex 10 to the International Civil Aviation Convention (Rules of Procedure for Aeronautical Telecommunications)
WP	= designates a working document of the Fifth Session of the I.C.A.O. Communications Division (Montreal, March/April, 1954).

AUSTRALIA

Document S.G. IX/46-E
12th May 1955

Operation of I.C.A.O. teleprinter network
(Further to Document S.G. IX/34)

Dear Sir,

With reference to Document S.G. IX/34 issued on the 23rd February, 1955, I wish to advise that this Administration has considered the proposals contained in the copy of I.C.A.O. letter No. AN 7/42-957, and annexures, attached thereto and accordingly offers the following comments in regard to such proposals.

The emphasis placed, in the I.C.A.O. Document, on the simplicity of recognition of the " Letters " and " Blank " (Respectively Signals 29 and 32 of International Alphabet No. 2) appears out of place by comparison with the other technical complications accepted in a tape relay system.

From the point of view of the C.C.I.T., it might well be said that the answers to this proposal for an " End of Message " signal, and to C.C.I.T. Arnhem Question 60, already lie in the International Telegraph Regulations which stipulate the signal " + " (upper case Z Signal 26) as an " End of Telegram " signal. If the single " + " signal were not regarded as adequate (although the fact that it is an upper case character implies that a " Figures " signal must be associated with it) it would not involve much additional technical complication, or great departure in operating procedure, to require that the " + " signal be sent in the form of a succession of the three signals, Figures, Z, and Letters.

Incidentally, because of the present use of the " + " signal as an " End of Message " signal, its adoption in W.M.O. operating procedure (C.C.I.T. Question 40) cannot be supported.

The " Space " signal (International Alphabet No. 2, Signal 31) is favoured as a " Start of Message " signal. It appears that this could become acceptable to I.C.A.O. when one considers that the objection raised under paragraph 6.4 of page 19 may be readily overcome.

It is quite simply practicable in a tape relay system to arrange that whenever a tape awaits transmission in a transmitter, before transmission actually commences, the line normally connected to the transmitter may be switched for a few seconds to a source of " Letters " signals which may be used to automatically start the motor of a distant receiving machine. As is pointed out elsewhere in the proposal, only quite simple circuit arrangements are needed to generate the 20 millisecond pulses at 150 millisecond intervals which such an arrangement would require.

As suggested in the penultimate paragraph of the C.C.I.T. document mentioned above, Australian Civil Aviation authorities concerned with the activities of the I.C.A.O. Communications Division have been consulted in connection with the proposals in question and advise that, although I.C.A.O. have already been informed that Australia has no particular views on the proposals, such authorities are prepared to subscribe to the foregoing comments.

Yours faithfully.

C.C.I.T. STUDY GROUPS III AND VII

Document S.G. IX/67-E
15 May 1956

The " Message separation " signal

(Report by Study Groups III and VII to Study Group IX,
extract from Document S.G. VII/27)

Study Groups III and VII noted that Study Group IX considers that a message separation signal should be standardized for use in the international public telegraph service for insertion immediately after the end of a telegram, or of a series of telegrams similarly routed, and that the choice of this signal should be left in the first instance to Study Groups III and VII in collaboration with Study Group IX.

In examining the technical aspects of the question, Study Groups III and VII considered that the following points were relevant to the choice of a " message separation " signal and therefore offer them for the consideration of Study Group IX.

Factors affecting the choice of a " message-separation " signal

1. Is it required that the signal shall produce a printed indication on a receiving teleprinter? If so, it must include at least one of those combinations admitted as giving a printed indication in the International Alphabet No. 2. If printing is only required on printing reperforators (e.g. those used at transit centres), then the signals for " carriage return " and " line-feed " might also be regarded for this purpose as printing characters (see Recommendation C.10).

2. Is the complete signal to be inserted by the originating teleprinter operator? If so, it could only be composed of used combinations in International Alphabet No. 2. Specifically this would exclude Combination 32.

3. If the signal (or part of the signal) is to be inserted otherwise than by an actual operation of the teleprinter keyboard, then it could possibly include Combination 32. It would need to be decided at what point in the system the signal (or the appropriate part thereof) was to be inserted.

4. Is the signal to be used in conjunction with messages originating at offices connected to an automatic teleprinter exchange but destined to be passed to a transit centre employing a semi-automatic or automatic reperforator switching? If co-operation between the two systems is in fact envisaged, there might be some advantage in including in the signal a sequence of several Combinations 32, because these are generated by the clearing signal used in switched networks and would, in any event, appear on a reperforator receiving the signals.

5. It would seem to be prudent to choose as " message separation " signal a combination or series of combinations selected from the International Alphabet No. 2, which would not be likely to appear erroneously either as the result of a fault or by reason of a misoperation by the sending operator, and which would never, or extremely rarely, occur in the body of the message.

In this connection Combination 32, because of its simple pattern, can be easily produced automatically and can be easily detected at the point where it is required to be effective.

On the other hand, it can readily be produced by a transient fault on a telegraph channel. The seriousness of the effect of the occurrence of a spurious " message separation " signal would depend upon the exact operations initiated in a given system upon its reception. The longer the series of combinations composing the " message separation " signal, the less likely it is to occur erroneously and cause a false switching operation.

6. If it were necessary, the various combinations composing the " message separation " signal need not all be effective in every country, and Administrations could, if necessary, be free to choose which combination in the signal would be effective in their own country.

7. Study Groups III and VII were not able to make a comprehensive study of all the technical factors likely to affect the choice of a " message separation " signal, but consideration of the foregoing comments might enable Administrations, wishing to make use of a " message separation " signal in the international public telegraph service, to submit positive proposals tending to lead to an acceptable basis for standardization.

8. During the course of the discussion the following information was given:

i) The U.S.S.R. already uses Combination 32 of International Alphabet No. 2, repeated twice, as a " message separation " signal.

ii) A system designed for use in Argentine and which combines both automatic switching and reperforator switching uses Combination 4 preceded by Figure Shift (who are you ?).

iii) The Federal German Republic and the United Kingdom propose to use four repetitions of Combination 26 preceded by Figure Shift (four + signs are printed on the receiving teleprinter) in connection with leased networks.

The Study Groups were unable to consider in detail the relative merits of the foregoing signals but it seemed rather likely that the use of the " who are you ? " signal, at any rate in the European system, would entail operation complications, and this use justified further study taking account of the provisions of Recommendation C.11.

LETTER-TELEGRAMS

(C.C.I.T. Question 63 — Document 112)

CABLE AND WIRELESS

Extracts from Document S.G. X/12
8 June 1954

Comments on question 63

Document 112

Cable and Wireless Ltd. considers that the present regulations concerning the delivery of letter-telegrams have worked fairly well. In practice, however, it is necessary to be able to ascertain delivery times at a glance and, in order to bring this about, the Company compiled a chart basing the information therein on the regulations concerned. A copy of this chart, which is also used by several other Administrations and Recognized Private Operating Agencies, is attached. Cable and Wireless Ltd. thinks the International Telegraph Regulations might well be amplified (in annex form) by the reproduction of a chart of this character which should materially help in the clarification of this matter.

Annex

Zone I	Zone II	Zone III	Zone IV
North and South America West Indies Central America Falkland Isles Pacific Isles East of international date line i.e. Sandwich Isles Fanning Isle Midway, etc.	Europe Africa Madagascar Zanzibar Mauritius Azores Canaries Cape Verde Isles Madeira Ascension St. Helena Mediterranean Area Middle East including Aden Saudi Arabia Israel Jordan Iran Iraq Seychelles	Afghanistan Pakistan India Ceylon Burma Br. N. Borneo Sarawak Malaya Indonesia Siam Hong Kong Manila Japan Vietnam China Russia in Asia Netherlands New Guinea	Australasia

	From zone I	From zone II	From zone III	From zone IV
To Zone I	A 0800 the day after filing	B 0800 the day after filing	C 0800 the day after filing	D 0800 the day after filing
To Zone II	E 0800 the day after filing	F For internal Europeans see Regulations for ELTs. For others, 0800 the day after filing	G 0800 the day after filing	H 0800 the day after filing
To Zone III	I 1400 * the day after filing, except Canada, British Guiana, British Honduras, Bermuda and British West Indies to India and Pakistan, at 0800 the day after filing	J 1400 * the day after filing, except intercommonwealth where NLT service operative at 0800	K 0800 the day after filing	L 0800 the day after filing
To Zone IV	M 0800 the second day after filing, except U.S.A. and Canada to New Zealand at 0800 the day after filing.	N 1400 the day after filing	O 1400 the day after filing, except Malaya, Indonesia, Netherlands New Guinea, British North Borneo, and Sarawak to Australasia	P 0800 the day after filing

* In the case of Hong Kong and Philippines delivery effected after 1600 by local agreement.

ITALCABLE

Extracts from Document S.G. X/14-E
10 June 1954

Improvement of the methods used for delivery of letter-telegrams

The Paris Conference, animated by a praiseworthy anxiety to simplify matters, abolished differed and CDE telegrams, and assimilated the rates for such correspondence to those for ordinary telegrams, reduced by 25 %. Certain delegations felt that this was the first step towards complete amalgamation of ordinary telegrams with letter-telegrams, and hence towards the disappearance of the latter.

Such a reform would, however, militate against the interests of users, who find the letter-telegram service satisfactory and cheap. Moreover, the volume of ordinary telegrams would grow to such an extent as to make their handling a slow business. Hence certain users would be obliged to have recourse to urgent telegrams.

For these reasons, we think that it would be advisable to keep a category of reduced-rate correspondence. This would be handled in accordance with the rules now in force for letter-telegrams, but with the following exceptions :

a) delivery would have to be by messenger, telephone or Telex, after delivery of ordinary telegrams, without artificial delays in the offices of destination ;

b) the chargeable minimum would have to be raised from 25 to 30 words ;

c) special services should be extended to all those available for ordinary telegrams, but should not include *urgency*.

It must be acknowledged that at the present time the artificially delayed delivery of letter-telegrams (extending even to postal delivery), is unjustified. It runs counter to the efforts made by engineers to increase the efficiency of circuits. Moreover, such artificial delay is dangerous to Administrations and private agencies, since under present conditions users are tempted to confide a part of their traffic to competing services (the telephone and the airmail letter in particular) instead of using the telegraph.

In view of recent progress in the realm of air transport, there would seem to be a call for improving the delivery of such correspondence. Consideration should be given to the fact that because of the varying geographical situation of countries, users are not all in the same position.

The chargeable minimum must inevitably be raised from 22 to 25 or 30 words, if we wish to avoid a situation in which, taking advantage of the new delivery conditions, a good deal of ordinary traffic is sent in the form of letter-telegrams. That might gravely affect the finances of Administrations and Private Operating Agencies.

The admission of the special facilities referred to in *c)* above would to some extent be a logical consequence of the new distribution rules.

With a view to creating a new source of traffic, the idea has taken shape in certain circles of making available to the public a long-text telegram, the rate for which would fall off for every 100 words sent.

This idea is not entirely new. It deserves, we feel, special attention. Introduction of the long-text telegram would be the most effective means of challenging airmail competition. In principle, we favour the idea.

* * *

In view, then, of the above, we would propose the abolition of the present letter-telegram, and the introduction of a new type of telegram with the characteristics either of the present letter-telegram (the rules for which would be amended as set forth above) or of the long-text telegram.

We propose the following rates and conditions for this new type of telegram:

Rates

Up to 40 words: half the ordinary rate, with a minimum of 25 to 30 words.

For every word above 40: one quarter the ordinary rate.

Paid service indications

= EDF = (DF being the abbreviation of the old differed type of telegram) in relations between countries in the European system.

= DF = in other relations.

Language admitted

Plain only.

Special services available

All special services available for ordinary telegrams, except *urgency*.

Delivery

By messenger, telephone or Telex, after delivery of ordinary telegrams, without artificial delays in the offices of destination.

Statistical data in our possession show that the average number of words in letter-telegrams is 30/31 in European relations, and 31/32 in others. Hence the new reform would seem to mean that the income accruing to Administrations and private agencies would at least remain at its present level.

Comment: There would be nothing very complicated about the accounts for such correspondence. Such accounts might be drawn up by using the following very simple formulae:

CREDIT DUE TO THE ITALCABLE COMPANY

Radiotelegraph circuit Rome-London; relation Italy-United Kingdom of Great Britain and Northern Ireland

Record for (date) :

1 May, 1954

No. of the telegram	Ordinary	Urgent	Press			EDF	
	Number of words		Number of words				
			Ordinary	Urgent	Total	Ordinary rate reduced by 50 %	Ordinary rate reduced by 25 %
1	32	—	—	—	—	—	—
2	15	—	—	—	—	—	—
3	—	11	—	—	—	—	—
4	—	15	—	—	—	—	—
5	—	—	54	—	—	—	—
6	—	—	—	42	—	—	—
7	—	—	—	—	42	40	2
8	—	—	—	—	55	40	15
9	—	—	—	—	30	30	—
10	—	—	—	—	105	40	65
11	—	—	—	—	116	40	76
etc.							
Total :	47	26	54	42	348	190	158
Rates per word	0.15	0.30	0.075	0.15	—	0.075	0.0375
Total sums	7.05	7.80	4.05	6.30	—	14.25	5.925

Recapitulatory record for EDF telegrams

May, 1954

Date	EDF Telegrams		
	Number of telegrams	No. of words at the ordinary rate reduced by 50 %	No. of words at the ordinary rate reduced by 25 %
1	10	295	110
2	12	316	170
3	8	210	60
4	15	435	156
5	21	615	201
etc.			
Total :			
telegrams	66	—	—
words	—	1871	697
Rates per word	—	0.075	0.0375
Total sums	—	140.325	26.1375

NEW CHARGING PRINCIPLES

(C.C.I.T. Question 63—Documents 102 and 103)
(C.C.I.T.T. Question 25/21)

ITALCABLE

Extracts from Document S.G. X/14
10 June 1954

Question No. 63 b) (Document No. 102)

To study a new charging system, in which the charge per telegram would include a charge per word for transmission (to be apportioned among Administrations as at present), plus a fixed charge.

The proposal submitted by the Spanish Administration is interesting and worthy of consideration. The Spanish Administration has very justly pointed out that with the present charging system the senders of long telegrams are badly off in relation to those who send short ones. We do, however, think that the proposals for the detailed implementation of the new system call for the following comments:

As before, everything in the preamble should be considered as service indications, and hence should not be subject to charge, since all these elements are necessary for the operation of a telegraph service, either for transmission, or for the purpose of statistics, accounting, or handling of claims for the refund of charges. Hence, in deciding on the rate per chargeable word, we should continue to bear in mind the effects of the preamble on operating costs.

The assessment of the charges to be levied from senders (charge per word and fixed charge per telegram; the latter, for simplicity's sake, should be the same in all European relations) could not be done with reference to the cost of the services rendered, both because view-points are likely to be very different (government Administrations and Private Operating Agencies) and because costs vary from country to country (even overlooking the grave international economic situation), and finally because the volume of traffic is not the same in all relations.

But what is most striking in this proposal is the fact that the calculation of charges to be levied on senders would be greatly complicated. Application of the new system in the way proposed would entail grave accounting difficulties and an increase in the cost of drawing up accounts.

This new system would not be in harmony with the principles of simplicity and uniformity laid down at the Paris Conference.

Moreover, the system, if implemented forthwith in its entirety, would mean that the fixed charge per telegram would be excessively high, since the transmission charge levied by the terminal Administrations would have to be decreased to the level of the normal transit charges.

Such a measure might well be a blow to the senders of short telegrams—those occasional users who would certainly consider any large rise unjustified.

We think that this proposal ought to be implemented by stages. The first step would be to lay down charging rules in accordance with the following; in this way income would be maintained at its present level.

1. *Rate per word.* The through rate per word would be made up of the terminal rates of the countries of origin and destination as at present, each of them minus two gold centimes, and the transit rates.

This through rate would be apportioned, as heretofore, among the Administrations concerned.

2. *Fixed charge per telegram.* The additional fixed charge per telegram would be *uniform* in all relations. It would be in gold centimes, and to begin with would be set at about four times the average number of words in ordinary telegrams, four gold centimes being the centimes deducted from the through rate per word.

This fixed charge would be apportioned among the terminal administrations in two equal portions.

Comment: Application of this new system would give rise to no difficulty, either in the acceptance of telegrams or in the drawing up of accounts. The creditor Administrations would be credited with that portion of the fixed charge due to the Administration of the country of destination (*the same* in all relations), besides the normal transmission charges.

Question No. 63 c) (Document No. 102)

Would it be opportune and possible for the C.C.I.T. to consider the possibility of finding, for the word count of telegrams, a more uniform and better-defined unit than the word pure and simple?

According to the basic rule given in No. 164 of the Paris Regulations, the rate is calculated per word. But it might be calculated on the basis of a character or the duration of transmission.

For the first time, two new ideas have been introduced for the calculation of charges to be levied on the user: that of character and that of time. We shall now consider them in turn.

Charging by character. At first sight it might well seem that the charging system based on the character, taken as a unit, would be the most suitable for assessment of the charge to be levied on the sender. It must be acknowledged that this system does have the advantage of eliminating the frequent discussions on word count, in connection with the joining of words and the alteration or abbreviation of plain-language words, and in connection with certain expressions considered, rightly or wrongly, to be current in normal or commercial correspondence.

A closer examination, however, seems to show that the new system recommended has no possibility of being adopted.

In view of the effect which the elements in the preamble have on cost price, they should perhaps be taken into account. Further, we must remember that the transmission of secret-language words is much more costly than the transmission of words in plain language.

Apart from this, we are struck by the serious complications this new system would entail at the reception of telegrams, during transmission, and in the drawing-up of accounts. These practical difficulties would entail a slowing-up of traffic, and would make it difficult, if not impossible, to assess, even approximately, the charges to be levied on senders. These charges, because of the excess work involved by the new system, would in all likelihood have to be increased.

Charging by time. The charging system based on the transmission time does not seem a practical means of assessing the charges for messages, since transmission times vary according to the media employed, and also according to whether the words transmitted are in plain or secret language.

The system can be used in the telephone service, in which calls start and finish at definite times, and in Telex, where the same considerations apply. It can be used for the lease of circuits by wire or radio. But in telegraphy it would give rise to the same complications, perhaps even more serious than those mentioned above in connection with the system of charging by characters. In all probability the time would have to be assessed in accordance with the number of these latter.

Hence it would seem that at the present time the best system for charging of telegrams is that now in force, namely, *charging per word.*

In the light of the new reclassification effected by the I.T.U. General Secretariat, we have closely scrutinized Chapters V and VI of the Paris Regulations, together with the remarks made in connection therewith by the Spanish Administration, by Mr. Foz, by Mr. C. E. Hudgell, and by the International Chamber of Commerce. We note that these provisions do in fact show gaps, together with a certain looseness; we are especially struck by the fact that the charging unit is exceedingly variable (in plain language). For example, the word " in " (two letters) is charged for as though it were one word, but so is the noun " responsibility " (14 letters).

Now for any particular commodity in commercial life there is a certain unitary price—so much per pound, per yard, or per gallon. As regards telegram charges, a constant relation is maintained between these two factors in secret language, in which the charging unit is made up, almost always, by a group of five characters. But this is not the case in plain language, since the length of the word may vary from one to fifteen letters.

These variations are costly for users. What can be done towards putting this state of affairs to rights?

The present Telegraph Regulations grant certain facilities in this respect. For example, names, designations, composite words and numbers, as set forth in 123, 124, 140 and 143, may constitute a single word. Commercial marks, trade marks, designations of goods, arbitrary technical terms, reference numbers and indications (39) can be admitted as a single group, and the same applies to house numbers and ordinal numbers made up of letters and figures (65 and 66).

We consider that other facilities should be granted to users, the most important being:

a) The joining-together of all plain-language words should be allowed. These words, so joined, would be considered as groups of letters without a secret meaning, but would be counted in groups of five characters.

b) In *figure* groups, the parenthesis should not be considered an isolated sign. It should count as two characters.

c) In *figure* groups, the multiplication sign, whether it denotes a multiplication or a dimension, should be counted as one character.

d) Besides conventional or abbreviated addresses, the abridged addresses of firms or other bodies, together with the abridged designations of stocks, shares bonds, etc., should be counted in groups of 15 characters.

As regards expressions in current use in normal or commercial correspondence, and new terms used in commercial correspondence, see our comments on Question 63 *a)*.

As regards the proposal made in *a)* above, we would point out that the addition of a paragraph (4) to Article 9, paragraph 2, of the International Telegraph Regulations (see annex), as proposed by us, is designed to bring about a juster treatment of the public, bearing in mind, more especially, those who send telegrams only occasionally. Our proposal is based on recommendations from several sources.

For example, there are in French, as everybody knows, expressions such as " *au fur et à mesure* ", " *c'est-à-dire* ", etc., which under the present system are counted as five and four words respectively (plain language), whereas if, in secret-language telegrams, they were joined together to make one word (" *aufuretamesure* ", " *cestadire* ") they would count as three and two chargeable words respectively (counting in groups of five characters), these expressions being considered as groups of letters.

Now the same tariff is applied, either to plain-language words, or to words in secret language, which are a good deal more costly to transmit. Hence it would seem just to eliminate this anomaly and to allow the combinations in question. They should, however, be considered as groups of letters with no secret meaning (Article 13, paragraph 3 *a)*), to be counted in groups of five characters per chargeable word.

This being so, the combinations in question might even be allowed in letter-telegrams. This would have the advantage of eliminating two different rules for the counting of words, in ordinary telegrams and letter-telegrams respectively.

It should, nevertheless, be noticed that such combinations are advantageous to users when the words are very short, since the joining of longish words would be of no benefit. Thus, for example, the words " *garde républicaine* " which would be counted as two words, would count as four words if joined together (17 characters).

People who are constantly sending telegrams are familiar with the rules governing this question, and consequently know what to do.

* * *

Hence we consider that the modifications and additions set forth in the annex hereinafter should be made in Chapters V and VI of the Regulations now in force, with a view to eliminating the gaps and the looseness we have commented on.

Any modifications and additions adopted by our Study Group might then be submitted by the C.C.I.T., in the form of a proposal, to the next administrative conference.

COUNTING OF WORDS

(C.C.I.T. Question 63 — Document 103)
(C.C.I.T.T. Question 27/21)

DIRECTOR OF THE C.C.I.T.

Document S.G. X/64
14 May 1956

Proposals for simplifying and improving the text of the present provisions of the telegraph regulations regarding the counting of words

Important note : In its Recommendation No. G.1, issued at Arnhem in 1953, the C.C.I.T. recommended a rearrangement of the provisions of Chapters V and VI of the Telegraph Regulations (Paris Meeting). Nevertheless, in this document the reference numbers given in the annex are those appearing in the Telegraph Regulations (Paris Meeting) ; for the time being this arrangement seemed more practical.

Reference in the Telegraph Regulations (Paris Revision)	Present provisions	Proposals and reasons for them
Article 10 § 2. 36	§ 2. By telegrams in plain language are meant those of which the text is wholly in plain language. The character of a telegram in plain language is not changed by the presence of: *a)* . . . . *g)*	
43 *bis*		1. AUSTRALIA Add : *h)* Groups representing sums of money. These groups may, exceptionally, be composed of letters and figures. *Reason* As indicated in respect of paragraph 120 (see proposal 43). This amendment would, if adopted, involve varying the method of counting shown in the following examples included

Reference in the Telegraph Regulations (Paris Revision)	Present provisions	Proposals and reasons for them
		on pages 27 and 28 of the Regulations; 10 fr. 50 c (7 characters, 2 words); 10 fr. 50 (6 characters, 2 words).
Article 12, § 7. 64	§ 7. (1) Expressions such as 30^{a}, 30^{ne}, 1^{o}, 2^{o}, ◇B◇, 1′ (minute), 1″ (second), etc., cannot be reproduced by the instruments; senders must substitute an equivalent which can be telegraphed, thus, for example, for the expressions quoted above: 30 power *a* (or 30 *a*), trentaine, primo, secundo, B in diamond, 1 minute, 1 second, etc.	2. CHINA Unchanged, except to remove the signs 1′, 1″ and its related words from the paragraph. *Reason* See revised paragraph 65 below (proposal 3).
65	(2) If, however, the expressions 30^{a}, 30^{b}, etc., 30 *bis*, 30 *ter*, etc., 30 I, 30 II, etc., 30^{1}, 30^{2}, etc., indicating the number of a house, appear in the address of a telegram, the counter officer shall separate the number from the letters or figures accompanying it by a fraction bar. The same rule shall be applied in transmitting house numbers such as 30 A, 30 B, etc. The expressions in question shall consequently be transmitted in the following form in the address of a telegram: 30/*a*, 30/*b*, etc., 30/*bis*, 30/*ter*, etc., 30/I, 30/II, etc., 30/1, 30/2, etc., 30/A, 30/B, etc.	3. CHINA Deleted and replaced by: (2) Expressions of 1′ (minute or foot), 1″ (second or inch) can be allowed in a telegram. In this case, the apostrophe and the single inverted comma are used as substitutes for transmission. *Reason* For telegraph users, the need of using apostrophe and single inverted comma in a group of figures either to show dimension or time has long been felt. The introduction of this new paragraph will meet the demand of the general public. The deletion of the original paragraph is based on the idea that there seems no call to have a fraction bar inserted in a house number simply to separate letters from figures. Meanwhile, commercial marks, compound words, ordinal numbers and various designations composed of letters and figures are allowed without having a fraction bar separating them.
Article 18, 104	§ 1. (1) Everything that the sender writes on his copy for transmission shall be charged and, therefore, included in the number of words, with the exception of the route indication, and the name of the code used for the wording of a secret language telegram when this information is required by the country of origin or by the country of destination.	4. AUSTRALIA Everything that the sender writes on his copy for transmission shall be charged and, therefore, included in the number of words, with the exception of *a)* the route indication; *b)* the name of the code used for the wording of a secret language telegram when this information is required by the country of origin or by the country of destination; *c)* dashes used only to separate on the sender's copy the different words or groups; (present paragraph 106); *d)* isolated signs, unless the sender has specifically requested their transmission: (present paragraph 107);

Reference in the Telegraph Regulations (Paris Revision)	Present provisions	Proposals and reasons for them
		e) a fraction bar written in accordance with the terms of Article 19 (3); (portion of present paragraph 121); *f)* an apostrophe, a hyphen or a fraction bar used to make separate words into a combination, in cases where the combination appears in a standard dictionary of one of the admitted languages (covered in existing paragraph 119). *Reason* At present, the Regulations relating to the non-chargeable material which the sender may write on his telegram are widely spaced (paragraphs 104-107, 119 and 121). In the proposed amendment, the relative Regulations are brought together for simplification purposes. The amendment, if adopted, will involve a consequential re-numbering of the Regulations contained in Article 18. Following a Recommendation made by the Commonwealth Telecommunications Board, London, in 1952 (the minutes of the 85th Meeting held on 9/9/52 refer), supplementary instructions relating to deferred delivery such as " Deliver 15th " have been acceptable free of charge in international telegrams to and from British Commonwealth countries. Australia did not agree with the principle involved, it being considered that such instructions inserted by the sender should be chargeable. If supplementary instructions such as " Deliver 15th" are to be generally acceptable free of charge, it would be desirable to include a reference that such instructions are not to be counted and to indicate this by making specific reference thereto in the exceptional cases following paragraph 104. However, Australia does not consider an amendment along these lines is warranted.
Article 18, 105	(2) The following shall neither be charged not transmitted:	
107	*b)* isolated signs, unless the sender has specifically requested their transmission.	
		5. CHINA Add *b* 1): an apostrophe or a hyphen or dash used in a word which can be admitted as a single word according to a standard dictionary. In such case, the accepting clerk shall join the parts into a single word, deleting the apostrophe or hyphen or dash.

Reference in the Telegraph Regulations (Paris Revision)	Present provisions	Proposals and reasons for them
		Reason To make it more complete.
		6. FEDERAL GERMAN REPUBLIC Isolated signs shall be transmitted free of charge. *Reason* In the German national service isolated signs are transmitted free of charge. The Federal German Administration of Posts and Telecommunications considers that if isolated signs were also transmitted free of charge in the international service, the counting of words would be thereby simplified. The numerous differences in the counting of words, and the resultant requests, would be abolished.
		7. U.S.S.R. Add : In these cases the telegram should include the note " signs counted ".
108	(3) When signs, instead of being used separately, are repeated one after the other, they shall be charged as for groups of figures (§ 7).	8. AUSTRALIA No change in wording proposed but it would be necessary to renumber this sub-paragraph in consequence of the above-mentioned proposed amendments to paragraphs 104-107 (proposal 4).
		9. JAPAN (3) Delete this sub-paragraph. *Reason* This sub-paragraph is fully covered by § 7 (1).
		10. ITALCABLE § 1. (3) When signs, instead of being used separately, are grouped one after the other, they shall be charged as for groups of figures (§ 7). *Reason* The word *repeated* which appears in this paragraph might give the impression that groups of signs would be admitted only if they were composed of the same sign and not of

Reference in the Telegraph Regulations (Paris Revision)	Present provisions	Proposals and reasons for them
		different signs. This interpretation would not, however, be in the spirit of the rule, which, according to the context of the phrase, is general in character. Therefore, to remove any doubt, it would be advisable to substitute the word *grouped* for *repeated*. As a result of this alteration, the full stop between brackets (.), for example, which some senders use to ensure that the full stop is transmitted, would indubitably be counted as one word.
111	§ 4. At the time of acceptance of a telegram of more than fifty words, the counter officer shall mark with a cross [1] the last word of each section of fifty actual words (irrespective of the rules of charging), the paid service indications and the words in the address being included in the first section. Each cross shall be followed by a figure indicating the number of words. The cross and the figure shall not be charged for.	11. JAPAN § 4. Transfer this paragraph before § 9 of this Article. *Reason* This paragraph is not directly concerned with the counting of words.
112	§ 5. The following shall be counted as one word in all languages: *a)*	
114	*b)* in money order telegrams	12. SWITZERLAND Add the following new sub-paragraphs *b^bis* and *b^ter*: *b^bis)* in money order telegrams and postal cheque telegrams, the postal number of issue; *b^ter)* in the paid service instructions, the original telegram number, the number or numbers of the preceding paid service instruction or instructions; *Reason* *b^bis)* The postal number of issue is a postal service indication which is not the concern of the sender. It would therefore seem justified that the sender in every case should have to pay the telegraph charge for a single word only, even when the post office of issue uses numbers of more than 5 figures. *b^ter)* For clarification; these numbers are the exclusive concern of the telegraph service. It would therefore not be fair to charge them as more than one word, even if they consist of more than 5 characters or when several numbers are used consecutively.

Reference in the Telegraph Regulations (Paris Revision)	Present provisions	Proposals and reasons for them
115	*c)* each isolated letter, figure and sign transmitted at the specific request of the sender (§ 1).	13. CHINA *c)* Each isolated letter, figure and sign or each punctuation used immediately after a spelled text word transmitted at the specific request of the sender. In the latter case, the accepting clerk shall insert " Punctuations Counted " in the service instruction in order to draw attention of both the sending and receiving operators. *Reasons* Punctuations are sometimes requested to be transmitted in press telegrams. This rule will concur with the present practice. 14. CHINA Add *c)* 1.: an underline, irrespective of its length. Add *c)* 2.: a question mark. *Reasons* Both are counted as a separate word in all languages. (The counting rule of an underline which appeared in Cairo Regulation, paragraph 114 should be reinstated.) 15. GERMAN FEDERAL REPUBLIC (See proposal No. 6) 16. SWITZERLAND *c)* each isolated sign transmitted at the specific request of the sender (§ 1) ; *Reasons* An isolated letter or figure is always transmitted without the sender's having to make a specific request. 17. ITALCABLE *c)* each *isolated* letter and figure. *Reasons* See proposal No. 34.
116	*d)* the two signs forming brackets (parentheses).	18. AUSTRALIA *d)* the two signs forming brackets (parentheses), except in the case contemplated in 120 ;

Reference in the Telegraph Regulations (Paris Revision)	Present provisions	Proposals and reasons for them

Reasons

Paragraph 120 authorizes the counting at the rate of one word for each 5 characters of groups containing letters, figures or signs or a mixture thereof, where authorized, i.e. in the case of trade marks, commercial marks, designations of goods, reference numbers, etc., as indicated in paragraph 39.
It seems reasonable to assume that some reference numbers, trade marks, etc., may contain brackets, and it seems to be justified, in such cases, for each of the signs forming brackets to be counted as a character in the group in which it occurs.

19. BELGIUM

d) The two signs forming brackets (parentheses when they enclose a word or text). When they appear in a group of figures and/or letters, the parentheses shall not be counted as an isolated word but the two signs which form it shall each count as one character.

Reasons

To remove the possibility of differences in interpretation.

20. CHINA

To be deleted.

Reasons

See proposal No. 27.

21. JAPAN

d) Add the following at the end:
" except in the cases contemplated in § 7 (1) ".

Reasons

Brackets in the groups of figures, commercial marks, etc., should be counted in conformity with the provisions of § 7 (1) and following the examples mentioned in Article 24.

22. RHODESIA AND NYASALAND

d) "the two signs forming brackets (parentheses) (except in the cases contemplated in 120) ".

Reference in the Telegraph Regulations (Paris Revision)	Present provisions	Proposals and reasons for them

Reasons

d) It is not clear how groups such as " ASD (123) 7 " should be counted. It is considered that in such groups, when authorized, the two signs forming brackets should each count as one character, and the amendment is designed to make this clear.

23. UNITED KINGDOM

The two signs forming brackets (parentheses) except as contemplated in 120.

Reasons

Reg. 39 permits the use of signs in commercial marks, reference numbers, etc., which are counted at the rate of 5 characters to the word. We regard bracket signs used in such expressions as regular signs within the meaning of the above quoted Regns. and count as single characters within the group in which they appear.

Study group X may wish to consider any necessary amendment to Regn. 37 to provide for brackets and other signs appearing in groups of figures or letters or both, constituting plain language, i.e., mathematical equations and the like which do not appear in a catalogue or similar document available to the public (Regn. 39).

24. SWITZERLAND

d) The two signs forming brackets (parentheses); (except in the case mentioned in 121 *bis*);

Add the following 121 *bis*:

(3) Each sign in the parenthesis shall be counted as one character in groups of figures or in groups composed of letters and figures designating marks, designations, terms and expressions, reference numbers and indications referred to in 39.

Reasons

Logic and partially established practice.

25. CABLE AND WIRELESS

d) The two signs forming brackets (parentheses) except as contemplated in Article 10, paragraph 2 *c)*.

Reference in the Telegraph Regulations (Paris Revision)	Present provisions	Proposals and reasons for them
		Reasons Article 10, paragraph 2 *c)* and Article 18, paragraph 7, provide for the use of signs in commercial marks, trade marks, etc., to be counted at the rate of five characters to the word.
		26. ITALCABLE *d)* the two signs forming brackets (parentheses) and quotation marks (inverted commas) respectively, and the fraction bar, except in cases referred to in § 5 *bis* below.
		Reasons See proposal 34.
117	*e)* a fraction bar, a hyphen or dash (except in the cases contemplated in 120, 121 and 134 ;)	27. CHINA To be deleted.
		Reasons Regrouped in a new paragraph 119 below.
		28. SWEDEN To be deleted.
		Reasons See proposal 41.
		29. ITALCABLE *e)* the full stop, comma, colon, question mark, apostrophe and hyphen or dash transmitted at the express request of the sender (§ 1), which shall always be treated as isolated signs, except in cases referred to in § 5 *bis* below.
		Reasons See proposal 34.
118	*f)* the signs forming quotation marks (inverted commas).	30. CHINA To be deleted.
		Reasons Regrouped in a new paragraph 119 below.

Reference in the Telegraph Regulations (Paris Revision)	Present provisions	Proposals and reasons for them
		31. JAPAN
		f) Add the following at the end: "except in the cases contemplated in § 7 (1)."
		Reasons
		Same reasons as mentioned above. (proposal 21).
		32. ITALCABLE
		See proposal 26.
118 *bis*		33. FEDERAL GERMAN REPUBLIC
		Add after 118 *f)* the following text for 118 *bis*:
		g) abbreviated expressions in current use in ordinary or commercial correspondence (42). Groups with such an expression shall count as two or more words.
		Reasons
		In our opinion the instructions at present given in 113 to 118 are incomplete, and should be amplified. New composite words are constantly being used; for example the word Radar is an abbreviation which is now in general use.
118 *ter*		34. ITALCABLE
		§ 5 *bis*. (1) In the marks, designations, technical terms, reference numbers or indications and expressions referred to in 39, and in the groups of signs referred to in 108, the parentheses and quotations marks (the two signs used respectively to form them) shall be counted as two characters, and the other signs as one character.
		(2) In the other groups of figures where they appear, and in groups of figures or figures and letters forming house numbers, the full stop, comma, colon, fraction bar and hyphen or dash shall be counted as one character, the parentheses as two characters.
		(3) However, when the fraction bar and the hyphen or dash are used in the cases referred to in Article 19, § 3 and Article 34, they shall not be counted as a character even when the sender has written them on the form.

Reference in the Telegraph Regulations (Paris Revision)	Present provisions	Proposals and reasons for them
		Reasons The present provisions of the ITR governing the counting of signs are vague and there are omissions therein. 115 stipulates that isolated signs, transmitted at the express request of the sender, shall be counted as one word, but it does not specify the cases in which the signs are to be treated as isolated. Moreover it does not specify how many characters are to be counted for the parentheses and quotation marks (the two signs used respectively to form them) in groups where they are admitted as non-isolated signs. Some Administrations consider that according to 116 and 118, the parentheses and quotation marks should be counted as one word in every case, even if they appear in the marks, designations, etc., referred to in 39, regardless of the provisions of 120. The new working of the regulations in question clearly defines the cases where signs are to be treated as isolated and consequently counted as one word if the sender expressly requests their transmission. According to the new § 5 *bis* (2), which contains part of the provisions of 118 of the Cairo Regulations, the parentheses would apparently be admitted in groups of figures in plain language and counted as two characters. § 7 (2) has been transferred *in toto* to § 5 *bis* (3) of that article as a more appropriate place. *Comment*. It should be pointed out that according to the above rules, signs appearing in groups of letters in plain language (excluding those referred to in 39) (*examples :* (A) and (I.T.U.) and the full stop sign in abbreviated words (example : Ing.), would be treated as isolated signs, as the mixing of letters and signs in these groups of letters and words is not authorized. The Study Group's attention is drawn to this point.
118 *quater*		35. UNITED KINGDOM Proposed new rule to be added : *g)* " arbitrary or abbreviated (registered) addresses ".

Reference in the Telegraph Regulations (Paris Revision)	Present provisions	Proposals and reasons for them
		Reasons The Regns. do not at present contemplate the method of counting arbitrary or abbreviated (registered) addresses except as vaguely given in Regns. 135 and 141. As an abbreviated (registered) address is in the nature of a secret language expression (admitted as plain language Regn. 38) it is considered that it should be counted as one word but that a restriction should be put on the number of letters allowed. In the U.K. we restrict abbreviated addresses to 10 letters. If this amendment is accepted, Study Group X may wish to consider revising Regn. 91 to make it clear that an abbreviated address must not contain more than 10 letters.
118 *quinquies*		36. UNITED KINGDOM Proposed new rule to be added : *h)* " each group of four figures taken from the official telegraph dictionary of the Chinese Administration (45 and 78) ". *Reasons* Clarification. Not contemplated elsewhere in Regulations. Reg. 120 provides for" groups of... figures, etc., shall be counted at the rate of five characters to the word ".
119	§ 6. Words separated or joined by an apostrophe, a hyphen or a fraction bar shall be counted as separate words, unless they appear in a standard dictionary of one of the admitted languages, in which case the accepting clerk shall join the parts into a single, deleting the apostrophe, hyphen or fraction bar, and for the word count shall apply the provisions of 136.	37. BELGIUM *Read :* ... of one of the admitted languages or refer to compound Christian names. In the latter cases the accepting clerk... *Reasons* Because of the proposed amendment to 123. (see proposal 62).
		38. CHINA Replaced by : § 6. *a)* a bracket (two signs forming) or a quotation mark (the signs of inverted commas) is counted : *as one word* when one or more spelled words are included within it. *Exa. :* (two signs) 3 words " one " 2 words *as one character* if it appears in a group of figures or signs, or a mixture thereof, or it

Reference in the Telegraph Regulations (Paris Revision)	Present provisions	Proposals and reasons for them

is used with a letter simply to denote a certain number or order of an item.

Exa.: (12/3) . . . 2 words
" 12/3 " . . 2 words
(a) or *a)* . . 1 word
" *a* " . . . . 1 word

Reasons

A bracket has the same generalities as a quotation mark, and some rules are essential as to how they should be properly counted.

39. CHINA

b) the apostrophe or the single inverted comma used in a group of figures to show " feet ", " inch " or " minute " " second " is counted as one character. The same rule applies when the apostrophe used other than prescribed in 107 *b)* is to be transmitted in the words, in this case, the apostrophe with the letter or letters which follow is counted as a separate word in accordance with the provision of 120.

Exa.: 12′ 3″. . . . 1 word
Geht's . . . 2 words

Reasons

In this particular case, these signs are comparable with the " comma " or " colon " in a group of figures, therefore it is justified to count them as characters.

Also see reason contained in revised paragraph 65 (proposal 3).

40. CHINA

c) a fraction bar, a hyphen or dash (except in cases contemplated in 107 *b*1)) shall be counted:

as one word when it is to join two distinct spelled words.

Example: May/August . . . 3 words
as one character in all other cases.

Example: 2-2/3 . . . . . 1 word
3/m . . . . . 1 word
(commercial mark)

Reasons

To avoid ambiguities in counting and to concur with present practice.

Reference in the Telegraph Regulations (Paris Revision)	Present provisions	Proposals and reasons for them
		41. SWEDEN
		§ 6. Add a second paragraph :
		(2) In other cases, when the apostrophe, the hyphen, or the fraction bar separating or joining two words is transmitted at the express request of the sender, this sign shall be counted as one word, as in 115. The same applies to a full stop added to a word to show an abbreviation.
		42. ITALCABLE
		No change.
		Add the following § 6 *bis :*
		§ 6 *bis*. The provisions of 136 shall also apply to arbitrary or abbreviated addresses (38) written in full, without signs.
		Reasons
		Arbitrary or abbreviated addresses have always been counted as fifteen characters, but there is nothing in the Regulations establishing this rule. To avoid misunderstanding, it would seem advisable to remedy this oversight.
120	§ 7. (1) Groups composed of letters, figures, signs, or a mixture thereof, where authorized (39), house numbers (65) and ordinal numbers (66) consisting of figures and letters shall be counted at the rate of five characters to the word plus one word for each five characters or fraction of five characters in excess.	43. AUSTRALIA
		" Real words used with other than the meaning normally assigned to them in the language to which they belong (48), groups of letters, figures, signs or a mixture thereof, where authorized (39, 43 A), ... " (rest unchanged).
		Reasons
		(i) The impression could be gained from paragraph 136 that a dictionary word used with a meaning other than that normally assigned to it in the language to which it belongs (that is, secret language in accordance with 48) should be counted at the rate of one word for each 15 letters or portion thereof. This would not be appropriate and the proposed amendment seeks to correct the position.
		(ii) The mention given to " 43 *bis* " in the proposed amendment relates to a new paragraph (see proposal 1). It has been a common practice in Australia for some years for groups composed of letters and figures representing sums of money, e.g. 85d (eighty-

Reference in the Telegraph Regulations (Paris Revision)	Present provisions	Proposals and reasons for them

five pence), 7*s*.1d. (seven shillings and one penny) to be acceptable and counted at the rate of one word for each 5 characters or portion thereof. The proposed amendment is designed to regularize this practice.

44. FEDERAL GERMAN REPUBLIC

(1) Groups composed of letters, figures, punctuation and multiplication signs .or a mixture thereof, where authorized (39) etc...

Reasons

Since multiplication signs may be used as well as punctuation, it would be preferable to say " punctuation and multiplication signs ".

45. UNITED KINGDOM

Groups composed of letters, figures, signs, or, where authorized, a mixture thereof, shall be counted at the rate of five characters to the word plus one word for each five characters or fraction of five characters in excess. Acceptable mixed groups of letters, figures and signs are : numbers, etc. (37), commercial marks, trade marks, etc. (39), meteorological groups (41), house numbers (65), ordinal numbers (66).

Reasons

It is considered that the existing rule needs clarifying and amplifying to cover all expressions for which a mixture of characters might reasonably be allowed. Study Group 10 may wish to consider complementary amendments to Regs. 40 and 41 to make it clear that exchange and market quotation as well as meteorological groups may constitute mixed groups. (See also proposed amendment above in proposal 23).

Reference in the Telegraph Regulations (Paris Revision)	Present provisions	Proposals and reasons for them

46. SWEDEN

§ 7. To be replaced by the following:

(1) In the groups where they appear, full stops, commas, colons, apostrophes, hyphens or dashes and fraction bars shall count as one character.

47. SWITZERLAND

The beginning of the text should read:
§ 7. (1) Groups composed of figures (except in the cases covered by 114 *bis*), letters...

Reasons

See the proposal for 114 (proposal 12).

48. CABLE AND WIRELESS

Groups composed of letters, figures, signs, or, where authorized, a mixture thereof, shall be counted at the rate of five characters to the word plus one word for each five characters or fraction of five characters in excess. Acceptable mixed groups of letters, figures and signs are:

Commercial marks, trade marks, etc. (Article 10, paragraph 2 *c)*);

Meteorological groups (paragraph —);

House numbers (Article 12, paragraph 7);

Ordinal numbers (paragraph —);

Arbitrary or abbreviated (registered) addresses shall be limited to a maximum of ten letters and shall be counted as one word.

Reason

In order to obtain greater clarification.

49. ITALCABLE

§ 7. In view of the provisions of § 5 *bis* above, (see proposal 34), groups composed of letters, figures, signs or a mixture etc. (the rest unchanged).

Reasons

To draw the clerk's attention to the counting of signs, especially in the case of the parenthesis and quotation marks.

Reference in the Telegraph Regulations (Paris Revision)	Present provisions	Proposals and reasons for them
121	(2) Nevertheless, a fraction bar, a hyphen or dash written in accordance with the terms of Article 19 (3) and Article 34 respectively, shall not count as a character even when the sender has written them on the form.	50. BELGIUM (2) Nevertheless, a fraction bar, a hyphen or dash written in accordance with Article 19 (3) and Article 34 (221) shall not count as a character even when the sender has written them on the form. *Reason* Because of the proposed amendment to 134 (see proposal 76). 51. CHINA (2) Arbitrary words composed of letters, figures, or signs (those to be counted as characters) are counted : *(a)* in full rate telegrams : at five characters to one word plus one word for each five characters or fraction of five characters in excess. *Example :* RYT30 . . . . . 1 word *(b)* in LT telegrams : only words in abbreviated expression with explicit meaning are admitted. In such case, the letters and figures should then be counted as fully spelled out words. *Example :* RYT30 . . . . . 4 words (Referring your telegram 30) *Reason* Provision for counting of compound words is still lacking in the present Regulations. Some guiding rules must be set up in this respect in order to avoid confusion. As secret language can be used in full rate telegram, and there are no specific restrictions relating to the structure of the text words in a full rate telegram, it is therefore justified to count them on a pure character basis. 52. RHODESIA AND NYASALAND (2) " nevertheless a hyphen or dash transmitted in accordance with 221, Article 34, shall not count as a character ". *Reason* If it is necessary for the fraction bar, hyphen or dash to be inserted and transmitted to

Reference in the Telegraph Regulations (Paris Revision)	Present provisions	Proposals and reasons for them
		make the sender's intention clear, it should be charged for. The only exception should be the dash separating the fraction from the whole number during transmission as envisaged in 221.
		53. SWEDEN
		(2) Nevertheless, a fraction bar, etc. (unchanged) § 7 *bis*. Groups composed of letters etc. (present wording of § 7 (1)).
		54. U.S.S.R.
		To be deleted.
		Reasons
		Count as one sign, irrespective of who has written the signs in question (sender or receiver of telegram) to avoid difficulties when fixing the charges for telegrams.
		55. ITALCABLE
		To be deleted.
		Reason
		This paragraph has been transferred to § 5 *bis* (3) above (see proposal 34).
122	§ 8. (1) Combinations or alterations of plain language words contrary to the usage of the language to which they belong shall not be allowed in plain language telegrams.	56. BELGIUM
		Add the following to this paragraph :
		Expressions such as RETEL, VOTEL, YOURTEL formed by the joining of actual words altered should be counted :
		— in full rate telegrams in accordance with Article 18 (120).
		— in reduced rate telegrams as the number of actual words they comprise.
		Comment : A reference to 122 should also be added to 42.
		Reasons :
		To preclude differences of interpretation in the counting of words.
		57. JAPAN
		§ 8. (1) Combinations of plain language words contrary to the usage of the language shall be counted according to the correct usage

Reference in the Telegraph Regulations (Paris Revision)	Present provisions	Proposals and reasons for them

of the language to which they belong. Nevertheless, the combinations consisting of within five letters shall be counted as one word in the telegrams in which secret languages are allowed. Combinations of the abbreviated expressions (Art. 10 § 2 *f)*) appearing in the telegrams in which secret languages are allowed shall be counted at the rate of five characters to the word plus one word for each five characters or fraction of five characters in excess.

(2) Alterations of plain language words contrary to the usage of the language shall be counted according to the correct usage of the language to which they belong. Nevertheless, the alterations appearing in the telegrams in which secret languages are allowed shall be counted at the rate of five letters to the word plus one word for each five characters or fraction of five characters in excess.

Reasons :

To make the counting of words which are combined or altered clearer.

58. UNITED KINGDOM

Except as provided in 43, combinations or alterations of plain language words, contrary to the usage of the language to which they belong, shall not be allowed in telegrams for which plain language is stipulated.

Reasons

Article 11 provides for secret language words, names, expressions or combinations of letters not fulfilling the conditions laid down for plain language. In ordinary rate telegrams, the U.K. Administration admits as secret language such expressions as ONTOP, TOBE, ANDOR chargeable as one word each, although the rest of the text might consist entirely of plain language words. In order to avoid any misunderstanding regarding the acceptance of such expressions in letter telegrams for which plain language is stipulated, it is considered that the rule needs clarification as suggested. The foregoing assumes that it was the intention of the Paris (1949) revision to admit such groups in telegrams other than plain language (letter and press) telegrams i.e. secret language telegrams (see Cairo, 119).

As regards the exception provided in Reg. 43, since a check word is not defined otherwise

Reference in the Telegraph Regulations (Paris Revision)	Present provisions	Proposals and reasons for them

than that it must not exceed 5 letters or figures placed at the beginning of a message, we admit expressions such as RECAB, RELET, etc. used as the first word in the text of letter telegrams. It is not known whether this practice is generally acceptable to Overseas Administrations, but the implication of the amended regulation should remove any cause for dispute.

59. SWITZERLAND

Add at the end :

If the sender makes a formal request that expressions made up of words combined or altered, contrary to normal usage in the language, be transmitted in the form he has written them, they shall be counted as one word for each group of five letters or characters or for a fraction of such a group.

Reasons

It often happens that senders insist that expressions not conforming to normal usage in the language concerned should be transmitted in the way they have written them, which leads to arguments at the counter. It is therefore desirable to determine how these expressions should be counted.

60. CABLE AND WIRELESS

Except as provided in Article 10 paragraph 2 *(c)*, combinations or alterations of plain language words, contrary to the usage of the language to which they belong, shall not be allowed in telegrams for which plain language is stipulated.

Reason

In accordance with *Article 10*, the combination of any 5 letters is permissible as secret language and in ordinary telegrams should be counted and charged as one word, even if it appears to be two plain language words joined together e.g. ONTOP.

It would be difficult to refuse such an expression in an ordinary telegram but it should not be used in Letter-telegrams which must be expressed wholly in plain language.

61. ITALCABLE

§ 8. (1) Combinations, alterations or abbreviations of plain language words contrary etc. (The rest unchanged.)

Reference in the Telegraph Regulations (Paris Revision)	Present provisions	Proposals and reasons for them
		Reason The word *abbreviations* has been added to this paragraph because the word *alterations* does not mean the same as abbreviations.
123	(2) Nevertheless, family names belonging to one person, the full or abbreviated names of places, squares, boulevards, streets and other public ways, names of ships, designations of aircraft, railway trains and similar designations, compound words which can be justified, if required, whole numbers, fractions, decimal or fractional numbers, written in words, may be grouped as a single word, which shall be counted in accordance with the provisions of 136.	62. BELGIUM (2) Nevertheless, family names belonging to one person, compound Christian names written by the sender as one word or joined by a hyphen or dash, the full or abbreviated names... *Reason* As the use of compound Christian names is becoming general in some countries, the word count for such names should be subject to the same rules as for family names.
		63. CHINA (2) Nevertheless, full or abbreviated names belonging to one person, names of telegraph offices and of land and mobile stations as defined in Article 15, § 13 and Article 19, § 1, names of towns, countries and smaller divisions of territory, the full or abbreviated names of places, squares, boulevards, streets and other public ways, names of ships, designations of aircraft, railway trains and similar designations, compound words which can be justified, if required, whole numbers, fractions, decimal or fractional numbers, written in words, may be grouped as a single word, which shall be counted in accordance with the provisions of 136. *Reason* To make it more complete. The family name can be linked with a Christian name or the first and second name or initials, as a single word, because it belongs to one person.
		64. RHODESIA AND NYASALAND " Nevertheless, family names belonging to one person, the full or abbreviated names of places, squares, boulevards, streets and other public ways, names of ships, designations of aircraft, railway trains and similar designations and whole numbers, fractions,

Reference in the Telegraph Regulations (Paris Revision)	Present provisions	Proposals and reasons for them

decimal or fractional numbers, written in words, may be grouped as a single word, which shall be counted in accordance with the provisions of 136."

Reason

It is extremely difficult to decide which compound words can be justified. The only justification, while the existing methods of counting and charging are in force, should be whether or not the words appear in a standard dictionary, and the provisions of 119, 122 and 136 cover the matter adequately.

65. UNITED KINGDOM

Nevertheless, family names belonging to one person, the full or abbreviated names of places, squares, boulevards, streets and other public ways, names of ships or of hotels, designations of aircraft, railway trains and similar designations...

Reason

By analogy with other designations admitted as one word (subject to the 15 letter count) it is thought that " delapaix " " desitaliens " " delagare " " Princeofwales " etc., used in conjunction with " Hotel " constitute a proper name which can be justified and should count as one word.

66. UNITED KINGDOM

Insert new rule 123 *bis* : Surnames, christian or given names and the names of business firms or organizations shall also be counted in accordance with the provisions of 136.

Reason

Clarification. Except by vague implication, the existing Regulations do not contemplate the method of counting. Regulation 123 merely contemplates names, etc. which may be joined together. " Given names " is intended to cover nicknames and other names to which the expression " Christian name " is clearly inapplicable.

Reference in the Telegraph Regulations (Paris Revision)	Present provisions	Proposals and reasons for them

67. SWITZERLAND

Amplify the text as follows:

... designations of aircraft, airline flights, railway trains... written in words, the complete designations of currencies, may be ...

Reason

Designations of airline flights appear in the schedules of airline companies and have a meaning analogous to those designating trains in the timetables of railway companies (see the proposal for 158).

It has always been difficult to fix charges for currency designations. In the present circumstances, it seems justified to admit as one word expressions such as francfrançais, Usdollars, Deutschemark, etc.

68. ITALCABLE

(2) Nevertheless, the following may be grouped in a single word which is counted in accordance with the provisions of 136:

a) family names belonging to one person;

b) full or abbreviated names of places, squares, boulevards, streets and other public ways written in full;

c) the names of ships, aircraft and railway trains and similar designations;

d) compound words which can be justified, if required;

e) whole numbers, fractions, decimal or fractional numbers, numbers indicating the percentage or per thousand (examples: *threepercent*, *twoperthousand*), and numbers indicating multiplication or a dimension (example: *fourbythree*) written in full.

Reason

§ 8. (2) *b)* Obviously the grouping referred to here applies to designations written in full. The designation *36 street*, for example, can be grouped if it is written in full *thirty-sixstreet* (see the examples of counting words in Article 24).

§ 8 (2) *c)* It is also obvious that this refers to names and not designations composed of groups of letters and/or figures, for if that were the case these groups could not be counted in accordance with the provisions

Reference in the Telegraph Regulations (Paris Revision)	Present provisions	Proposals and reasons for them
		of 136, i.e. as 15 characters, but as 5 characters. Since the Table of examples of counting words (Art. 24) includes two examples of designations of an aircraft and a railway train composed of letters and figures to be counted as 5 characters, it is necessary, in order to complete the rules for such designations, to insert the following words in 39, after *reference numbers or indications :* " designations of ships, aircraft and railway trains or similar designations." § 8. (2) *e)* The numbers indicating the percentage or per thousand, multiplication or a dimension, have been inserted along with the other numerical expressions referred to in that paragraph. If the fractional number 4½ or the decimal 3.40, for example, is written in full, the words composing them may be grouped in a single word (*fourandahalf*, *threepointforty*). By analogy the same facility might be granted for the numerical expressions 3 °/₀, 2 °/₀₀, 4×3 (*threepercent*, *twoperthousand*, *fourbythree*). The addition proposed would seem advisable since a number of Administrations give this interpretation to the provision.
124	(3) The provision of 123 shall likewise apply to numbers written in words in which the figures are represented separately or in groups, for example : thirtythirty instead of threethousandandthirty or sixfoursix instead of sixhundredandfortysix.	69. CHINA Slightly change " ... Written in words " to " written in letters ". *Reason* To make the meaning more precise.
124 *bis*		70. JAPAN Add the following paragraph before § 9 : " At the time of acceptance of a telegram of more than fifty words, the counter officer shall mark with a cross [1] the last word of each section of fifty actual words (irrespective of the rules of charging), the paid service indications and the words in the address being included in the first section. Each cross shall be followed by a figure indicating the number of words. The cross and the figure shall not be charged for.

[1] For transmission, see Article 36 § 8 (2).

Reference in the Telegraph Regulations (Paris Revision)	Present provisions	Proposals and reasons for them
		Reason See the reasons as regards § 4 (see proposal 11).
125	§ 9. The counting of the office or mobile station of origin shall be decisive, both for transmission and for the international accounts.	71. BELGIUM *At the end of this article add :* subject, however, to the provisions of 149. *Reason* To draw attention to the departure from the general rule.
		72. UNITED KINGDOM Except as provided in 149, the counting of the office or mobile station of origin shall be decisive, both for transmission and for the international accounts. *Reason* A cross reference to Regulation 149 seems desirable here in order to avoid misunderstandings which occasionally arise with other Administrations.
		73. CABLE AND WIRELESS The counting of the office or mobile station of origin shall be decisive, both for transmission and for the international accounts (except as provided in Article 23, paragraph 1). *Reason* A cross reference of this kind appears desirable.
133	§ 2. If it has not already been done, the counter officer shall join up the different parts of each of the expressions which are specified under 127 to 132 and counted as one word, provided that this does not distort the name of the office of destination.	74. BELGIUM § 2. If it has not already been done, the counter officer shall join up the different parts of each of the expressions which are specified under 127 to 132 and counted as one word. If there are difficulties in determining the office of destination, the transit offices must bear in mind that the names of offices beginning with the letter S signifying " Saint " are separately indexed in the " Official List of Telegraph Offices open for International Traffic ".

Reference in the Telegraph Regulations (Paris Revision)	Present provisions	Proposals and reasons for them
		Reason The Belgian Administration thinks that the joining of words in the name of the office of destination is desirable because the last word of the address is normally regarded as the name of the office of destination. There is a risk of doubts and even errors in directions when the name of the office of destination is split into several words. Example of possible confusion S. Bartolome Cordoba (Argentine) and Cordoba (Spain).
		75. SWITZERLAND In this last case, the counter officer shall separate the different parts by a fraction bar, and the whole shall count as one word. *Reason* To facilitate routing, and the checking of the number of words by the receiving officer.
134	§ 3. A fraction bar shall not be counted as a character in a group of figures or of figures and letters forming a house number in the address of a telegram, even when the sender has written it on the form (number 65).	76. BELGIUM § 3. A fraction bar, and a hyphen or dash when used to replace a fraction bar in transmission shall not be counted as a character in a group of figures or of figures and letters forming a house number in the address of a telegram, even when the sender has written it on the form (numbers 65 and 158). *Reason* To bring it into line with numbers 121, 134 and 158 (house numbers).
		77. CHINA Deleted. *Reason* A fraction bar in a house number should be counted as one character without exception. See reason contained in revised paragraph 65 (see proposal 3).
		78. RHODESIA AND NYASALAND " A fraction bar shall be counted as a character in a group of figures or of figures and

Reference in the Telegraph Regulations (Paris Revision)	Present provisions	Proposals and reasons for them
		letters forming a house number, even if it is inserted by the counter officer (number 65)." *Reason* See the reason against the proposed modification of number 121 (2) (proposal 52).
		79. U.S.S.R. Deleted. *Reasons* As stated in paragraph 2 (see proposal 54).
135	§ 4. Each other word in the address shall be counted at the rate of fifteen characters to the word plus one word for each fifteen characters or fraction of fifteen characters in excess.	80. UNITED KINGDOM " Except as provided in Article 18, each other word in the address..." *Reasons* To provide for words mentioned in Article 18 for which the five character count is appropriate.
Article 20,	THE COUNTING OF WORDS IN THE TEXT	81. AUSTRALIA
136	§ 1. (1) In telegrams in plain or secret language, each word appearing in a standard dictionary of one of the admitted languages (number 44), each word in common use in one of those languages or any expression mentioned in numbers 119, 123 and 124, shall be counted at the rate of fifteen characters to the word, plus one word for each fifteen characters or fraction of fifteen characters in excess.	" In telegram in plain language (36), each word appearing in a standard dictionary of one of the admitted languages ... shall be counted at the rate of fifteen characters to the word... (rest unchanged)." *Reasons* It is recongnized that a secret language telegram may contain one or a number of words in plain language (including dictionary words) and that it is to these dictionary words that paragraph 136 relates so far as " telegrams in secret language " are concerned. A telegram expressed partly in plain language and partly in secret language was known as a " mixed telegram " up to the time the Paris Regulations were introduced. It is now known as a " secret language telegram " (paragraph 55). To avoid confusion, it is thought desirable to omit the words " or secret language " in the first line of paragraph 136 and to indicate

Reference in the Telegraph Regulations (Paris Revision)

Present provisions

Proposals and reasons for them

the method of counting words and groups in a " mixed telegram " in a separate paragraph, as proposed below (new paragraph 137 A).

82. BELGIUM

Read : ... in common use in one of those languages, any arbitrary or abbreviated address or any expression mentioned...

Reasons :

To indicate the system for counting arbitrary or abbreviated addresses.

83. CHINA

Unchanged, except to amend the paragraph " 119 " to " 107 *bl)* ".

Reason

Revised

84. JAPAN

§ 1. (1) In telegrams in plain or secret language, each word appearing in a standard dictionary of one of the admitted languages (Art. 10, § 3), each word in common use in one of those languages, any expression mentioned in Article 18, § 6 and 8 (3) and (4), and arbitrary or abbreviated addresses (Art. 15 § 10) shall be counted at the rate of fifteen characters to the word, plus one word for each fifteen characters or fraction of fifteen characters in excess.

Reasons

To make clearer the counting of the arbitrary or abbreviated addresses in the text.

85. UNITED KINGDOM

" In telegrams in plain or secret language each word appearing in a standard dictionary of one of the admitted languages (44) ... shall, provided it is used as plain language (35), be counted... "

Reasons

To make it clear that even when words appear in a standard dictionary they are only counted as plain language when used as such.

Reference in the Telegraph Regulations (Paris Revision)	Present provisions	Proposals and reasons for them
137	(2) Words not fulfilling the conditions in 136 and groups of letters, figures and signs indicated in 120 shall be counted in conformity with the provisions of Article 18.	86. BELGIUM *After* " 120 " *insert the following :* artificial expressions made by joining and altering actual words (see 122) shall be counted in conformity with the provisions of Article 18. *Reasons* Because of the proposed addition to 122 (see proposal 56).
		87. CHINA Unchanged, except to add " 121 (2) *a)* " after " 120 ".
		Reason Revised.
137 *bis*		88. AUSTRALIA " 137 A—In the text of telegrams containing a mixture of plain and secret language, each plain language word or groups shall be counted in accordance with 119, 120, 123 and 124, whichever appropriate, and each secret language group shall be counted at the rate of one word for each 5 characters or portion of 5 characters in excess."
		Reason To clarify the intention of counting plain language words and secret language groups in a " mixed telegram ".
139	(4) The multiplication sign (×), replaced in transmission by the letter X (62), shall be counted as one character in the group in which it appears.	89. BELGIUM *Read :* (4) The multiplication sign (×), replaced in transmission by the letter X (62), placed between figures or groups of figures and indicating dimensions or " multiplied by " shall be counted as one character in the group in which it appears.
		Reasons In accordance with the wish expressed by the working party of S.G.X. at its meeting in July, 1955.
		90. FEDERAL GERMAN REPUBLIC Replace, from " the letter X (62) ... " by " shall, in the group in which it appears,

Reference in the Telegraph Regulations (Paris Revision)

Present provisions

Proposals and reasons for them

be counted as one character when it means " multiplied by ", or as a separate word when it indicates dimensions in the group in question.

Reasons

The former wording might give rise to mistakes.

91. UNITED KINGDOM

" The multiplication sign or sign of dimension (×) replaced in transmission by the letter X (62) shall be counted as one character in the group in which it appears."

Reasons :

The existing regulations do not contemplate the use of the dimension sign " × ". It is considered that such signs do in fact constitute an integral part of the groups in which they appear, similar to the multiplication sign " × ".

Study group X may wish to consider any necessary amendments to Regulations 57 and 62 if the proposal is adopted.

92. ITALCABLE

(4) The multiplication sign (×), replaced in transmission by the letter X (62), shall be counted as one character in the group in which it appears, whether it indicates multiplication or a dimension.

Reasons :

It does not seem quite fair that the multiplication sign must be counted as one word when it indicates a dimension (Article 24) and be treated as an isolated sign.

139 *bis*

93. JAPAN

Add the following subparagraph to § 1 : Commercial marks, designations of goods etc. (Art. 10. § 2 *c)*) expressed in real words shall be counted in accordance with provisions of § 1. (1) above and Article 18. § 8. (1) and (2).

Reasons

To clarify the counting of commercial marks, designations of goods etc. expressed in real words.

Reference in the Telegraph Regulations (Paris Revision)	Present provisions	Proposals and reasons for them
140	§ 2. Names of telegraph offices and of land and mobile stations as defined in Article 15, § 13 and Article 19, § 1, names of towns, countries and smaller divisions of territory, may be grouped in a single word, which shall be counted in accordance with the provisions of 136 of this article.	94. CHINA Deleted. *Reason* Already covered in revised paragraph 123 (see proposal 63).
		95. UNITED KINGDOM " Names of telegraph offices and of land and mobile stations as defined in Art. 15 § 13 and Art. 19 § 1, names of towns, or countries or smaller divisions of territory, may each be grouped... " *Reasons* Clarification. As the rule stands, Maidenhead Berks could be joined together to count as one word. This is clearly not intended. The inclusion of Berks is not necessary for identification purposes and should therefore be counted and charged as an additional word.
141	§ 1. (1) Each word in the signature shall be counted at the rate of fifteen characters to the word, plus one word for each fifteen characters or fractions of fifteen characters in excess.	96. UNITED KINGDOM " Except as provided in 142, each word in the signature ... "
142	(2) When, however, an arbitrary word, other than an arbitrary or abbreviated address (38) appears in the signature, such a word shall be counted at the rate of five characters to the word, plus one word for each five characters or fraction of five characters in excess.	97. UNITED KINGDOM " When an arbitrary word, other than an arbitrary or abbreviated address (38), or a house number appears in the signature, such words shall be counted ... " *Reasons* Existing regulation does not contemplate the use of a house number in the signature.
143	§ 2. If the signature is followed by names of telegraph offices and land and mobile stations as defined in Article 15, § 13 and Article 19, § 1, names of towns, countries and smaller divisions of territory may be grouped in a single word, which shall be counted in accordance with the provisions of 136.	98. UNITED KINGDOM " Names of telegraph offices and of land and mobile stations as defined in Article 15, § 13 and Art. 19 § 1 names of towns, or countries or smaller divisions of territory may ... " *Reasons* Clarification. For the reasons given in the case of Regulation 140 (see proposal 95).

Reference in the Telegraph Regulations (Paris Revision)	Present provisions	Proposals and reasons for them
145	§ 2. This rule shall apply specially:	99. BELGIUM
146	1. to a telegram containing words mentioned under 136 of more than 15 characters;	*at the end of this paragraph add:*
	. . . . .	and to artificial expressions made by joining and altering actual words counted as 5 characters or as many words as they comprise,
147	2. to groups of figures or letters as defined in 120, containing more than 5 characters;	depending on whether they are in a full rate telegram or a reduced rate telegram (122).
		Reasons
		Because of the proposal 56 regarding 122.
		100. CHINA
		Amended to:
		2. to group of letters, figures, or signs as defined in 120 and 121 (2) *a)* containing more than 5 characters.
		Reason
		Revised.
		101. UNITED KINGDOM
		" to groups of letters, figures, signs, or a mixture thereof as defined in 120, containing more than 5 characters; "
		Reasons
		The existing rule does not contemplate mixed groups.
148	3. to the case contemplated in 142.	102. UNITED KINGDOM
		" to the cases contemplated in 142 ".
		Reasons
		Arising from the suggested amendment to 142 (see proposal 97).
148 *bis*		103. ITALCABLE
		Add the following No. 4 *at the end of the paragraph:*
		4. to certain expressions such as eight/10, 5/twelfths, May/August, which are accepted as a single actual word because they are used in ordinary and commercial correspondence, but counted as the number of words composing them (Article 24).

Reference in the Telegraph Regulations (Paris Revision)	Present provisions	Proposals and reasons for them
		Reasons This addition should remove any doubt which exists in the matter. The addition proposed would appear to be in the spirit of the existing Regulations.
149	§ 1. As an exception to the general rule laid down in 125, when a telegram contains combinations or alterations of words of a language other than the language or languages of the country of origin, contrary to the usage of that language, Administrations and Recognized Private Operating Agencies have the right to direct that the delivery office shall collect from the addressee the amount undercharged. When this right is exercized, the delivery office may decline to deliver the telegram if the addressee refuses to pay.	104. FEDERAL GERMAN REPUBLIC When a telegram contains combinations or alterations of words of a language other than the language or languages of the country of origin, contrary to the usage of that language, the delivery office shall consider the word count of the country of origin as valid. No additional charge shall be made to the addressee. *Reason* It is impossible for the counter officers in delivery offices to know the numerous languages admitted or to have access to the corresponding dictionaries. Arguments with users of telegraph services in connection with additional charges in the delivery office involve further administrative expenses which are not justified when compared with the additional amount charged.
		105. ITALCABLE § 1. As an exception to the general rule laid down in 125, when a telegram contains combinations, alterations or abbreviations of words of a language other than the language or languages of the country or origin, contrary to the usage of that language, Administrations and Recognized Private Operating Agencies have the right to direct that the delivery office shall collect from the addressee the amount undercharged. *Reasons* See proposal 107.
150	§ 2. Administrations and Recognized Private Operating Agencies which make use of the foregoing provision shall notify this to the other Administrations and Recognized Private Operating Agencies through the medium of the General Secretariat.	106. ITALCABLE § 2. If the clerk suspects that a telegram contains combinations, alterations or abbreviations contrary to the usage of that language but is unable to detect them, he must ask the sender to give a written undertaking guarantee-

Reference in the Telegraph Regulations (Paris Revision)	Present provisions	Proposals and reasons for them
		ing payment of the amount undercharged, if the delivery office notifies the sending office of such an infringement. *Reasons* See proposal 107.
151	§ 3. In the case of refusal to pay, a service advice worded as follows shall be sent to the office of origin: " A Wien Paris 18 1710 (date and time of handing in) = 456 eighteenth Lemoine (number of telegram, date in words, name of addressee) held (if delivery of the telegram has been withheld pending collection of the deficiency) (quote the words irregularly combined or altered) ... words (state how many words should have been charged) ". If the sender, on being duly informed of the reason for non-delivery, agrees to pay the deficiency, a service advice worded as follows shall be sent to the office of destination: " A Paris Wien 18 1940 (date and time of handing in) = 456 eighteenth Lemoine (number of telegram, date in words, name of addressee) deficiency collected x words admitted " (x indicates the number of words in the telegram after amendment). On receipt of this service advice, the delivery office shall deliver the telegram, if it has been withheld.	107. ITALCABLE § 3. If the addressee refuses to pay, the telegram shall nevertheless be delivered, and a service advice worded as follows shall be sent to the office of origin: " A Wien Paris 18 1710 (date and time of handing in) = 456 eighteenth Lemoine (number of telegram, date in words, name of addressee) addressee refuses to pay additional charge (quote the words irregularly combined, altered or abbreviated)... words (state how many words should have been charged) ". If the sender, being duly informed, pays the deficiency, a service notice worded as follows shall be sent to the office of destination: " A Paris Wien 1949 (date and time of handing in) = 456 eighteenth Lemoine (number of telegram, date in words, name of addressee) deficiency collected x words admitted " (x indicates the number of words in the telegram after amendment). If, on the contrary, the undertaking referred to in the paragraph above has not been requested and the sender refuses to pay the deficiency, the service advice should be worded as follows: " A Paris Wien 18 1940 = 456 eighteenth Lemoine deficiency not collected x words admitted " (x indicates the number of words of the telegram established by the office of origin which remains decisive) (125). *Reasons* (for proposals 105, 106 and 107). The addition of the words " or abbreviations " in § 1 follows on the amendment proposed to § 8 (1) of Article 18. (Proposal 61). As regards the question of substance in the paragraphs referred to above, the Italcable Company thinks that the rule at present in force, that a telegram cannot be delivered if it contains irregular combinations, alterations or abbreviations, is too stringent. When a telegram has been accepted with or without reservations, the sender should feel assured that, *force majeure* excepted, his telegram will be duly transmitted and delivered, and moreover an addressee cannot be held responsible for any mistakes of the sender which are not pointed out by the office of origin.

Reference in the Telegraph Regulations (Paris Revision)	Present provisions	Proposals and reasons for them
		For these reasons, and also because quite often senders make such mistakes in good faith through insufficient knowledge of the language used, the Italcable Company thinks that in all these special cases the telegrams should be delivered, subject to the application by all Administrations (and Recognized Private Operating Agencies) of the provisions of the new paragraphs 1, 2 and 3). The number of cases of non-recovery of the amount undercharged would then be practically negligible. Notification to the General Secretariat (see the existing § 2) would be unnecessary, as the new rules could be applied uniformly by all Administrations (and Recognized Private Operating Agencies).
154	§ 6. A transit office may not suspend transmission of such a telegram and, except in the case provided for in 149, a delivery office may not suspend delivery.	108. ITALCABLE § 6. A transit office may not suspend transmission of a telegram and a delivery office may not suspend delivery. *Reason* Follows on the proposal 107.
155	§ 7. When the office of destination observes that a letter telegram, worded in a language other than one of those of the country of origin, does not comply with the conditions laid down in 752 and 653, it may collect from the addressee a supplementary charge corresponding to the difference between the cost of an ordinary telegram and that of a letter-telegram.	109. SWITZERLAND Amplify the text as follows : ... in 752 and 753, or that a letter telegram in any language contains one or more words in secret language, it may collect... *Reason* It is logical, and already applied in practice.
157	§ 9. If the addressee refuses to pay the charges referred to in 155 and 156, the provisions of 149 and 151 shall be applied.	110. ITALCABLE § 9. It is the duty of the clerk to warn the sender of a letter-telegram drawn up in a language other than that of the country of origin, or of a press-telegram, that if the telegram is not in conformity with 155 or 156 respectively, he may have to pay the deficiency not collected at the destination. In that case provisions similar to those in 151 shall be applied. *Reasons* The same as those given for the alterations proposed to paragraphs 1, 2 and 3 (proposals 105, 106 and 107).

158 *Article* 24

The following modifications have been proposed to the list giving examples of counting of words :

Proposals	Reasons
111. AUSTRALIA	
Read :	See proposal 43
Page 27 : 10 fr. 50 c (7 characters) 2 words	
10 fr. 50 (6 characters) 2 words	
112. AUSTRALIA	
Omit :	
Page 27 : L 10	The use of the letter L to represent the pound sign " £ " is confusing to some recipients.
Page 28 : £ 10	The sign " £ " has no equivalent in the table of telegraph signals shown in paragraph 57.
113. AUSTRALIA	
Amend :	
Page 28 : threeandsix . . . . . 3 words	The admissibility of such a group for acceptance as one word is not recognized. Such a group would appear to be an irregular combination.
114. BELGIUM	
Page 25 : *add* after : Dubois (personal name)	
Marie-Louise . . . . . 1 word Marie-Louise . . . . . 1 word Marie-Louise . . . . . 3 words	Because of the proposal 62.
115. BELGIUM	
Page 28 :	
Line 12 : 15 x 6 (transmitted 15 x 6) . . . 3 Line 13 : 15x6 (without spaces) 1	
Read : 15 x 6 (the sign (x) signifying " multiplied by " or indicating dimensions) 1 15 x 6 x 14 (7 characters) 2	Because of the proposal 89
116. BELGIUM	
Page 28, *add*, in fine :	
10) . . . . . 3 characters 1 4 (201) . . . . . 6 " 2 C (M2) 6 . . . . . 6 " 2 C (MR) T . . . . . 6 " 2	1) Because of the alteration proposed for 116 (Proposal 19)
Irregular combinations and alterations : cesoir (irregular combination) 2 iresponsabilité (alteration ; 15 characters instead of irresponsabilite, 16 characters) 2 jariv (for j'arrive: combination and alteration) 2	2) To give some examples of irregular combinations and alterations.

Proposals

Reasons

ARTIFICIAL GROUPS

	Number of words Telegram rate *full*	*reduced*
RECAB (reference cable) . . .	1	2
REURTEL (ref. your telgr.) . .	2	3
RYC14 (ref. your cable 14th) .	2	4
YOURLET (your letter) . . .	2	2

3) Artificial groups, because of addition proposed to 122 (Proposal 56) and in relation to the use of altered words and figures in a single group (53).

117. CHINA

Page 26

Delete examples on House Numbers

See proposals 3 and 77 .

118. JAPAN

Insert the following examples at the appropriate places :

1949-1951	(7 characters)	2
13 : 19	(5 ")	1
(A)	(3 ")	1
(2)	(3 ")	1
(.)	(3 ")	1
(150)	(5 ")	1
(RA53)	(reference number) (6 characters)	2
(AAA) (trade mark)	(5 characters)	1
IL(10)C10-00008	(reference number) (15 characters)	3
(2.80 11/16)	(2 groups)	3
(Tokyo March 55)	(1 parenthesis, 2 words, 1 group)	4
" 37356 "	(7 characters)	2
" London "	(1 quotation mark, 1 word)	2
5...	(4 characters)	1
East36thstreet	(name of street) (14 characters)	1
Luckie3	(name of ship) (7 characters)	1
Luckyboy/WC5424	(name of ship) (15 characters)	1
Wepay (we pay)	in telegrams in which secret languages are allowed	1
	in telegrams in which secret languages are not allowed	2
RYT	(reference your telegram) in telegrams in which secret languages are allowed	1
	in telegrams in which secret languages are not allowed	3

The examples relating to brackets are inserted in order to fix the counting of expressions containing the brackets which surround a letter, a figure or a sign as well as to fix the counting of groups of figures containing the brackets. The examples relating to irregular combinations and alterations are inserted in order to clarify the counting of them in conformity with the proposal to Article 18 § 8 (1), (2). (Proposal 57).

Proposals		Reasons
USDOL (US (United States) DOL (dollar))		
in telegrams in which secret languages are allowed	1	
are not allowed	2	
B/LCIFL/C (B/L, CIF, L/C)		
in telegrams in which secret languages are allowed	2	
are not allowed	3	
MSEVEN (my seven)		
in telegrams in which secret languages are allowed	2	
are not allowed	2	

119. FEDERAL GERMAN REPUBLIC

Replace

Page 25, lines 4 and 5, by:			Emmingen Kr Fallingbostel-Soltau has been changed to Emmingen Kr Soltau.
Offheim, Kr Limburg, Lahn [1 2]	1	4	
Offheimkrlimburglahn (20 characters)	1	2	
Page 25, lines 16, 17 and 18, by			
Jean George van de Brande		5	The Christian names of the same person are also often combined into one.
Jeangeorge van debrande		3	
J.G. Vandebrande		2	

120. FEDERAL GERMAN REPUBLIC

Replace

Page 27, lines 25, 27, 29, 30, 31, 34, 35 Page 28, lines 1 and 7		The way in which the expressions are shown in the Regulations, i.e., with spacing, leaves no doubt that several words are involved. But these designations also count as several words when they are combined into one. To avoid doubts with regard to the word count both ways of writing, these designations (with and without spacing) should be indicated.
2 p % or 2p%	3	
2 p °/₀₀ or 2p°/₀₀	3	
10 francs 50 centimes (or) 10 fr. 50 c (or) 10francs50centimes (or) 10 fr. 50 c. . . .	4	
10 fr. 50 (or) 10fr.50	3	
fr. 10,50 (or) fr.10,50	2	
dols 50 (or) dols50	2	
L 10 (or) L10	2	
£ 10 (or) £10	2	
11 h. 30 (or) 11h.30	3	

121. FEDERAL GERMAN REPUBLIC

Replace

Page 28, lines 12 and 13, by		
15 X 6 (or) 15X6 (transmitted 15x6)	1	The two ways of writing 15x6 are the same, even where the designation serves to indicate dimen-

Proposals			Reasons
and *insert between* " 15x6 " *and* " *E* " :			sions, as 15 : 6 can also be written as one word and it is the same indication. When the sender has written this group with spacing, the counter officer recommends him to combine it in one group in order to save money. If the sender does not agree, the words are charged separately. The sender likewise writes telephone numbers in the way given in the official telephone directory for the sake of simplicity. As X no longer serves as an interruption sign, it could be used in a group of characters or between two words.
A X B (or) AxB (transmitted AxB) Length X Width		3	
7 42 93 (telephone number) (5 characters, transmitted 74293)		1	
Delete the notes at the foot of page 28.			

122. UNITED KINGDOM

Replace			
Page 25, lines 4 and 5 by			
Emmingen Kr Soltau 1) 2)	1	3	To conform with designation given in the International List (19th edition).
Emmingenkr soltau (16 characters) . .	1	2	

123. UNITED KINGDOM

Insert fresh examples			
Berlin W66	1	2	It seems desirable that an example should be given of the method of counting the name of a delivery office amplified by the addition of a district indicator in accordance with Regulations 131, 140 and 143, having regard to the fact that 133 is obligatory to 131 but not to 140 or 143.
BerlinW66 (9 characters)	1	1	
Maidenhead Berks	2	2	In the address Berks is an unnecessary addition and should be chargeable.

124. UNITED KINGDOM

Page 26, *under House Numbers*			
Insert : 444½ (transmitted in the address 444-½) (5 characters in the address and 6 characters in text or signature)	1	2	To make it clear that a fraction bar included in a house number is counted in the text or signature but not in the address.

125. UNITED KINGDOM

Replace, Page 27, line 1 :			According to authoritative dictionaries " quatre-vingt-quatorze " is a regular hyphenated (compound) expression, Regulation 119.
Deux mille cent quatre-vingt-quatorze		5	The appropriate charge for the example as written is considered therefore to be as for five words.

126. UNITED KINGDOM

Add :			Examples of method of counting in accordance with Regulations 40 and 120 (as suggested in proposal 45).
85s (exchange or market quotation) (3 characters)		1	

Proposals			Reasons
12 (ABCD/5) (Commercial mark) (10 characters)	—	2	In accordance with Regulations 39, 116 and 120 (as suggested in proposals 23 and 45).
Hôtel delagare	—	2	In accordance with 123 (as suggested in proposal 65).

127. UNITED KINDOM

Page 28, *replace* lines 12 and 13 by :

15 X 6 (transmitted etc...)		1	As suggested in amendment of Regulation 139 (proposal 91).
15x6 (without spaces)		1	

128. SWITZERLAND

Replace :

" number of words " at the top of the columns by " number of words charged "	For greater accuracy.

129. SWITZERLAND

Give the examples Sanct Pölten and Emmingen Kr Fallingbostel-Soltau in the following way :			See proposal 75 to 133. Furthermore, adaptation to the indications given in the present official list.
Sanct Pölten (transmitted in the address S/Poelten	1	2	
Sanctpölten (transmitted in the address S/Poelten)	1	1	
Emmingen Kr Soltau [2] (transmitted in the address Emmingen/Kr/Soltau) . .	1	3	
Emmingenkrsoltau (16 characters) (transmitted in the address Emmingen/Kr/Soltau)	1	2	

130. SWITZERLAND

Add, Page 27			Clarification necessary. These numbers can be written in figures, so naturally when they are written out in full, combination in one word must be allowed in accordance with 123.
deux pourcent		2	
deuxpourcent		1	
twopercent		1	
duepermille		1	

131. SWITZERLAND

Under the example 54-58, *add* the following new examples :			See proposal 67 for 123.
francfrançais		1	
Deutschemark		1	
Under the example fr. 10,50, *add* the following new examples :			See proposal 67 for 123.
Usdollars		1	
Egyptianpound		1	

Proposals	Reasons
Under the example £ 10, *add* the following new example : £10 (transit L10) (irregular combination) 2	To avoid any misunderstanding.
Under the example 11 h. 30, *add* the following new example : 11h30 (for 11 heures 30) (irregular combination) 3	To avoid any misunderstanding.

132. SWITZERLAND

Page 28, under the example 15 x 6, *delete* the footnote [1]. *Replace* the example 15x6 by the following : 15X6 (without spaces) (transmitted 15x6) 1 At the foot of the page *delete* notes [1] and [2].	The present examples and corresponding notes are liable to cause confusion by giving the impression that it is not permissible to join groups indicating dimensions. In the counting of words the governing factor must be the manner in which the groups are written by the sender, with or without spaces, and not their meaning (see 139).

133. SWITZERLAND

Add, Page 28	
35702B(3) (commercial mark) (9 characters) 2	See proposal 24.
AF176 (designation of an airline flight) 1	See proposal 67.

134. SWITZERLAND

(no text of proposal)	*Note :* The Swiss Administration considers that a regulation should be formulated in order to provide for a method of charging abbreviations such as RELET, YCAB, REURTEL, VOTEL, REMYTEL, YC385, etc., which are becoming more and more common. Some Administrations and Recognized Private Operating Agencies have come to authorize them, considering them as secret language, in accordance with No. 50 of the Telegrath Regulations. They accept them in full-rate telegrams and in letter-telegrams ; however, they count them as one word up to 5 letters or 5 figures in full-rate telegrams, while in letter-telegrams they count for as many words as they would have been if they had be n written in full plain words. This procedure appears to be somewhat irregular, for it seems that if these expressions are accepted on the basis of a provision governing secret language, then they should not be allowed in letter-telegrams (see No. 752 of the Telegraph Regulations). Moreover, the method of charging described above always gives rise to disputes with the senders. The question therefore arises, in view of the regular use nowadays of expressions of this type whether it might not be desirable to consider them as current abbreviations and to amplify Article 10 (plain language) of the Telegraph Regulations in this sense.

Proposals | Reasons

135. CABLE AND WIRELESS

Insert :

BF (8) (commercial mark) (5 characters) 1
21070A (1) (commercial mark) (9 characters) 2

136. ITALCABLE

Page 28, *replace*

15 x 6 (transmitted 15 x 6) 1) 3
15x6 (without spaces) 2) 1

by :

15 x 6 or 15x6 (without spaces) (where the sign x indicates multiplication or a dimension) 1

Consequently delete Notes [1] and [2] at the foot of the page.

Insert :

Etoile du Nord (railway train) 3
Etoiledunord 1
(2) (3 characters) 1
(1956) (6 characters) 2
10 (4-5) (7 characters) 2
45 : 22 (5 characters) 1
(.) (3 characters) 1
(A) (one letter and one parenthesis) . . . 2
M.1) (initial of a Christian name) 2
Ing. (for engineer) (transmitted Ing) . . . 1
Metalfabrik (abbreviated address) 1
UIT (name of an organ) 1
U.I.T. (transmitted U I T) 3
U.I.T. (1) 6
W/14 or W14 (designation of a ship) . . . 1
" 900 " (designation of merchandise) (5 characters) 1

FEDERAL GERMAN REPUBLIC

Document S.G. X/65-E
14 May, 1956

General proposals on the counting of words

Note by the Specialized Secretariat of the C.C.I.T.

When Administrations' detailed proposals for modifications in those provisions of the Telegraph Regulations which deal with the counting of words were submitted to Study Group X, proposals of a general nature were made by the Federal German Republic. The Specialized Secretariat of the C.C.I.T. thought it preferable to distribute these general proposals in a document distinct from Document S.G. X/64, which refers to the detailed proposals submitted by Administrations.

* * *

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[1] The charging clerk shall underline with a short dash the sign or signs (§ 5 e) of Article 18) whose transmission is requested, to draw it to the attention of the transmitting clerk.

Contribution made by the Federal German Republic to the work of C.C.I.T. Study Group X

Subject : *Question 63* (1953/1956)

Examination of the questions relating to rates and the counting of words contained in Documents 93, 102, 103 and 112 of the VIIth Plenary Assembly.

Reply

It is assumed that the problems involved in the counting of words, particularly as regards foreign-language telegrams, are well known. They were adequately dealt with in the article entitled " Counting of words in international telegrams " which was published in the Telecommunication Journal, 1952, No. 6. It should therefore be considered :

1. whether the existing provisions regarding the counting of words should be retained or simplified, or
2. whether these provisions should be fundamentally changed.

The Federal German Administration ventures to submit the following proposals and views :

Concerning 1

(The detailed proposals made by the Federal German Republic in connection with the first of the alternatives listed above are embodied in Document S.G. X/64).

Concerning 2

The word-count procedure hitherto used means that the counter clerk has to ponder over the sense or importance of a word. This, of course, leads to arguments about the counting of composite words. Such a procedure, too, does not make allowance for the work actually done in transmitting a word. A word of one character pays the same amount as a word of fifteen. Hence we need a new procedure for the counting of words—one that will enable the counter clerk to follow mechanical rules. He must no longer be required to reflect on the meaning of words. The following principles would seem to be required.

a) The sender should be authorized to compose words at will. He should be able to use any abbreviations he likes, and is responsible for the legibility of his text.

b) There should be no secret language.

c) The same rules should be applicable to full-rate telegrams and to letter-telegrams.

d) The length of a word charged for would be determined by detailed research. Isolated figures and characters, and mixtures of letters, figures and signs should count for up to five characters, plus one supplementary chargeable word for any excess.

e) Punctuation marks, which would be limited to the full stop, comma, colon and question mark, should be transmitted free of charge. All other signs would be counted as figures.

We are fully aware that such a radical revision would be of far-reaching importance. We are conscious, too, that various additions should be made to the principles succinctly set forth here.

Hence the aim of this paper is to indicate a way whereby, by the application of certain rules, words could be readily counted. We should try to arrange for the counting of words faithfully to reflect the telegraph services actually rendered.

In future, the number of characters included in the chargeable word might be chosen in such a fashion that loss of income would be to a great extent avoided.

COSTS

(C.C.I.T.T. Question 26/21)

STUDY GROUP X

Document S.G. X/72-E
20 November 1956

Report from the working party set up to study the costs involved in the handling of telegrams in the European system

1. The questionnaire drawn up by the Working Party of Study Group X was sent to the Administrations of the European system. From among some thirty Administrations, eleven replies have been received, which may be regarded as a satisfactory proportion.

2. After examining these replies, the Working Party agreed to adopt the various elements which have been entered in the Questionnaire (Annex 1) as a basis for its calculations. During the discussions, it was made clear that the costs of computing the charges for telegrams accepted by telephone or Telex were included in the figure inserted against paragraphs *b)* and *c)* of the first part of the Questionnaire. It was also pointed out that in the second part dealing with the delivery of telegrams an item *c bis)* should be added in respect of operations at the receiving telegraph centre, analogous to item *d)* in the first part.

A. Calculations of the cost of an outgoing telegram: first part of the questionnaire

Fixed amount

Telegrams handed in at the counter:

a) 1) ..... 55 gold centimes;
2) ..... 20 gold centimes.

Telegrams accepted by telephone:

b) ..... 90 gold centimes.

Telegrams accepted by Telex:

c) ..... 70 gold centimes.

Average cost of acceptance operations:

25 % at 75 c.	=	1875
60 % at 90 c.	=	5400
15 % at 70 c.	=	1050
Per hundred telegrams		8325
Per telegram.....		83.25
plus		
d)		12
		95.25 gold centimes.

Variable amount

To determine circuit costs, consideration was given to the findings contained in the report prepared by the Working Party of Study Group XI entrusted with the establishment of the costs of an international telegraph circuit (see Document A.P. VIII/17, page 64).

It may be useful to recall that these costs are as follows:

One end of a voice-frequency channel ..... 1500 gold francs per year.

Per hundred km of circuit ..... 900 gold francs per year.

According to these figures, the cost of an international circuit 300 km long (average length accepted by the Working Party) amounts to 4,200 gold francs.

Assuming that such a circuit can handle 5000 words per day for 300 days, the circuit-share in the transmission (or reception) of one word is $\frac{4200}{5000 \times 300}$ = *0.28 gold centimes.*

For the cost of transmission, allowance was made for the fact that a telegram from a place other than the town in which the international telegraph office is situated gives rise, within the country considered, to a double operation (transmission - reception). It was not thought necessary to consider a circuit-share for transmission over the internal network, as the coefficient 1.3 adopted for the average number of transmissions over this network (item 3.b), 4) of the Questionnaire) seems adequate to cover both handling and circuit costs.

Taking into account the standards found for items 3, a), 1), 2) and 3, b) 3) - 3, b), 4), the cost of transmitting one word is

60 % at 2 centimes
40 % at 4 centimes × 1.3

i.e., *3.28 gold centimes.*

The total cost of transmitting (or receiving) one word is thus

0.28
3.28
3.56 gold centimes per word.

As an indication, the cost of a telegram of 15 words (average length of an ordinary telegram) is thus:

1. Fixed amount	0.9525	gold francs
2. Variable amount, 3.56 × 15	0.534	,, ,,
Total	1.4865	gold francs

to which should be added 10 % overheads, which brings the cost up to *1.63 gold francs* in round figures.

B. Calculation of costs for the delivery of telegrams
Second part of the questionnaire

Fixed amount

Delivery by messenger:

a) 1) ..... 80 gold centimes
2) ..... 20 gold centimes
Total ... 100 gold centimes

Delivery by telephone:

b) ..... 90 gold centimes.

Delivery by Telex :

c) ..... 60 gold centimes.

Average cost of delivery operations :

60 % at 100 c.	=	6000
20 % at 90 c.	=	1800
20 % at 60 c.	=	1200
Per hundred telegrams		9000

Per telegram..... 90 gold centimes.

Plus

c) bis ..... 10 gold centimes

Total ..... 100 gold centimes.

Variable amount

This is established as for outgoing telegrams (see above). As an indication, the cost of a telegram routed over a circuit 300 km long is 1 gold franc plus 0.534, that is, 1.534 plus 10 % overheads = *1.68 gold francs* in round figures.

C. Average cost of transit operations

Considering the elements available, the Working Party thought fit to establish the cost per word of a transit telegram.

Three cases were examined.

1. Direct transmission without V.F. repeaters in the intermediate country.
2. Direct transmission with V.F. repeaters in the intermediate country.
3. Transit with retransmission in the intermediate country.

In all three cases allowance was made for a circuit with an average load of 5000 words per day during 300 days.

First case

On the basis of 900 gold francs per 100 km per year, the cost of one word in transit amounts to 0.06 gold centimes per 100 km.

Second case

Fixed amount applicable to the two V.F. equipments of the intermediate country (1,500 gold francs per equipment per year) :

Per word ..... 0.20 gold centimes.

Variable amount, as above :

0.06 gold centimes per 100 km.

Third case

It is recalled that the transmission (or reception) of one word was estimated at 2 gold centimes. The cost of one word in this case is thus

$$(2 + 2)\,1.1 + 0.2 + 0.06\frac{\text{km}}{100}$$

the figure 1.1 being adopted to make allowance for the 10 % increase for overheads. This increase does not apply to the two other elements, as the Working Party of Study Group XI had already included it in its figures.

* * *

At the request of some members of the Working Party, Annexes 2 and 3 reproduce the figures involved in the variable amounts for outgoing, incoming or transit telegrams for various lengths of international circuits.

Annex 1

QUESTIONNAIRE (ANNEXED TO C.C.I.T. CIRCULAR No. 3/56) ON THE COST OF THE VARIOUS OPERATIONS INVOLVED IN THE HANDLING OF INTERNATIONAL TELEGRAMS (EUROPEAN SYSTEM) COMPLETED BY THE FIGURES ADOPTED BY THE WORKING PARTY

Note : The costs are espressed in centimes of the gold franc.

FIRST PART

ACCEPTANCE OF TELEGRAMS

Note : Expenses involved in the acceptance of telegrams are indicated *per telegram* irrespective of the number of words or category.

a) *Handing-in at the counter of a telegraph office*

1) expenses in connections with the acceptance of the telegram, counting of words, recording, collection of charges 55

2) expenses in connection with the transport of the telegram from the handing-in office to the telegraph office (this transport may be by messenger, pneumatic tube, telephone, telegraph, etc.) 20

b) *Acceptance by telephone*

Expenses in connection with the reception of an outgoing telegram telephoned by a user 90

c) *Acceptance by Telex*

Expenses in connection with the reception of an outgoing telegram 70

d) *Miscellaneous Information*

Expenses in connection with operations preliminary to the transmission at the station serving the international telegraph circuit (including internal transport—by messenger, etc., supervision of the routing of telegrams, etc.) 12

% of telegrams accepted

— at the counter	25
— by telephone	60
— by Telex	15
Total	100

SECOND PART

DELIVERY OF TELEGRAMS

Notes : Delivery costs are not included in the case of letter-telegrams delivered by post.
Costs of transcription onto an ornamental form in the case of de luxe telegrams are not included.
Expenses are expressed *per telegram*, irrespective of the number of words or the category.

a) *Delivery by messenger :*

1) Calculation of the cost of delivering a telegram by telegraph messenger 80

2) Cost of transporting the telegram from the receiving telegraph office to the telegraph office responsible for sending the messenger (by pneumatic tube, cyclist, telephone, etc.) 20

b) *Telephoning the incoming telegram*

Estimated cost 90

c) *Transmission to the addressee by Telex*

Estimated cost 60

c) bis *Operations at the incoming telegraph office*

Estimated cost 10

d) *Miscellaneous information :*

% of telegrams delivered

— by messenger	60
— by telephone	20
— by Telex	20
Total	100

THIRD PART

EXPENSES IN CONNECTION WITH TRANSMISSION (OR RECEPTION)

Expenses in connection with the transmission or reception of telegrams are indicated in gold centimes per telegraph *word*.

a) *Transmission or reception costs :*

1) Estimated cost per word for transmission or reception of a telegram at a station operating an international telegraph circuit 2
(Expenses internal to the international telegraph office, excluding circuit expenses).

2) Estimated cost per word for transmission or reception on the internal network 2

b) *Miscellaneous information*

1) Average length of international telegraph circuit sections in your country (round figures) . . . . . 300 km

2) Estimate the average load (in number of words and per day) of an international telegraph circuit (or channel) : . . . . . 5000 words

3) In international outgoing or incoming traffic, what is the percentage of telegrams to or from the town in which the international telegraph office is situated (traffic giving rise to no retransmission in the internal network)? . . . . . 60 %

4) Estimate the average number of transmissions required to pass telegraph traffic in your country's network ? 1.3

5) what is the average length of telegrams of the European system ?

— ordinary telegrams . . . . . 15 words
— ELT letter-telegrams . . . . . 30 words

FOURTH PART

OVERHEADS

By what percentage should the figures for operating cost, indicated in the questionnaire, be increased to cover overheads? . . . . . 10 %

Annex 2

COST PER WORD OF AN INCOMING OR OUTGOING INTERNATIONAL TELEGRAM— VARIABLE AMOUNT—FOR DIFFERENT CIRCUIT LENGTHS

Length of circuit 1	Cost of circuit 2	Circuit share in transmission of one word 3	Cost of transmission 4	Total cost per word (3 + 4) 5
300 km	4,200 gold francs	0.28 gold centimes	3.28 gold centimes	3.56 gold centimes
400 »	5,100 »	0.34 »	3.28 »	3.62 »
500 »	6,000 »	0.40 »	3.28 »	3.68 »
600 »	6,900 »	0.46 »	3.28 »	3.74 »
700 »	7,800 »	0.52 »	3.28 »	3.80 »
800 »	8,700 »	0.58 »	3.28 »	3.86 »
900 »	9,600 »	0.64 »	3.28 »	3.92 »
1000 »	10,500 »	0.70 »	3.28 »	3.98 »

Annex 3

TABLE SHOWING COSTS FOR TRANSIT PER WORD ACCORDING TO TECHNIQUE USED AND IN RELATION TO CIRCUIT LENGTH

Circuit length	Direct transmission	Transmission using VF repeaters			Transit by retransmission			
		Fixed amount for repeaters	Line costs	Total	Fixed amount for repeaters	Line costs	Operator costs	Total
1	2	3	4	5	6	7	8	9
km	gold cent.	gold cent.	gold cent.	gold cent.	gold cent.	gold cent.	gold cent.	gold cent.
100	0.06	0.2	0.06	0.26	0.2	0.06	4.4	4.66
200	0.12	0.2	0.12	0.32	0.2	0.12	4.4	4.72
300	0.18	0.2	0.18	0.38	0.2	0.18	4.4	4.78
400	0.24	0.2	0.24	0.44	0.2	0.24	4.4	4.84
500	0.30	0.2	0.30	0.5	0.2	0.30	4.4	4.90
600	0.36	0.2	0.36	0.56	0.2	0.36	4.4	4.96
700	0.42	0.2	0.42	0.62	0.2	0.42	4.4	5.02
800	0.48	0.2	0.48	0.68	0.2	0.48	4.4	5.08

TRANSIT CHARGES

(C.C.I.T. Question 64 — C.C.I.T.T. Question 26/21)

NETHERLANDS

Extract from Document S.G. X/27
1 December 1954

Comments on question 64

Question 64

In an earlier phase of the studies, the Netherlands Administration submitted detailed comments on the subject of Question 64. In this connection it draws attention to pages 695-698, 700-702 and 704-705 of Volume II of the Supplements to the documents of the VIIth Plenary Assembly at Arnhem. Furthermore, the Netherlands Administration wishes to state that it is in agreement with the views expressed in the article on pages 42-47 of the Telecommunication Journal for March 1954.

It is obvious that the development of telegraphy for subscribers in the European network makes it necessary to reconsider the general structure of telegraphy in that system, for during the last twenty years there has been a radical change in circumstances. The quick and cheap Telex service has come into competition with, for example, the public telegraph service, and this has meant the introduction of regulations for transit traffic, the charges for which are based on totally different principles than the word-count system. On the basis of those regulations, transit lines are readily made available for the passing of Telex traffic, even in cases where, due to the small volume of traffic, the revenue is very small.

For transit lines allotted to circuits rented by private users, charges are worked out on the basis of 80 Telex units per day.

Lines are established " en masse " as compared with an earlier period, and the extensive network of lines crosses the transit countries " en bloc ".

In the sphere of public telegraph traffic there is nowadays little transit traffic " by wire " —as a result of the establishment of a number of radiotelegraph circuits—and where this transit traffic still exists, we find that transit charges based on the word-count are exorbitant.

Radio stations demand that their users or sister Administrations pay charges based on an imaginary passage across countries, and generally speaking it is these charges which are in fact the object of radio communications.

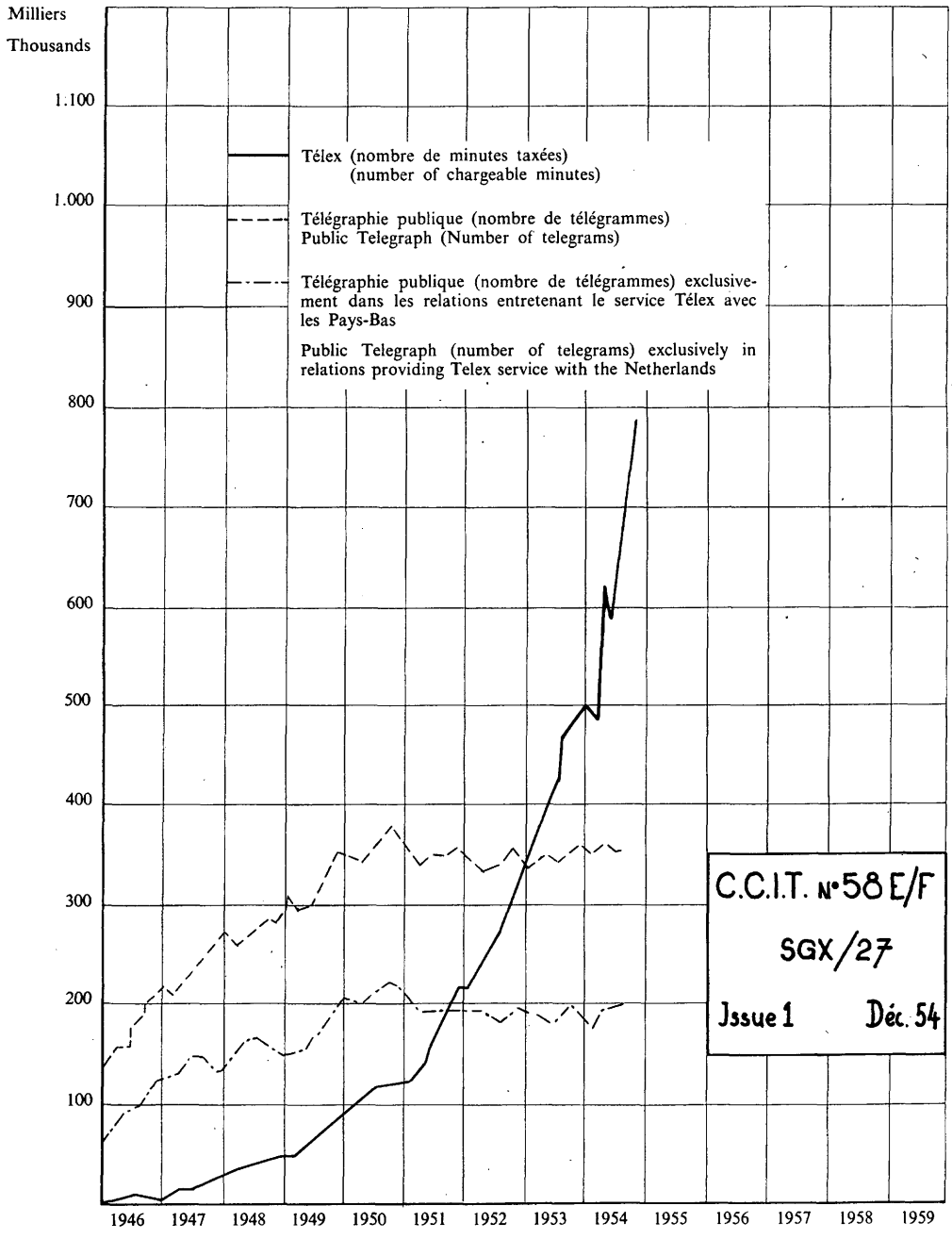
Moreover, in the public telegraph service special cables are used—for which cable charges per word are required—whereas in the same relations there is an abundance of Telex circuits which follow a different itinerary and pass through transit countries which would be quite prepared to accept telegraph traffic at a lower tariff based either on the word-count, or the time taken, or on a contractual basis.

For these reasons, the tariffs for telegrams between non-adjacent countries are often too high.

The transit charges per word also hamper the development of a switched network for the public telegraph service—a system which would undoubtedly provide a quicker service at a lower operational cost.

GRAPHIQUE COMPARATIF DU TRAFIC INTERNATIONAL, PAR MOIS, DE LA TÉLÉGRAPHIE PUBLIQUE ET DU TÉLEX DES PAYS-BAS

NETHERLANDS PUBLIC TELEGRAPH AND TELEX COMPARATIVE TABLE OF THE INTERNATIONAL TRAFFIC, PER MONTH



Thus it is essential to have a tariff on a time basis, with a ceiling charge for direct permanent circuits equivalent to the rental charged to private users.

Needless to say such a tariff system would operate to the disadvantage of those who are at present levying high charges for transit by radio or cable, but technical progress will inevitably cause repercussions in that sphere.

The Telegraph Regulations only fix the maximum transit charges. In the circumstances. individual arrangements between the parties concerned are possible.

Several Administrations represented in Study Group X have little or no experience of the Telex service.

It would therefore seem advisable to give an outline here of the development of Telex traffic as compared with public telegraph traffic in the Netherlands.

Graph No. 58 annexed hereto shows that at the present time 4 minutes of Telex traffic are registered for each telegram exchanged with countries to which the Netherlands are linked by the Telex service.

A telegram in the European system contains, on an average, 17 words. Assuming that generally speaking a subscriber transmits 25 words per minute (many subscribers lose time while waiting for the acknowledgment of receipt), the public telegraph service comprises only 1/7th of the total traffic. This fraction is tending to decrease rapidly as a result of the striking increase in the volume of Telex traffic.

In considering the proportional numbers in the telegraph service, it is also necessary to bear in mind the enormous amount of traffic passing over leased circuits, which probably even exceeds the volume of Telex traffic.

In Europe similar ratios will not be rare, and in the circumstances the public telegraph service is already far from occupying the first place in the various means of telecommunication in written form.

PREPARATION OF TELEGRAPH ACCOUNTS

(C.C.I.T. Question 66)

NETHERLANDS

Extracts from Document S.G. X/27-E
1 December 1954

Preparation of telegraph accounts

1. In the relations with the Netherlands Administration, the accounts for international telegraph traffic are prepared by the receiving countries, all Administrations also assembling the data concerning their outgoing traffic with a view to checking the accounts coming from other countries.

2. This procedure is in conformity with the International Telegraph Regulations (Article 91). However, these provisions are optional, and the Netherlands Administration has come to the conclusion—see also Question 66, C.C.I.T., Arnhem 1953—that it would be better to apply another method ,whereby the country of origin prepares the account.

3. The recording of data concerning incoming traffic involves a lot of work. If it is done by means of records or counterfoils, a large staff is required to fill them in and check them. If duplicators are used, special machines and operators are necessary. There are disadvantages in all the methods so far known.

Very frequently they cause delays in the handling of telegrams, and even though the greatest care is exercised in the preparation of the accounts, errors frequently occur in them which do not become apparent until they are checked in the country of origin.

4. It is true that in many relations, to simplify the accounts, an agreement has been reached not to exchange complete accounts any longer but merely to exchange, by telegraph, the figures showing the totals, but this system does not in any way minimize the disadvantages referred to in the previous paragraph.

5. On the other hand, things would be simplified if the countries of origin prepared the accounts, for those countries have the original telegraph forms, which can be sorted out efficiently, and the accounts can thus be prepared more simply and more accurately than on the basis of data on incoming traffic.

6. In this connection I would refer to the procedure that has already been in force for a number of years in the international Telex service. In most cases the subscriber is automatically selected at the outgoing International Telex Position, without any question of intermediary or registration in the country of destination. Accordingly, in the case of manual operation, the incoming Telex positions do not generally keep records, but rely on the accuracy of the data of the country of origin.

7. Thus the accounts work has been reduced to a very desirable minimum in the international Telex service.

8. For this reason I would suggest—as an experiment—that you adopt the same procedure for public telegraph traffic with the Netherlands and leave it to the incoming office to decide to what extent it still thinks it desirable to assemble data as a check.

9. Then the accounts should contain some data which would enable the incoming office to keep a check (the total number of telegrams involved), and some statistical details.

Enclosed you will find a specimen account of the type I suggest.

10. It is not my intention to institute a procedure exactly similar to that used for telephony and Telex, where the country of origin also prepares accounts for the transit countries, and I should prefer not to have a system which meant the preparation of a greater number of accounts than are required under the present system.

11. I would also point out that such a method would be easily adaptable to a switched service system, within the framework of which a large number of offices would take part in international traffic.

Administration (or Recognized Private Operating Agency) of country "A"

ACCOUNT FOR TELEGRAMS SENT BY COUNTRY "A" TO COUNTRY "B"

During the month 195

Country		Category	Number of		Equivalent to ordinary words	Credit to transit countries						Credit to "B"		Accessory charges
						"C"		"D"		"E"				
of origin	of destination		telegrams	words		Share per ordin. word	Total	Share per ordin. word	Total	Share per ordin. word	Total	Share per ordin. word	Total	
A	B	Ordinary												
		Urgent												
		(E)LT(F)												
		Press												
		Pr.-Urg.												
		TC												
A	P													
A	Q													
	etc.													
F	B													
G	B													
etc.														
F	P													
G	P													
etc.														
F	Q													
G	Q													
	etc.													

Totals .....

No. of service telegrams (including "conference") . . . . . .

Service advices . . . . . .

Chargeable service advices (ST and RST)

Total of telegrams transmitted . . . . .

Accessory charges :

Total credit to "B" :

12. I should be obliged if you would give me your opinion. As far as the Netherlands Service is concerned, the new system could be introduced at short notice. If you are in agreement, would you kindly suggest a date for the introduction of the system.

Director-in-Chief
of Telegraphs and Telephones.

Annex 2

Payment to transit countries in case of diversion of a V.F. system

In case of diversion of a V.F. system from its normal route to another route, the payment to the Administrations concerned should be based on the following :

1. The durations of the diversions during a whole month (Sundays excepted) are added together, each diversion being reckoned in minutes. The total number of minutes, after agreement between the Administrations at the two ends of the diverted V.F. system, is divided by 60 (any residue being disregarded), giving as a result the number of full hours during the relevant month.

2. A division by 24 gives the number of full days for which payment should be made. If the remainder exceeds 11 hours, it is counted as a whole day ; if it is 11 or less, it is disregarded. If the total number of hours is less than 24 hours, the same procedure is followed (11 hours or less to be disregarded).

3. The number of days thus obtained is expressed as a percentage of a whole month of 25 days hereinafter called (A %). It is agreed that A % of the month's traffic shall be considered as having passed while the system was diverted to the abnormal route.

4. Where working channels in a diverted V.F. system extend beyond the countries at the ends of the system, each of the two Administrations concerned is responsible for notifying the above-mentioned (A %) to those terminal Administrations of the extended channels lying beyond its territory. In cases where only a section of the V.F. system is diverted, the Administrations which effectuate the diversion inform the Administrations at the two ends of the V.F. system.

5. The V.F. system channels are used :

a) for public correspondence (telegrams),

b) for Telex communications,

c) for leased wires.

ad a) With regard to public correspondence the Administration which establishes the monthly accounts (the creditor Administration) will in the first place consider all telegrams as exchanged via the normal route.

When a diversion has occurred, the total number of words according to categories is converted into chargeable equated words, and A % of this total is considered as having been exchanged via the diverted route.

The Administration responsible for preparing the accounts shall make separate entries in respect of A % of the total traffic.

When the accounts are established in accordance with § 901 of the International Telegraph Regulations, the Administration to whom the normal transit rate accrues shall pay the new transit Administration(s) its/their notified quotas, where applicable, or the transit share at disposal divided in proportion to their notified quotas for A % of the total traffic, the balance of the total traffic (100 minus A %) being accounted for via the normal route.

When the accounts are established in accordance with § 902 of the International Telegraph Regulations, the Administration responsible for preparing the accounts shall send sufficient extra copies of the accounts to the Administration of acceptance to enable the latter to forward one copy to each of the new transit Administrations.

In a case where no transit share is available between limitrophe countries, the payment of a possible transit share in case of diversion shall be subject to special arrangement.

ad b) In the monthly Telex accounts the total traffic is divided into two portions, one of which (100 % minus A %) exchanged by the normal route is accounted for at normal quotas, and the other (A %) is accounted for at quotas appropriate to the diversion route.

ad c) The rental for each monthly or quarterly period will be paid by the lessee in the normal way, as if no diversion had taken place. If no special arrangement has been made between the Administrations concerned, the Administration(s) which according to the agreement in force for the leased circuit in question, collect(s) the transit amount relating to the V.F. system parcours from the lessee(s) shall, in case of diversion of the V.F. system, distribute the said amount to the Administration(s) on the normal route (100 % minus A %) and to the new Administration(s) (A %) for each month of the quarter in question.

6. The monthly telegrams relating to diversions might be worded as follows:

" Gentel to Gentel ..... During the month of ..... the V.F. system ..... has been diverted via ..... during ..... days equivalent to ..... percent of a whole month."

or

" Gentel to Gentel ..... During the month of ..... no diversions of the V.F. system ..... took place."

These advices should reach terminal Administrations not later than the fifth day of the following month.

DUPLEX OPERATION IN THE TELEX SERVICE

(C.C.I.T. Question 68 — C.C.I.T.T. Question 19/21)

FRANCE

Extracts from Document S.G. XI/16-E
21 June 1954

Comments by the French rapporteurs on the questions studied by Study Group XI

Question 68

Point 1 — Are there any grounds for introducing, in the international system, duplex working between Telex subscribers? If so, what would the terminal and transit charges be?

The French rapporteurs assume that the first part of this question is intended merely to admit duplex operation in principle and not to make it systematically compulsory. Paragraph *a)* under "considering" in Recommendation H.3 (Arnhem documents) recognizes that the introduction of duplex operation in the international Telex service may be of interest and paragraph 1 of the operative part of the same Recommendation defines the basic condition governing the introduction of this facility and leaves Administrations and Private Operating Agencies quite free to decide whether such a step is advisable or not.

The French Administration has not yet officially authorized its Telex subscribers to operate in duplex but it would not object in principle to the granting of this facility, if enough subscribers ask for it. The parts of Recommendation H.3 quoted above seem to meet the present position as regards technique and are sufficiently explicit.

The second part of point I really concerns the possible application of special rates and has already been thoroughly discussed at the Geneva and Arnhem Assemblies. In view of the difficulties that would arise from the application of special rates for duplex international Telex calls, the delegates adopted paragraph 3 of Recommendation H.3. It is true that paragraph 4 of the same Recommendation contains a serious amendment to the principle of equal rates for simplex and duplex communication, but the object of this amendment is to satisfy Administrations that were not too enthusiastic about equal rates and it clearly states that any question of surcharge is a matter to be dealt with at the national level, to avoid any interference with the regulations governing international Telex operation. There should thus be no need to go into this matter further.

Both the above questions relating to point 1 are answered in practice by Recommendation H.3 and they should be deleted from the list of questions for study by Study Group XI.

Point 2 — In the event of there being no regular exchange of answer-back codes, how would the start of the timing be determined?

This question has the drawback of considering only the timing aspect. If the international operator controlling the communication cannot, after selection, operate the answer-back unit

of the called subscriber, it is difficult to see how she can follow the operating procedure laid down in Article 25 of Recommendation H.1, especially in paragraphs 1 *c)*, 2 *e)* and 3 *h)*.

As far as timing is concerned, the original object of this question was to provide a method of finding out from what moment a special duplex charge should be applied. Even if the subscriber's equipment is designed for normal answer-back operation, it is not at all clear that the special charge should be applied immediately on establishment of the communication.

Arnhem Recommendation H.3 provides two negative solutions of this difficulty : in paragraph 1, it advocates the maintenance of the normal answer-back procedure after selection and in paragraph 3, amended by paragraph 4, it eliminates the signalling difficulties which would be the inevitable outcome of special duplex rates in international Telex communication.

This second point should therefore also be deleted from the list of questions for study.

Point 3 — What special monitoring devices are to be introduced in international Telex positions?

In the view of the French rapporteurs, no special devices should be provided so long as international Telex operators are not asked to choose between two separate metering methods.

Theoretically, the only difficulty that might arise from duplex operation is how to engage a monitoring on an established communication. This should obviously be effected by inserting the service teleprinter in one transmission direction only and not in both together, as is generally done. Most international Telex positions probably have equipment providing this separate monitoring facility, because of the answer-back operation necessitated for purposes of selection. All the Telex positions of the French network are thus equipped.

Point 4 — Should the use of a special teleprinter be made obligatory for the supervision of transmissions among subscribers and how will subscribers having duplex facilities at their disposal be denoted?

This question may seem to be settled by paragraph 2 of Recommendation H.3 which formally lays down that subscribers participating in the duplex Telex service should be equipped with two teleprinters.

The undersigned rapporteurs think that such an obligation is excessive and ask for this paragraph of Recommendation H.3 to be deleted or at least seriously amended. Generally speaking, it will be difficult to impose this condition whenever the subscriber states that a single teleprinter will satisfy his requirements, if his staff take certain operational precautions. Two examples will illustrate this :

A) When the subscriber's teleprinter is an apparatus with electric local recording, it is always possible to separate the emission components from the reception components. It could be objected that it is no easy matter, without local record, correctly to transmit a message intended for reception on a page-printing apparatus. This problem is quite adequately solved by the addition of a signals counter on the keyboard which, incidentally, could omit signals not causing the carriage to move forward (inversions and line feed).

B) Duplex operation is of great interest when the two correspondents have each previously prepared their messages on perforated tape. Such preparation makes it possible not only to correct typing errors but also to effect a preliminary check of the text (corrected or not) on available

apparatus. The local record of the message actually transmitted on the line will then be of subsidiary interest and the usefulness of a second teleprinter in the installation of such subscriber is debatable.

As a contribution to the work of S.G. XI, we have annexed to these comments diagrams of installations corresponding to cases A and B above. The diagrams also constitute a reply to Question 68, point 5, which will be explained below (see diagrams C.C.I.T. 41 and C.C.I.T. 42).

An argument which had greatly impressed the members of the Study Group when paragraph 2 of Recommendation H.3 was being adopted, is the following :

In case of query, it must be possible to compare the received text with the local copy. Example B above shows that even if the subscriber has two machines, there will be nothing to distinguish between a local copy printed at transmission on the line and a text obtained by a purely local transmission. Thus, if paragraph 2 were dropped, there would be no additional complication entailed for the services investigating subscriber's complaints, since this drawback is already present in simplex installations equipped with automatic transmitters.

In short, it would be desirable to leave each Administration or Recognized Private Operating Agency free to decide whether it is necessary to have a second teleprinter for a local recording in installations providing duplex possibilities.

Point 5 — Is it desirable to use apparatus of such a type that the equipment of each subscriber who has duplex facilities at his disposal will be found, on a call being made, in the simplex condition, so as to obviate the possibility of the regular answer-back procedure being unavailable?

Paragraph I of Recommendation H.3 gives a formally affirmative answer to this question, which becomes pointless in its present wording. Paragraph 5 of the same Recommendation, however, asks each Administration to advise the Telex Study Group of the technical arrangements and operating methods adopted.

The tests made by the French Administration on duplex operation in the Telex service have so far used only the usual equipment slightly modified. The results of these tests, however, have made it possible to define the equipment which will be used in France for subscribers asking for duplex facilities. The test installations correspond to cases A and B mentioned under point 4 above.

In both cases, the equipment has been designed :

1. To enable the subscriber to switch over from simplex to duplex and vice versa at a moment's notice and as often as he feels it necessary during the call.

This is done by means of a two-position switch, marked " simplex-duplex ", mounted on the subscriber's control unit.

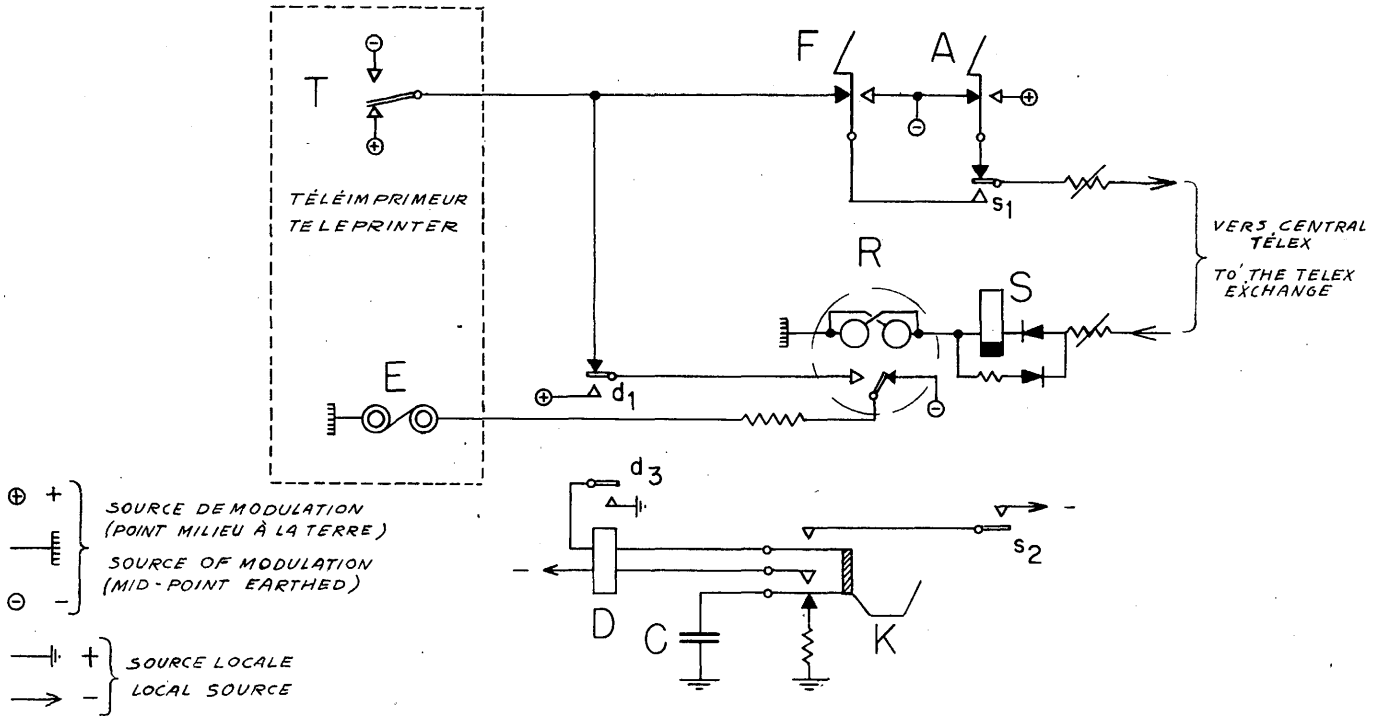
2. To put the apparatus back into the " simplex " position automatically at the end of the call and to keep it in that position until a fresh call occurs, even if the operator has forgotten to switch back to " simplex ".

Case A — (See Diagram C.C.I.T. 41).

The subscriber's installation comprises :

— a teleprinter with electric local recording, double-current working, i.e. with a polarized receiving electro-magnet E and a two-pole transmitter T ;

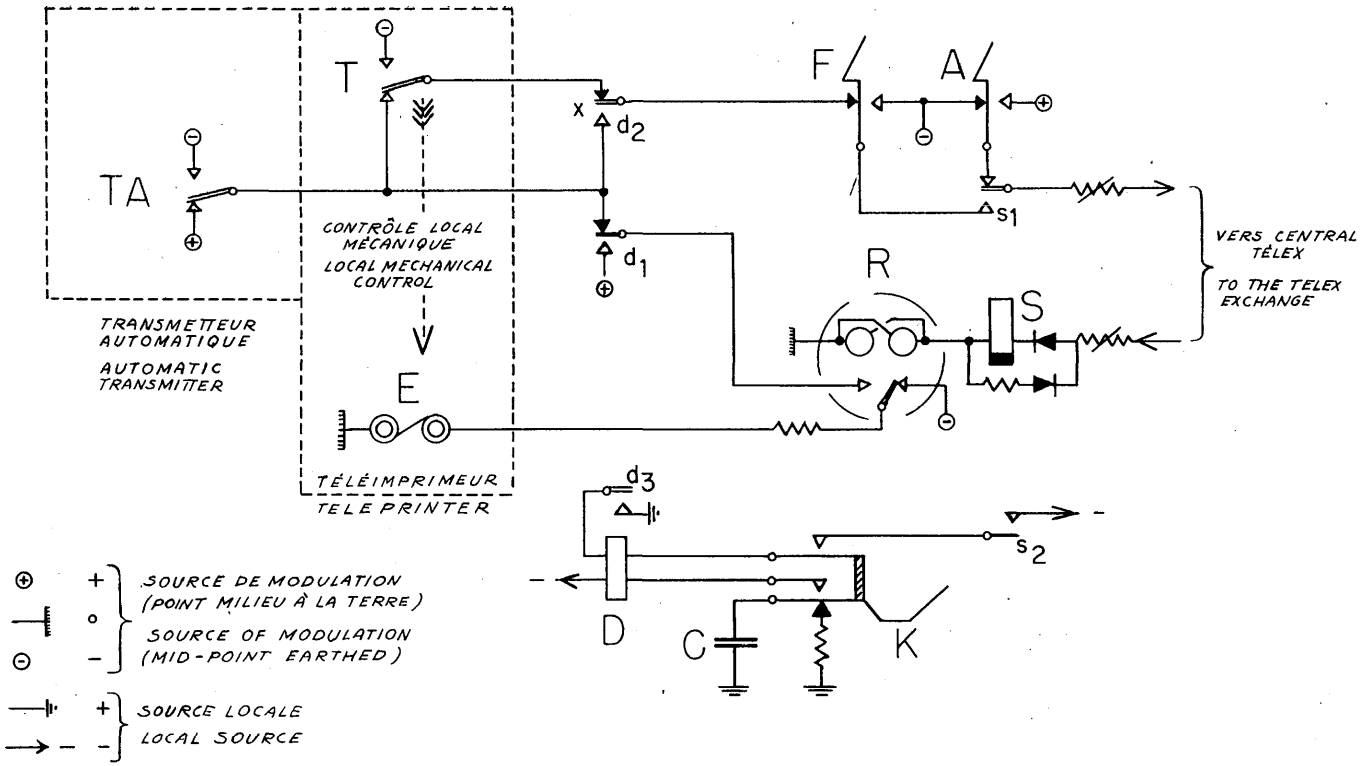
— a supply of telegraph current giving two symmetrical voltages, positive and negative in relation to earth, together with a voltage for the operation of the relays of the control unit ;



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TXI H
(SGXI/16)
ÉDITION 1 JUIN 21,1954
ISSUE JUNE

POSTE TÉLEX DUPLEX AVEC TRANSMISSION MANUELLE
DUPLEX TELEX STATION WITH MANUAL TRANSMISSION

QUESTION 68 C.C.I.T.



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POSTE TÉLEX DUPLEX AVEC TRANSMETTEUR AUTOMATIQUE
DUPLEX TELEX STATION WITH AUTOMATIC TRANSMITTER

QUESTION 68. C.C.I.T

— a control unit chiefly comprising the customary elements :

— call signal button A ;

— clearing signal button F ;

— supervising relay S delayed for discrimination of the clearing signals ;

and completed with the following extra elements :

— a receiving telegraph relay R also providing local recording in simplex working by the well-known series contact method, on the local recording circuit ;

— a " simplex-duplex " switch cutting in or out a condenser C ;

— a duplexing relay D activated by this switch K and including a holding circuit governed simultaneously by a " make " contact of the switch K and a " make " contact of the supervising relay S (or of an auxiliary relay controlled by the latter).

In the simplex position, the modulation emitted by the transmitter T is transmitted on line through the " break " contact of F and the " make " contact S_I. At the same time this modulation is fed to the receiving electro-magnet E through the " break " contact d_I of the duplexing relay and the " mark " contact of the receiving relay.

Turning the switch K discharges the condenser C into the excitation winding of the relay D which will hold through its other winding, that is, until the communication ceases or until the operator has switched back to the normal position. This relay cannot be re-excited unless a double condition is fulfilled—the call must still be taking place (or must be re-established) and the switch K must actually be turned from simplex to duplex.

The local recording connection is broken by the rise of the relay D, and the electro-receiver can then only receive the double-current modulation arriving through the receiving relay R.

To simplify the diagram, the accessories normally employed in the control unit have not been shown (motor-starting contacts, bell signal relay, auxiliary relay, etc.).

Case B (see diagram C.C.I.T. 42) :

The subscriber's equipment comprises :

— a teleprinter double-current working with mechanical local recording between its transmitter T and its receiving electro-magnet E, which is polarized ;

— a double voltage supply similar to that in the previous case ;

— an automatic transmitter TA, double-current working, the transmission contact of which is connected in series with the " marking " contact of the teleprinter transmitter, so as to give normal keyboard operation in the simplex position, without disconnection of the automatic transmitter. This arrangement also ensures sending of the answer-back code by the apparatus, provided that the automatic transmitter is stopped in the " marking " position, which is done in most machines by mechanical means ;

— a control unit similar to that in the previous case. This unit is, in particular, fitted with a receiving relay R which ensures the local recording of automatic transmissions made in the simplex position. It also carries a switch K and a duplexing relay D, operated by a condenser discharge, in exactly the same way as described in A above.

In the " simplex " condition, the signals transmitted by the teleprinter are mechanically recorded. This offers the advantages of printing in two colours, as is generally the case on equipment of this type. The signals are sent on line to the correspondent by the " break " contact d_2, and

by the other customary elements of the unit. The signals emitted by the automatic transmitter are emitted over the same path, from the " marking " contact of the transmitter T of the teleprinter. These signals are also led through the contact d_1 in the " break " position and by the receiving relay stop, so as to be used for an electric local recording.

In the " duplex " condition, the transmitter of the keyboard is made inoperative, and the automatic transmitter is then directly connected to the transmission line by the contact d_2 of the relay D. The local recording deviation is then disconnected by the other contact d_1 of this same relay.

The duplexing relay D is brought into action and put out of action by the switch K, or at the end of a call, in exactly the same way as in the previous case. The arrangement shown in case B offers an additional advantage—there is no mutilation of the signals emitted by the automatic transmitter in the duplex position if, because of an error in transmission committed by the correspondent, the automatic answer-back unit is engaged in this position.

This arrangement, which involves the association of a teleprinter with an automatic transmitter and does not require the use of a second teleprinter, may readily be adapted to the case of a teleprinter with electric local recording, provided that the latter be of the double-current working type.

In the case of teleprinters and automatic transmitters designed for single-current operation, the same operating criteria may be obtained by incorporating a telegraph repeater in the subscriber's equipment with the requisite power supply.

LEASE OF TELEGRAPH CIRCUITS

(C.C.I.T. Question 73 — C.C.I.T.T. Question 35/21)

MR. PERRY, Chairman

Extract of Document S.G. XI/1
10 December 1953

Preliminary report on the question of lease of telegraph circuits

. . . . . .

7. The subject is very important. During the last few years leased telegraph circuits in large numbers have been made available to users. We have been in a position to observe that lessees, with the aid of such circuits that originally were intended simply as means of communication between 2 points, have gradually developed networks to meet their specific needs, networks so extensive that they practically span the globe. We find such networks with press agencies, groups of newspapers, airline companies (either co-operating in this field, or not); industrial undertakings, Civil Aviation and Meteo and other international organizations, etc. The systems in question are often combined with the use of Telex services, public telegraph and telephone services. They also exist operated in combination with service for emissions to multiple destinations, by radio and by wire, and even with private radio networks, such as that of S.I.T.A. By means of all these combinations, traffic has developed to an enormous extent, such as perhaps only a few amongst us considered to be a possibility as little as ten years ago.*

8. It is clear that this important development has its repercussions on public telegraphy and Telex services and it is readily understood that here and there ideas vary as to terms and conditions on which leased circuits can be made available as well as to the matter of the relative rates for leased telegraph circuits.

9. I sincerely hope, however, that our Committee will succeed in finding a simple and uniform solution of the present problems which can be accepted unanimously, or at least with a large majority of votes, and which would at the same time satisfy the important groups of users.

10. In order to draw up a report that covers as far as possible all the aspects of the problem we are going to study and taking into account the fact that on our Committee are represented a number of Administrations and Recognized Private Operating Agencies which participate in the study for the first time and which consequently are not conversant with the discussions of the last few years, I have deemed it wise to preface my considerations with a summary of the history of the regulations appertaining to the field of leased circuits.

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* Interesting in this respect is also the development of a system which in Air-line Companies circles is called " Tel-Air ".

In this system the transport by plane replaces telecommunication for certain sections of a route to be followed by a message where adequate telecommunication means are not available, or where the relevant tariff is considered too high.

Historical survey relative to rates applicable to leased telegraph circuits

11. As early as 1934, the C.C.I.T. considered the matter of prices for leased telegraph circuits on a uniform basis. At the time, proposals were submitted to fix it at the cost of 40 telephone calls of 3 minutes per day between the points in question. In that manner the rate would be a third part of the rate payable for a leased telephone circuit, for which C.C.I.F. fixed a price equivalent to the rate for 120 telephone calls per day.

12. As to the number of 40, agreement was only reached during a subsequent session ; in the meantime, however, the rate applicable to a leased telephone circuit, was in 1936 reduced from 120 to 80 telephone call units per day and thus the price ratio between the lease of telegraph and telephone circuits came to be 1 : 2, which ratio was likewise accepted for Telex and telephone, as regards the 3 minute units.

13. The rate established in this manner was, apart perhaps from a single temporary exception, applied both to simplex traffic and duplex traffic.

14. Even under the very first regulations in this field, it was stipulated that correspondence handled on leased circuits was to relate exclusively to the business of the lessee and that use by third parties was strictly prohibited. This is self-explanatory because, without this stipulation, the way would be clear to establish private telegraph enterprises which would skim the cream off the public telegraph services whenever and wherever a remunerative operation would be possible.

15. However, after the war the problem of use by third parties presented itself in an acute form, when the air-line companies pressed for joint lease of circuits to be allowed.

16. The Brussels meeting (1948) of the C.C.I.T. decided officially to consider the problem of sharing which had thus arisen. The result was that Recommendation 951 on the leasing of telegraph circuits was worded in such a manner that for the first time it included the possibility of making circuits available to several renters ; it was decided, however, that a detailed settlement of the matter would remain for study.

17. The problem was next tackled at the Administrative Conference in Paris in 1949. I would refer to Resolution 9 and point out that there the terms " 40 telephone units " were for the first time replaced by " 80 Telex units " and that in the European system two possibilities of calculating rates for shared use were provided :

a) metering rental, the basis being a minimum rental, equivalent to 100 Telex units per day, 60 % of the additional traffic being payable under the Telex rates ;

b) overall rental, based on the number of users, when the basic price of 80 units was increased by 37.5, 60, 77.5, 90, 95, 97.5, 100, 101 % etc. per user.

18. Point 9 *c* of this Resolution confirms the fact that the same tariff is applicable both to simplex and duplex traffic.

19. Study Group XI thereupon studied the matter further and the conclusion was reached that the two possibilities of calculating sharing-rates, as indicated in Resolution 9, were too greatly divergent and that a simpler settlement, to be uniformly applied, would be preferable. Thus Recommendation 951 in its present form came into being with a rate of 110 Telex units per day for a shared circuit, irrespective of the number of users.

20. The Study Group has not proceeded to establish general rates for circuits that are only required by users during a few hours per day (the so-called part-time lines). The Group was of opinion that in such cases it would be preferable to apply the terms " subscription Telex calls " (Article 14 of the Telex Regulations), when, if calls are of a long duration, the optional clause relative to decrease in rates, as contained in § 3 of art. 33 of the Telex Regulations, can be applied.

The form and the level of rates for telegraph circuits leased to one single user

21. The present rate for the single user on the basis of costs of 80 Telex units per day leads, together with the additional stipulation that the month is counted as 25 days, to a remuneration according to the ratio of 2,000 Telex units per month.

22. As will be seen from the statistics which I had distributed during the C.C.I.T. meeting in Arnhem, such a load does not occur on the circuits in the Telex groups of circuits between the countries that have hitherto introduced Telex facilities. This is moreover readily understandable from the fact that the Telex service has a no-delay character. From this—but especially from the fact that in the case of leased circuits the operation and occupation of switching equipment, which constitute a relatively important part of the cost price in the Telex traffic, do not come into the picture—it follows that for the Administrations the proceeds from a leased circuit, as compared with those of a circuit in normal Telex traffic, are very favourable.

23. It is quite possible that, with ever expanding groups of circuits and especially when in the near future the intervention of position operators in the international Telex traffic, consequent upon steps taken for total automatisation, is dispensed with, a similar load on circuits will be more closely approximated in the Telex traffic. But even then the proceeds of the circuit that yields 2,000 units per month and that does not make use of switching equipment for Telex, can be considered as remunerative. In this connection, it should also be taken into account that nowadays the leased circuits are no more taken from the existing Telex groups, but that at present telegraph circuits in many relations are available in abundance, or can be easily formed at a moderate price.

24. So, if the present rate for a leased telegraph circuit is in various ways favourable to the Administrations, it is nevertheless also favourable for the users, who, according to recent traffic meterings, generally handle a volume of traffic that exceeds the number of 3 minute units quoted.

25. As to the number of 40, a compromise is involved, in which, on the one hand, the users bind themselves under contract with the Administrations concerned to guarantee a fixed and high yield of the circuit and in which, on the other hand, excellent possibilities are given for heavy volume of traffic. It is for this reason, and in particular because the rate is fixed on the overall principle and independent of circuit load, that a development in communication facilities on the present scale has been possible.

26. In this procedure it seems reasonable that, apart from cost price consideration, the Administrations make profits in order to compensate, if only partly, for the large amount of expenditure invested everywhere for the development of new techniques for the Telex service and generally to cover losses incurred on internal and international public telegraph services which are to be maintained at reasonable rates in the interest of the public.

27. Our Study Group will now have to consider two other forms of rates. They relate to re-introduction of a metering rate and a rate in which an effort is made for closer relation to cost prices than at present.

28. The metering rate was extensively discussed by this Group at an earlier date. I would refer you to annex 1 in this connection.

29. An adaptation of the tariff to cost price is now on the C.C.I.T. agenda for the first time.

. . . . . .

33. If the Group should decide at short notice to renounce a metering rate (and this is what I deem probable in view of opinions recently expressed), we shall have first of all to consider the existing rate and at the same time the suggestions made by the United Kingdom Administration, viz. to apply same only in those cases when there is no retransmission to and from points outside Europe.

Sharing

34. On the principle of imposing a higher rate when the circuits are shared, there is not much divergence of opinion in our Group.

35. A supposed increased use is not the only reason for applying a higher rate (in many cases we even see a greater circuit load with single users than with some multiple users); the higher rate is much more justified by the consideration that the correspondence by teleprinter equipment exchanged by co-users no longer accrues to public Telex services. It is actually a question of loss or revenue, which cannot be regarded as compensated for by the overall rental charges that are already levied on the first user as a compensation for the loss in Telex traffic suffered by the Administration in respect of his own traffic.

36. Therefore, in the metering scale under Resolution 9, it was not a minimum basic rate of 80 units that was applicable, but a higher one, i.e., of 100 units; further in this respect each step in the overall rates mentioned in it virtually represents a new lump sum. When a possible reduction of rates on the basis of calculations of cost-prices is envisaged, we should certainly take these considerations into account with reference to the sharing procedure.

37. However apparent a difference between the sharing and the single user rate may be, it would seem to me that the Administrations, on the basis of commercial considerations, should also maintain the sharing rate at a moderate level. Too high a rate might have a general prohibitive effect on the leasing of circuits. Too high a sharing rate would induce users to prefer to incur all sorts of expenses, to improve on circuit output, e.g. by increasing the number of their staff and by choosing the technique to be applied (reperforator-switches), in cases when an increase of the number of circuits would be the correct solution and would be advantageous to the Administrations.

38. Here the question asked in 2 *d* of Document 116 is relevant, namely whether or not, generally speaking, i.e. both as regards single utilization and sharing, the possibility of reducing rates should be studied in the case of more than one circuit between same points being rented to the same lessee or lessees.

39. The present difference in price between circuits rented by single users and those rented on the multiple basis amounts to 37.5 % (80 and 110 units).

40. The United Kingdom Administration now proposes to increase this difference considerably in cases when more than two users are concerned, i.e. in single steps, up to 75 %. Thus we should, in point of fact, revert to the scale according to point 10 of Resolution 9, which our Group put aside in Geneva in 1951.

41. In the field of tarification relative to sharing, I would invite your close attention to the fact that there are various organizations that have for many years rented circuits at the single rate, organizations, however, which on a literal interpretation of Recommendation H.5 come under the sharing notion. I enumerate here: news agencies, whether co-operative organs of newspapers or radio news services or not, which receive their messages from all sides, so as to reforward them to all quarters; and organizations such as Civil Aviation and Meteo, which receive for one another and re-dispatch for one another. In all these cases application of § 5 of Recommendation H.5 would be implied.

42. In such cases there would be difficulty in proceeding to an increase of rates, as we saw during previous sessions of our Group, and the appropriate solution would seem the one in which the organizations enumerated in paragraph 41 would be specifically mentioned as exceptions, so far as sharing is concerned.

Comparison of rates applicable to leased telegraph and leased telephone circuits

43. As I have already stated in the historical survey, the ratio of 1 : 2 was established in 1936 for the rates of leased telegraph and leased telephone circuits, respectively. This ratio exists

still. However, the C.C.I.F. now uses 6,000 conversation minutes per month for the indication of the equivalent, and no longer 80 telephone units per day.

44. Due to the wording of Paris Resolution 9, in which the terms " 40 telephone units " were replaced by "80 Telex units", the ratio between tariffs applicable to leased telegraph and leased telephone circuits has virtually become dependent on the ratio between the prices for Telex calls and telephone conversations.

45. The latter ratio is nowadays also 1 : 2, but it would seem probable to me that a change is likely at no distant date not only, possibly, as a result of the study that we are now to undertake, so as to further analyse the Telex rates, but also because in C.C.I.F. studies trends are apparent to decrease the telephone rate. Should those trends be realized, then various countries, notably the smaller countries, will probably no longer be able to cover costs of installations and of handling Telex calls out of the 50 % telephone rate.

46. The question will then arise :

a) whether the C.C.I.T. and the C.C.I.F. will have to continue to take as basis the same number of minutes per month in calculating leased circuit rates, in which case the 1 : 2 ratio is lost, or,

b) whether this ratio must nevertheless be maintained in particular for leased circuit rates, with application of different comparison figures for telegraphy and telephony.

47. In cases where Administrations proceed to a (relative) increase of the Telex rate, they will probably do so due to the fact that costs for operation and equipment represent a large amount of the expenses of a Telex call. If this supposition is true, it might be an argument for not maintaining the rate for a leased circuit at 2,000 Telex units per month, but for decreasing the latter number so as not to disturb too much the ratio as regards the rate applicable to leased telephone circuits.

48. It is evident that the ratio between the rates for leased telephone and leased telegraph circuits will also be changed, if the C.C.I.T. should decide to introduce a new method of calculation of the rates applicable to leased telegraph circuits, that is to say if the suggestions relative to adapting them to cost prices (if only for transit circuits), the re-introduction of metering, or the repercussion on the rate in case of reforwarding are accepted.

49. If changes in the present analogy, according to the possibilities mentioned, are indeed recommended, the calculation of circuit rates in relations in which there is so far no Telex traffic will likewise have to be further considered.

Re-transmission

50. In paragraphs 7 and 41 above I already stressed the extent to which re-transmission has now already in practice become part and parcel of the trade, in many shapes and forms and on an extensive scale.

51. This is quite understandable, since reception and re-transmission of messages is a simple manipulation, and equipment such as reperforators and automatic transmitters, which are used in such large numbers, have been specially manufactured for the purpose. Besides, reception and retransmission of messages is often part of the very function of lessees ; in this connection I would only make reference to news agencies and meteorological institutions.

52. In my opinion it is logical for any user to be allowed to make use of the various telecommunications services in combinations thereof. Before renting circuits he will make his calculations for the circuit-capacity required, including reforwarding and take into account the economics of the systems and of his organization as a whole.

53. I do not know of any stipulation prohibiting the transmission of correspondence from one leased circuit to another. On the contrary, in Recommendation H.5, § 5 it is officially recognized, at least in the European system, that this possibility exists and from it the sharing characteristic is deduced, without any further consequences as to rates.

54. The United Kingdom Administration now submits a proposal to create possibilities to increase rates for leased circuits at present mentioned in Recommendation H.5, in cases of reforwarding of traffic from and to points outside the European system. In my opinion this suggestion would include both reforwarding from a leased circuit to another leased circuit and to other routes, e.g. those of the public telegraph service, the Telex service and services such as those of S.I.T.A. where users have their own radio transmitters.

55. It would seem to me that, should our Group adopt the point of view of the United Kingdom Administration, it would have to consider also the consequence on the rates for Telex calls with regard to reforwarding.

56. Reforwarding *via the public telegraph* service has been dealt with in Art. 49 of the International Telegraph Regulations and also in Art. 7 of the Telex Regulations. Here it is a question of *prohibitive* regulations which originated in tariff problems arising particularly in the field of public telegraph service.

57. It is doubtful whether elimination of prohibitive regulations such as those of International Telegraph Regulations for the sake of higher rates for leased telegraph circuits lies within the competence of our Group and also whether this could be effected for the extra-European traffic only. Most probably, our Group will be able to deal with only part of the reforwarding problem, i.e. that part in which use of public telegraph service is not concerned.

58. It is clear that the question of reforwarding will require a profound study, not only in principle but also with regard to details. By way of example I mention the difficulty of effective control of the level of the extra rental, connected or not with the different word-rates for the respective destinations, and the complications that can arise if, when sharing, one party proceeds to reforwarding, and the other does not.

Annex I

STUDY OF RESOLUTION 9

Study of Resolution 9, Part II (Paris Conference) entrusted to S.G. XI by the meeting of Group Chairmen, held at Geneva on 28, 29 and 30 November 1949.

This part of the Group's programme has given rise to full debates.

First of all the existing rate systems were analysed. A simplified graph has been annexed to this report.

The trend of the lines shows that the metering rental and the overall rent established on the basis of the number of users differ considerably.

The lines V, VI, VII, VIII and the arrows IX-XIV inclusive represent the rates which according to Resolution 9 are due for 2, 3, 4, 5 users and 8, 33, 58, 108, 208 and 408 users respectively. Moreover, the line V indicates the rent for each additional circuit in the same relation, independent of the number of users, whereas line IV represents the scale of rates of the shared circuit on a metered basis with the introduction of the additional rent of 60 % for the units over and above the daily minimum of 100 units.

The rate of a circuit leased by two users on the basis of an overall rent will never exceed the rate due for 110 units, while an intensive use calculated on a metered basis would involve a maximum rate of 328 units.

Generally speaking, the triangles ABC, A^1BC^1, A^2BC^2 etc. represent the increase in charges to be paid by the users in case of metering. On the other hand the metering system involves profits for the users, when their traffic does not exceed the units due by an equal number of users for whom the system of an overall rent applies.

This fact justifies the conclusion that the users will always urge their Administrations to apply the most profitable system in a particular case ; this will not fail to bring about difficulties in the relations between the Administrations and the users, as well as between the Administrations mutually, in the international negotiations.

The Danish rapporteur has added some elements to the said difficulties :

a) It is difficult to distinguish the categories of single and joint users. In practice it will often happen that third parties take advantage of circuits leased to single users.

b) The rate for a leased circuit and the volume of traffic handled over it must harmonize.

The rate thus fixed must be comparable to the charges generally paid by the Telex subscribers, even if the latter require a large number of calls not to one and the same point but to various points.

That is why the Danish Administration has suggested to abandon the system of an overall rent, both for the single users and for joint users, and to adopt the metering rental as a single system in all relations.

Moreover, the Danish Administration would consider the fact that an Administration leasing a circuit saves the normal Telex operational cost.

In this connection, the Danish Administration also suggests reducing the Telex rate to 1/3 of the telephone rate.

After ample discussions, the Study Group could only conclude that it would not be possible to distinguish single users as such, and that abuses on a large scale could not be prevented.

As to point *b)* it was alleged in the meeting that clearly the availability of a leased circuit involves the transmission of a large number of messages which, in the absence of the circuit, would not have been transmitted by means of telecommunication. In fact it can be shown that the greater part of the heavy traffic on a leased circuit must be considered as traffic of a new category.

In relation to the preceding consideration, the necessity of the mentioned harmony was contested. Since, moreover, an increasing volume of traffic will not result in an increased cost price for the Administrations, several members thought it reasonable to fix a " ceiling " price.

The Study Group could not decide on recommending either the general introduction of the metering system or its application to circuits for single users. They did not want to take into consideration for the time being a reduction of the rate to 1/3 of the telephone rate.

During the discussions, attention was drawn to the fact that in virtue of the regulations existing formerly a number of circuits have been leased on the basis of 80 units to users who may be doubted to be considered still as " single " under Resolution 9. In fact this Resolution in its § 7 determines the number of users of a circuit directly in accordance with the nature of the traffic handled ; it considers as a " user ", anybody from whom or to whom traffic is transmitted on a circuit. In virtue of Resolution 9 it would be difficult to consider as a single user a press agency which by its very nature envisages the distribution and the retransmission of press news.

Analogous situations will be found on closer consideration of circuits rented to I.C.A.O. and meteorological services.

The Study Group would be reluctant to make proposals intended to increase the rate at present in force for the cases mentioned. In this particular connection great difficulties are expected on the part of the press (restriction of the Freedom of Information).

Efforts made in the meeting to find a solution by modifying the wording of Resolution 9 failed to succeed.

In order to find a solution for the present cases of sharing (joint use of circuits by aeronautical companies, which are nationalized in many countries) some delegates suggested the possibility of fixing a general flat rate at a moderate level, viz at 120 units.

For lack of time this idea could not be fully discussed. That is why the Group Chairman has undertaken to prepare a preliminary study.

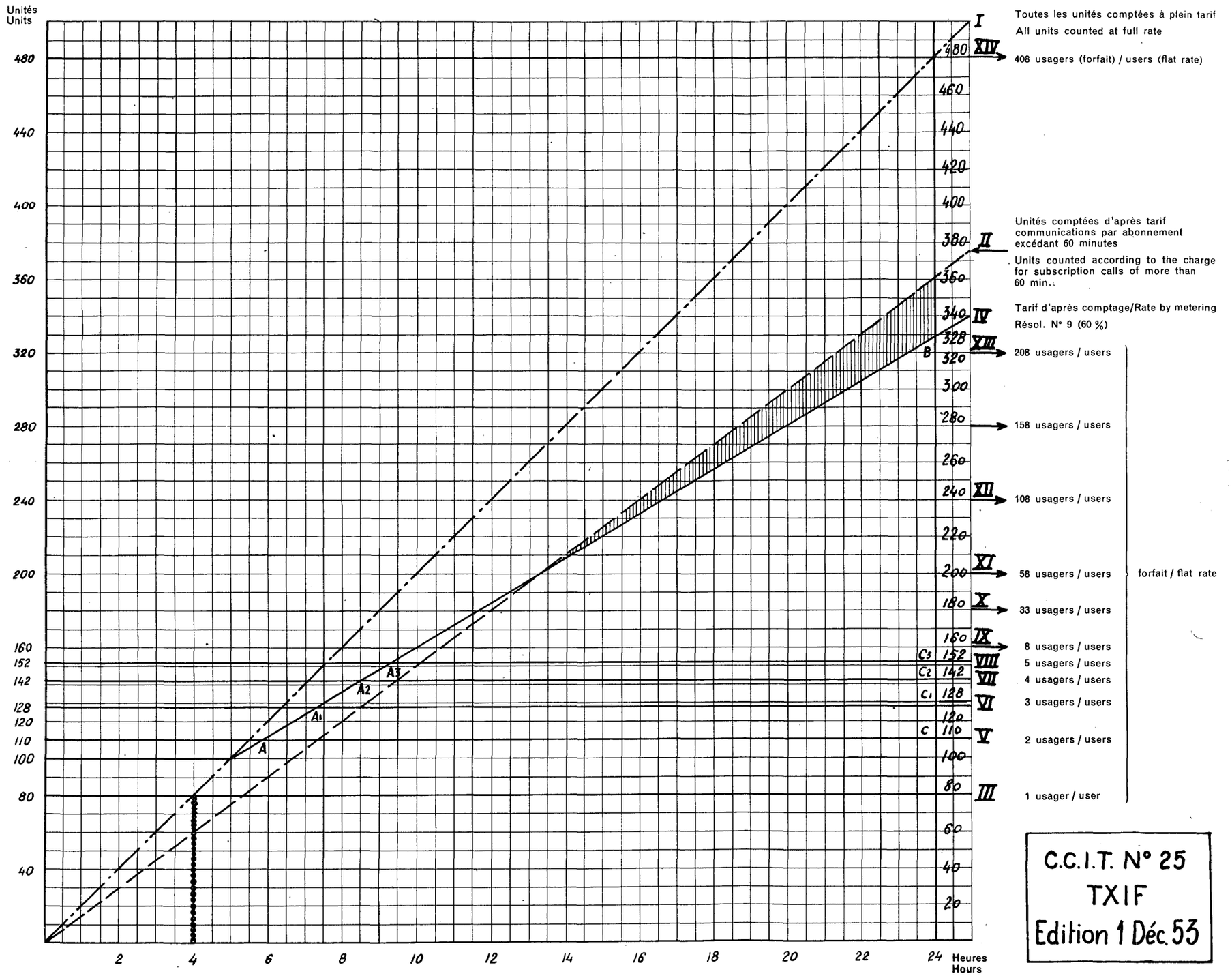
In the opinion of the Group Chairman there would be an objection to the C.C.I.T. establishing a special rate for the aeronautical companies. On the other hand the rate of 120 units a day could be generally adopted for the cases of sharing, provided the Administrations mutually agreed whether they could accept sharing and what constituted a case of sharing.

A general overall rent on an average level is undoubtedly preferable to the complicated system of rates actually inherent in Resolution 9.

However, the number of 120 units involves an increase of the scale of 110 units now in force for two users, and would probably be accompanied by difficulties for some existing cases.

With regard to the relatively low price of telegraph circuits, which will gradually become available in considerable quantities, the Group Chairman, after having heard the opinion of the Netherlands Administration, wonders whether nevertheless the number of 120 units is still too high.

In this connection it will be opportune to refer to the remark made by the Director of the C.C.I.T. at a meeting of Study Groups VI and VII of the C.C.I.F. together with Study Group XI of the C.C.I.T., drawing attention to the high revenue collected by the telegraph service in respect of the multiple utilization of a single two-wire telephone circuit (18 or 24 times).



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A high overall rental would put a check on the subscribers' demand for additional circuits in the same relation. Such an overall rent would induce them to have recourse to the tape relay system in cases when through-connection of circuits would probably be preferable for the handling of traffic. On the other hand users might be disposed to tolerate the inconvenience of delays which they could have avoided by leasing additional circuits.

If the calculation of the operational costs of Telex communications (for which costs the Administrations realize economies in case of leasing circuits) would result in amounts about equal to those of the telephone service (0.80 gold francs), the entire output of 120 units would in many European relations be equivalent to the net proceeds of a number of Telex calls such as would never be handled in practice on one single rapid service circuit.

If, moreover, the possibility is considered of introducing in certain cases special reduced rates in periods of light traffic (in conformity with the proposals to modify the Telex regulations) or to apply the optional arrangement of admitting long duration subscription calls at a reduced rate, it would probably be better to reduce the above-mentioned number of 120 units to 100 units.

Undoubtedly cost prices would still be covered in this case too.

The problem is submitted to you to be studied in detail in the above sense.

UNITED STATES OF AMERICA

Document S.G. XI/4-E
10 March 1954

Observations on questions assigned to study group XI

The United States has no comment with respect to the specific level of the rates for Telex and leased telegraph circuits in the European System. As a matter of information, in the United States the rates for TWX (the U.S. equivalent of Telex) and private line telegraph service are determined independently for each service in accordance with accepted rate making principles and are not dependent on each other or on the rates for any other communications service. Leased telegraph circuits may be used jointly by two or more users at no increase in charges over the single user rate. Each authorized user on a joint circuit must qualify under the following definition:

> An authorized user is a person, firm or corporation who is authorized by the customer to be connected to the circuit or circuits leased to the customer. An authorized user must be specifically named in the application for service and each authorized user shall transmit and receive his particular communications over the equipment installed in his office for this purpose. Only the following may be authorized users:
>
> *(a)* Persons, firms or corporations who are to receive and send communications from and to the customer only and relating solely to the customer's business.
>
> *(b)* Corporations over which the customer exercises control by contract, lease, or ownership of more than 50 % of the voting stock.
>
> *(c)* Persons, firms or corporations in the same line of business as the customer. Banks, security dealers and exchange brokers dealing in stocks, bonds or commodities shall be considered to be in the same line of business.

Facilities furnished in private line telegraph service may be employed only for the private use of those companies whose offices are connected to the circuits, their affiliated and subsidiary companies and their representatives and each such office shall transmit and receive its particular communications over the equipment installed therein. Further, such facilities shall not be used either directly or indirectly for the handling of communications for the public or any person, firm or corporation other than those whose offices are connected to the circuits or their affiliated and subsidiary companies and their representatives.

In the United States the rates for private line service, as such, are on a " flat rate " basis depending on the hours per day, and days per week for which the circuits are leased and are independent of the actual use the customer makes of the service. Other services (such as Telemetering and International Metered Communications services) are available on a " metered " basis where the user does not require extensive use of the circuit or where circuits are shared (through automatic means in the offices of the telegraph company) with other non-related users. Under these latter cases " metering " is a desired method of charging.

However, the United States are opposed to " metering " as the *sole* method of charging for leased telegraph service because in our opinion such principle is contrary to the fundamental basis of full use of private line service. Any user who leases a private line should be entitled to make full use of the circuit during the lease period since the costs of rendering the service are not appreciably affected by such use and presumably the factors of value of service and possible loss of message revenues to the administrations or operating agencies have been taken into account in fixing the basic rate. Obviously, when an unlimited leased circuit is available, correspondence is routed over it, which would otherwise be sent by mail or not sent at all. There appears to be no reason to force such traffic off the leased circuit as would occur if the " metering " system of charging were the only method applied.

In the United States the inter-exchange of correspondence at their own offices (by manual transfer or in some instances by automatic or semi-automatic relay) relating to the business of the authorized users of the private line and TWX services, among private line circuits, TWX service and the public message telegraph network is permitted and is widely used by government agencies, aviation interests, manufacturers, press and newspaper organizations, banking and other commercial interests, etc., and no restrictions are applied to the inter-exchange of international traffic over such of these services as are furnished internationally by United States operating agencies. In the interests of full and efficient use of the telegraph service, the United States consider that there should be no artificial restrictions placed on the users of international telegraph service to prevent them from inter-exchanging correspondence at their own offices on their legitimate business over their own leased private line networks, their TWX facilities or the public message telegraph service. Therefore, the United States are opposed to the principle of applying surcharges to any portion of the charges for facilities where traffic is inter-exchanged between different communications services.

COST OF TELEGRAPH CIRCUITS AND TELEX COMMUNICATIONS

(C.C.I.T. Questions 71 and 73)

STUDY GROUP XI — September 1955

T.XI.0/0354

Questionnaire for the study of the costs of an international leased telegraph circuit and of an international Telex call (in the European system)

A. General comments and definitions

1. The calculation of the costs of an international leased telegraph circuit and of an international Telex call depends on :

a) the average cost of a telephone circuit used to carry voice-frequency telegraph circuits ;

b) the average cost of the telegraph equipment, in particular the voice-frequency terminal equipment and the repeater or switching equipment.

The C.C.I.F. is studying the costs of a telephone circuit, and the figures it arrives at will be used as a basis for calculation of *a)*.

2. Cost figures supplied in reply to this questionnaire should be expressed both in national currency and in gold francs.

3. The figures given for the cost of plant and equipment should represent the present cost of the equipment in question, as new.

4. Capital expenditure should not include costs of accommodation (land, buildings, etc.). Since, generally speaking, voice-frequency telegraph and Telex switching equipment share the same premises as the general telegraph service or other services, it would seem preferable to assess accommodation costs in the form of an annual rental, to be shown under the heading of annual charges.

5. In calculating staff expenses, account should be taken of salaries, allowances of all kinds, and expenditure by the Administration on pension schemes, insurance, medical attention, etc. Not only operating staff proper, but also supervisors, foremen, specialized staff (Administration enquiries, claims, statistics, international accounting) and staff sometimes held in reserve should be taken into account.

6. The figures given in reply to Questions 1, 5, 11, 13, 15, 17, 22, and 24 should include Administrations' overheads, such as expenditure on central services, research, staff training, publicity, taxation, etc.

7. *Definitions*

The following terms are used in this questionnaire with the meanings indicated :

International Telegraph circuit

A permanent connection between two telegraph centres in different countries.

The circuits to which the questionnaire refers are always assumed to be direct, i.e., it is assumed that no retransmission equipment is used. Such circuits are set up on voice-frequency telegraph circuits and provide for both-way transmissions.

The " terminal " centres for an international circuit are considered to be as follows :

in the case of a leased circuit : the centres containing the long-distance telegraph equipment nearest, in a particular circuit, to the operating stations. The *extension circuit* (connection between the station and the nearest centre giving access to the long-distance network) is excluded from the international circuit ;

in the case of a circuit for the general service (or public telegraph service) : the centres containing the long-distance telegraph equipment nearest in a particular circuit, to the telegraph office ;

in the case of Telex circuits : the international Telex terminal exchange.

International voice-frequency telegraph circuit

That part of an (international) telegraph connection (both-way transmission) between a voice-frequency telegraph terminal station in one country and a voice-frequency telegraph terminal station in another country, there being no telegraph repeater (nor intermediate V.F. telegraph equipment) between these two stations.

International terminal stations

The stations at which an international voice-frequency telegraph circuit terminates.

National trunk section of a circuit

The section of the circuit between the terminal centre (at which the extension circuit terminates) and the international terminal station.

Voice-frequency telegraphy transmission link

The section of the circuit between two successive voice-frequency telegraph terminals.

B. Questionnaire for calculation of the cost of an international telegraph circuit

B. I. *Capital costs of an exclusively telegraphic character*	In national currency	In gold francs
1. What is the average cost (including overheads) of setting up the terminal equipment (transmission and reception) per international voice-frequency telegraph circuit ? . . .		
N. B. :		
a) Allowance should be made in this calculation for common equipment (measuring apparatus, audio frequency generators, power supplies, etc.)		
b) The number of circuits to be taken into consideration in this calculation is the total number of international circuits connected to the international terminal stations (working circuits, speaker circuits and spare circuits).		

B. II. *Annual charges*	In national currency	In gold francs
Charges on capital		
2. What is the average rate of interest you pay on borrowed capital (average over the last three years) ?		
Depreciation costs		
3. What average length of life do you assume for voice-frequency terminal equipment ?		
4. If, in calculating the depreciation of equipment you allow for a residual value, what percentage is it of the initial value, in the case of voice-frequency terminal equipment ?		
Maintenance costs		
5. What are the average annual maintenance costs (including overheads) of the V.F. terminal equipment per international circuit (transmission and reception) ? . . .		
In replying to this question, allowance should be made for labour costs, consumable stores and electric power charges.		
Notes B. I *a)* and B. I *b)* apply equally to question 5.		
Accomodation costs		
6. What is your estimate of the annual rental for the accommodation of the V.F. terminal equipment per international voice-frequency circuit (transmission and reception) ? . .		
N. B. : The figures should cover :		
Capital expenses and depreciation of the property, Maintenance costs, Heating, lightning, cleaning, care-taker etc.		
Notes B. I *a)* and B. I *b)* apply equally to this question.		
Share in the annual cost of the telephone circuit		
7. What is the average length, on your territory, of the international telephone circuits carrying international voice-frequency telegraph systems ?		
8. What is the average number of international voice-frequency telegraph circuits to each such telephone circuit ?		
N. B. : The total number of circuits installed (working circuits, speaker circuits, and spare circuits) should be taken into account here.		
9*a*. What is the average percentage of spare telegraph circuits (including speaker circuits) ?		
This should be calculated by comparing the number of spare circuits (speaker circuits included) with the total number of circuits. Thus, 40 spare circuits and speaker circuits for 60 working circuits represent a reserve of 40 % in relation to the total number of circuits.		
9*b*. What, in your opinion, should normally be the average proportion of spare circuits ?		

	In national currency	In gold francs
10. Please fill in the following table. Its purpose is to establish for each service (Telex, leased circuits, general telegraph service) the average number of voice frequency links per national trunk section of an international circuit. The following examples may help you to fill up the table.		

Examples :

1. Paris and London are the terminal centres of a Telex circuit. It is made up of an international voice-frequency circuit and has no national trunk section.

In the table, the international voice-frequency circuit will count as one unit, both as regards the French and the United Kingdom replies :

— in the total number of international voice-frequency circuits . . . . = line 1, column 1 ;

— in the total number of international voice-frequency telegraph circuits used for Telex . . . . . = line 1, column 2 ;

— in the number of international voice-frequency telegraph circuits not extended by a national trunk section . . . . . = line 2, column 1;

— in the number of international voice-frequency telegraph circuits used for Telex and not extended by a national trunk section . . . . . = line 2, column 2 .

2. Marseilles and Manchester are the terminal centres of a leased circuit. It comprises an international voice-frequency telegraph circuit between Paris and London, a voice-frequency telegraph circuit between Marseilles and Paris, and a voice-frequency telegraph circuit between London and Manchester (three voice-frequency links—one national trunk section of one voice-frequency link in each country).

In the table, the international voice-frequency circuit between Paris and London will count as one unit for :

line 1, column 1 ;

line 1, column 3 (channel used by a leased circuit) ;

line 3, column 1 (circuit extended by a trunk section of one voice-frequency link) ;

line 3, column 3 (circuit extended by a trunk section of one voice-frequency link and used by a leased circuit).

This would be the case both in the reply from France and in that from the United Kingdom.

If the leased circuit had been between Marseilles and London, there would have been no change, as far as France is concerned ; but for the United Kingdom entries would have been made in the table as follows :

line 1, column 1
line 1, column 3
line 2, column 1, and
line 2, column 3

3. A Telex circuit Frankfurt-Madrid is made up of two international voice-frequency circuits, Frankfurt-Paris, Paris-Madrid, (two links, no national trunk sections in Germany, France or Spain).

In the table drawn up by the Federal German Republic, the international circuit Frankfurt-Paris would count as one unit for :

line 1, column 1
line 1, column 2
line 2, column 1, and
line 2, column 2

In the French table, the international circuits Paris-Frankfurt and Paris-Madrid would each count as one unit for :

line 1, column 1
line 1, column 2
line 2, column 1, and
line 2, column 2

In the Spanish table, the international circuit between Madrid and Paris would be similarly recorded.

	Number of international voice-frequency telegraph circuits terminating in your country	Number of circuits in Col. 1 used by the Telex service	Number of circuits in Col. 1 used for leased circuits	Number of circuits in Col. 1 used for the general service	Spares (including speaker circuits)
1. Total circuits	(600)	(400)	(50)	(30)	(120)
2. Number of circuits not extended in the country over a national trunk section	(395)	(350)	(20)	(25)	
3. Number of channels extended in the country over a national trunk section of one voice-frequency telegraph link	(75)	(50)	(20)	(5)	
4. Number of channels extended in the country over a national trunk section of two or more voice-frequency telegraph links	(10)	(0)	(10)	(0)	

N. B. : for illustrative purposes, the table has been filled with hypothetical figures in brackets. You should enter your own figures in the appropriate spaces, above the hypothetical figures.

C. Questionnaire for calculation of the costs of an international Telex call

	In national currency	In gold francs
C.A. *Switching expenses*		
C.A. I : *Capital Costs*		
11. State the total cost (including overheads) of the equipment in service and in reserve) in your international Telex terminal exchanges for manual-manual switching	.....	.....

N. B. :

1. The figure given should be the present day value of the equipment as new.

2. Account should be taken in this calculation, not only of the positions and their teleprinters, but also of common equipment (distribution frames, wirings, power supplies, measuring apparatus, enquiry positions, etc.).

	In national currency	In gold francs
12. How many international Telex circuits are operated *manually* (manual-manual) in your international Telex terminal exchanges?		
(This figure should cover all outgoing, incoming, and both-way circuits).		
13. State the total cost (overheads included) of the equipment (in service and in reserve) in your international Telex terminal exchanges *for the switching of semi-automatic* (manual to automatic) *outgoing traffic*		
N. B.: The notes to Question 11 apply equally to Question 13.		
14. How many international Telex circuits are operated *semi-automatically (manual to automatic) for outgoing traffic*, in your international Telex terminal exchanges?		
15. State the total cost (overheads included) of the equipment (in service and in reserve) in your international Telex terminal exchanges *for the switching of semi-automatic (automatic from manual) incoming traffic, and for the switching of fully automatic (subscriber to subscriber) incoming traffic*		
N. B.: The Notes 1 and 2 to Question 11 apply equally to Question 15.		
16. How many international Telex circuits are operated *semi-automatically* (automatic from manual) and fully automatically for incoming traffic in your international Telex terminal exchanges?		
17. State the total cost (including overheads) of the equipment (in service and in reserve) in your international Telex terminal exchanges for the switching of fully automatic (subscriber to subscriber) outgoing traffic		
N. B.: Notes 1 and 2 to Question 11 also apply to Question 17: in particular, account should be taken of signalling and dialling converters, etc., required for passing from the national system to the system used in the distant country.		
18. How many fully automatically switched outgoing international Telex circuits have you?		
N. B.: Administrations finding difficulty in replying separately to Questions 11, 13, 15 and 17 can give a single comprehensive answer to these questions.		
C. A. II. *Switching costs annual charges*		
19. *Charges on capital:* What is the average rate of interest you pay on borrowed capital?		
(Give the average for the last three years).		
20. *Depreciation costs:* What is the average length of life you assume for the equipment used for:		
a) manual-switching?		
b) semi-automatic switching?		
c) fully-automatic switching?		
21. If, in calculating the depreciation of equipment, you allow for a residual value, what percentage is it of the initial value, in the case of equipment used for:		

		In national currency	In gold francs
a) manual-switching ?			
b) semi-automatic switching ?			
c) fully-automatic switching ?			

22. *Annual maintenance costs for switching equipment*

What, on an average, is the cost of maintenance (including overheads) per international Telex circuit in service :

a) manual ?			
b) outgoing semi-automatic ?			
c) incoming semi-automatic or incoming fully-automatic ?			
d) outgoing fully-automatic ?			

N. B. In answering these questions allowance should be made for labour costs, consumable stores, and electric power charges.

Remark : The remarks in Section C.A. I. apply equally to Question 22 : different types of circuit may be grouped by giving an average value.

23. *Annual accomodation costs*

What is your estimate of the annual rental, for each international Telex circuit in use :

a) manual ?			
b) outgoing semi-automatic ?			
c) incoming semi-automatic or incoming fully-automatic ?			
d) outgoing fully-automatic ?			

N. B. : Same note as that for Question 6.

Remark : Same remark as for Question 22.

C. B. *Annual operating costs*

24. What, on an average, is the cost of providing operating staff (including foremen, supervisors, the staff of specialized accessory services, such as administration, enquiries, accounting, etc. and reserve staff), assessed in accordance with the recommendations in General Observation No. 5, and including overheads, *for each international Telex circuit in service :*

a) manually-operated ?			
b) semi-automatically operated for outgoing traffic ?			
c) semi-automatically or automatically operated for incoming traffic ?			
d) automatically operated for outgoing traffic ?			

C.C. *Annual costs of an international Telex circuit*

(*Note :* the information required will be provided by Part B of the questionnaire).

C. D. *Costs of the national section of the international Telex call*

	In national currency	In gold francs
25. What is your estimate (on an average and per chargeable minute) of the costs attributable to the inland section of international Telex calls:		
a) in the case of an outgoing call?		
b) in the case of an incoming call?		

Remarks :

1. When there is more than one charging area in a country, separate estimates should be made for each of them.

2. Should it be difficult to assess these expenses directly for each zone, you should show the *average* charge which would result from application of the inland rates between the international Telex position and the called or calling subscriber, as the case may be.

3. If the Telex circuits terminate on automatic switching equipment in the country of arrival, and if the Administration of that country finds it difficult to identify the called subscribers, it should be assumed that the distribution of incoming traffic is the same as for outgoing traffic.

C. E. *Number of chargeable minutes per circuit*

26. What is the average number of chargeable minutes per year per international Telex circuit:		
a) outgoing, manual operation?		
b) incoming, manual operation?		
c) outgoing, semi-automatic operation?		
d) incoming, semi-automatic operation?		
e) outgoing, fully-automatic operation?		
f) incoming fully-automatic operation?		

N. B. :

1. Administrations which do not possess figures for incoming traffic should obtain them from the Administration responsible for the outgoing traffic.

2. International *switched transit* calls will be counted as :
— outgoing, in the country of origin
— incoming and outgoing, in the transit country
— incoming, in the country of destination.

3. The number of circuits in service to be taken into account for Question 26 should be the average number of circuits in service during the annual period considered for assessing traffic.

STUDY GROUP XI

Document S.G. XI/62-E
10 July 1956

Cost of an international telegraph circuit

I. BASES OF CALCULATION

After examining replies by Administrations to the September, 1955, questionnaire for the study of the costs of an international telegraph circuit and of an international Telex call in the European system (Document T XI 0/0354), the working party adopted the following values for the different headings of the questionnaire which had to be considered in calculating the cost of an international telegraph circuit:

I A. General comments

1. The calculation of the costs of an international leased telegraph circuit (and of an international Telex call) depends on:

a) the average cost of a telephone circuit used to carry voice-frequency telegraph circuits;

b) the average cost of the telegraph equipment, in particular the voice-frequency terminal equipment and the repeater or switching equipment.

The C.C.I.F. is studying the costs of a telephone circuit, and the figures it arrived at have been used as a basis for calculation of *a)*.

2. The figures given for the cost of plant and equipment represent the present cost of the equipment in question, as new.

3. Capital expenditure does not include costs of accommodation (land, buildings, etc.). Since, generally speaking, voice-frequency telegraph and Telex switching equipment share the same premises as the general telegraph service and other services, it seemed preferable to assess accommodation costs in the form of an annual rental, shown under the heading of annual charges.

4. In calculating staff expenses, account has been taken of salaries, allowances of all kinds, and expenditure by the Administration on pension schemes, insurance, medical attention, etc.

Not only operating staff proper, but also supervisors, foremen, specialized staff (administration, enquiries, claims, statistics, international accounting) and staff sometimes held in reserve— have been taken into account.

5. The figures given in reply to Questions 1, 5, 11, 13, 15, 17, 22, and 24 include Administrations' overheads, such as expenditure on central services, research, staff training, publicity, taxation, etc.

I B. VALUES ADOPTED

B. I. *Capital costs of an exclusively telegraphic character*	In gold francs
1. Average cost (including overheads) of setting up the terminal equipment (transmission and reception) per international voice-frequency telegraph circuit	4000

N. B. :

a) Allowance has been made in this calculation for common equipment (measuring apparatus, audiofrequency generators, power supplies, etc.)

b) The number of circuits taken into consideration in this calculation is the total number of international circuits connected to the international terminal stations (working circuits, speaker circuits and spare circuits).

B. II. *Annual charges*

Charges on capital

2. Average rate of interest paid on borrowed capital	5 %

Depreciation costs

3. Average length of life assumed for voice-frequency terminal equipment	10 years
4. Percentage ratio of the residual value to the initial value of voice-frequency terminal equipment	0

Maintenance costs

5. Average annual maintenance costs (including overheads) of the V.F. terminal equipment per international circuit (transmission and reception)	300

In replying to this question, allowance has been made for labour costs, consumable stores and electric power charges.

Notes B.I *a)* and B.I *b)* apply equally to question 5.

Accomodation costs

6. Annual rental for the accomodation of the V.F. terminal equipment per international voice-frequency circuit (transmission and reception)	10

N. B. :

The figures cover :

Capital expenses and depreciation of the property,
Maintenance costs,
Heating, lightning, cleaning, care-taker, etc.

Notes B. I *a)* and B.I *b)* apply equally to this question.

7. Not used in the calculation.

8. Average number of international voice-frequency telegraph circuits for each telephone circuit carrying an international voice-frequency telegraph system	18

N. B. : The total number of circuits installed (working circuits, speaker circuits, and spare circuits) has been taken into account here.

9. Average percentage of spare telegraph circuits (including speaker circuits)	30 %

This has been calculated by comparing the number of spare circuits (speaker circuits included) with the total number of circuits.

10. Average number of voice-frequency links per international trunk section of an international voice-frequency telegraph circuit, in order to complete the international connection in each country :

a) a Telex circuit	0
b) a leased circuit	0.40
c) a general-service circuit	0.40

II. CALCULATION OF THE COSTS OF TELEPHONE CIRCUITS USED FOR VOICE-FREQUENCY TELEGRAPH SYSTEMS

The factors making up the cost price of a telephone circuit were supplied by the C.C.I.F. Committee for the Revision of International Tariffs (September, 1955).

The meetings of this Committee concluded that a distinction should be made between modern circuits, established by carrier current on symmetrical pairs or coaxial cables, and old-type circuits.

For modern circuits the annual cost has been taken as

$$F_1 = (0.107 + 0.25 \frac{L\ km}{100} + 0.107) \times \frac{40{,}000}{3} \text{ gold francs}$$

where:

0.107 gold francs is the share of the terminal equipment of a carrier current circuit in the cost of a 3-minute telephone call;

0.25 gold francs is the charge for 100 kilometres of circuit in the cost of a 3-minute telephone call;

40,000 is the average number of chargeable minutes over a circuit with rapid service operation.

L is the length of the circuit in kilometres, as the crow flies.

In the case of old-type circuits, the *annual* cost F_2 has been taken as

$$F_2 = 0.60 \times \frac{L\ km}{100} \times \frac{60{,}000}{3} \text{ gold francs,}$$

where:

0.60 gold francs is the charge for 100 kilometres of circuit in the cost of a 3-minute telephone call;

60,000 is the average number of minutes charged for calls over a circuit operated with advance preparation.

Telephone circuits used for international voice-frequency telegraphy are still of the old type in many cases; in these circumstances it seemed advisable to distinguish between the two types.

Further, telephone services often leave an emergency circuit at the disposal of the telegraph service which might need it for voice-frequency telegraphy; the V.F. telegraph system may then be diverted to the emergency circuit without the intervention of operational staff at the telephone exchanges and without the risk of interrupting a telephone call in progress.

It was estimated that such circuits are placed at the disposal of the telegraph service on an average of 1 emergency circuit for 2 telephone circuits carrying voice-frequency telegraph systems. Hence the cost of a telephone circuit must be multiplied by 1.5 in order to allow for the real cost of telephone circuits in the total costs of voice-frequency telegraph systems.

The cost of telephone circuits for a voice-frequency telegraph system is thus:

in the case of a modern circuit:

$$F_1 \text{ corrected} = 0.107 \times \frac{40{,}000}{3} \times 1.5 + 0.25 \frac{L\ km}{100} \frac{40{,}000}{3} \times 1.5 + 0.107 \frac{40{,}000}{3} \times 1.5 \text{ gold francs}$$

$$= 1425 \times 1.5 + 3300 \frac{L\ km}{100} \times 1.5 + 1425 \times 1.5$$

terminal costs at one end — costs in proportion to the length — terminal costs at the other end

in the case of an old-type circuit:

$$F_2 \text{ corrected} = 12{,}000 \times 1.5 \times \frac{L\ km}{100}$$

III. CALCULATION OF THE ANNUAL COST OF AN INTERNATIONAL VOICE-FREQUENCY TELEGRAPH CHANNEL

This is the sum of H + F + H

where F is the share of telephone circuit per voice-frequency telegraph channel and H is the cost of one end of a voice-frequency telegraph channel (transmission and reception).

If A is the annual total capital invested in equipment for one end of the V.F. telegraph channel,

B is the annual maintenance cost for same

C is the annual depreciation cost for same

$$H = A + B + C$$

In this calculation the effect of compound interest and amortization of plant on annual capital costs has been ignored.

Symbols :

E capital invested (in gold francs) ;
E_f residual value (in gold francs) (0 in this case) ;
e annual maintenance costs and accomodation charges (in gold francs) ;
r rate of interest (in %) (5 % in this case) ;
v life in years ;
N number of telegraph channels per telephone circuit ;
R number of reserve sets of equipment per 100 sets.

Calculation of F (share of telephone circuit)

$$F = \frac{F_1 \text{ corrected}}{N} \times \frac{100}{100—R} \text{ or } \frac{F_2 \text{ corrected}}{N} \times \frac{100}{100—R}$$

with N = 18 (reply to question 8)
R = 30 (reply to question 9)

for a modern telephone circuit

$$F = 170 + 393 \frac{Lkm}{100} + 170$$

for an old-type circuit

$$F = 1428 \frac{Lkm}{100}$$

Calculation of A (annual capital cost of transmitting and receiving equipment at one end of a V.F. telegraph channel)

$$A = E \times r \times \frac{100}{100—R}$$

with E = 4000 (reply to question 1)
R = 30 (reply to question 9)

whence

A = 286 gold francs.

Calculation of B (annual maintenance cost and accomodation for transmitting and receiving equipment at one end of a V.F. telegraph channel).

$$B = e \frac{100}{100—R}$$

where *e* = 300 (reply to question 5)
+ 10 (reply to question 6) = 310
R = 30 (reply to question 9)

whence B = 443 gold francs.

Calculation of C (annual cost of amortizing transmitting and receiving equipment at one end of a V.F. telegraph channel)

$$C = \frac{E - E_f}{v} \times \frac{100}{100-R}$$

where

E = 4000 (reply to question 1)
v = 10 (reply to question 3)
R = 30 (reply to question 9)
whence C = 571 gold francs

Summary

Total fixed annual telegraph terminal costs per channel:
H = 286 + 443 + 571 = 1300 gold francs.

Annual cost or a voice-frequency telegraph channel

1. on a modern telephone circuit

$$V_1 = 1300 + 170 + 393 \frac{L}{100} + 170 + 1300 \text{ gold francs;}$$

2. on an old-type circuit

$$V_2 = 1300 + 1428 \frac{L}{100} + 1300$$

The table below compares the costs of:

a V.F. telegraph channel of:	over a modern telephone circuit	over an old-type telephone circuit	
100 km	3 333	4 028	gold francs
200 km	3 726	5 456	
500 km	4 905	9 740	
1000 km	6 870	16 880	

The table below gives a summary in a different form:

Annual cost of an international voice-frequency telegraph channel

	over a modern telephone circuit	over an old-type telephone circuit
Part for line proportional to cost of line per 100 km	393	1428
Cost of terminal equipment: per channel at each end		
telegraph	1300	1300
telephone	170	0

Average formula:

It can be estimated that in 1956 about 50 % of telephone circuits carrying voice-frequency telegraphy were of the modern type. The average cost price V proposed for an international V.F. telegraph channel then comes to:

$$V = 1500 + 900 \frac{Lkm}{100} + 1500$$

in round figures.

N. B.: When the voice-frequency telegraph system includes a section of submarine cable as part of its itinerary, then the higher cost for the submarine section must be taken into account; for example, in the value L, the submarine section can be counted as twice its actual length.

IV. CALCULATION OF THE ANNUAL COST OF AN INTERNATIONAL TELEGRAPH CIRCUIT

In Section III, the cost of an international voice-frequency telegraph *channel* between two international voice-frequency telegraph terminal centres was considered. An international telegraph *circuit* is often made up of one international voice-frequency telegraph channel to which one or more national voice-frequency telegraph channels are connected.

The replies to question 10 gave rise to the following proposals:

a) *for an international Telex circuit*, the circuit comprises only one international voice-frequency telegraph channel.

The average annual cost incurred by each Administration for an international Telex circuit is therefore given by:

$1500 + 900 \frac{L km}{100}$ gold francs, L being the radial distance between the international terminal centre and the frontier;

b) *for a leased circuit*, the elements for calculating the cost of an international channel may be applied, to all intents and purposes, without change, to the calculation of the average cost of a national channel.

It should however be noted that in the case of a national section, both ends of the channel contribute to the cost to be borne by the Administration; this cost is therefore:

$$2 \times 1500 + 900 \frac{L km}{100} \text{ gold francs.}$$

Administrations are thus in a position to calculate the cost of any international circuit whose make-up is known.

Nevertheless, the C.C.I.T. has been inclined to propose, as in Recommendation H.5, a lump-sum payment for leased circuits, irrespective of the actual make-up of the circuit.

With the aim of contributing to the possible establishment of such a charging system, the working party studied an average cost formula prepared on the basis of replies to question 10 for leased circuits.

According to the information thus acquired, an average of 40 % of international leased circuits consist of an international voice-frequency telegraph circuit extended by a national V.F. telegraph circuit.

In this way, in the case of 40 % of circuits, there are three sets of terminal equipment (terminal equipment for the international connection, two sets of terminal equipment for the national channel), whilst in the case of 60 % of circuits there is only one terminal equipment set (terminal equipment for the international connection).

The average burden of equipment in a formula which ignores the make-up of the circuits is therefore

$$0.6 \times 1500 + 0.4 (3 \times 1500) = 1.8 \times 1500 \text{ gold francs.}$$

For the length of circuit, the Working Party did not submit a formula which would ignore the make-up of the circuit, and proposed that the part in proportion to the length should be taken as:

$$900 \times \frac{L_1 + L_2}{100} \text{ gold francs}$$

where L^1 is the radial distance between the frontier and the international terminal centre and L_2 the radial distance between the international terminal centre and the terminal station of the national trunk section.

However, the Working Party draws the attention of Administrations to the fact that when the ends of the international circuit are geographically close and the circuit passes through international terminal centres which are fairly distant from the frontiers, this formula gives results which are very different from those which would be obtained from a calculation of the radial distance between two ends of a circuit.

For example, in the case of a circuit Lympne - Le Touquet, going via London and Paris, the cost price formula proposed involves:

for the English Administration $L^1 = 150$ km, $L_2 = 100$ km;

for the French Administration $L^1 = 300$ km, $L_2 = 200$ km;

in the total formula the distance involved is thus:

250 km on the English side
and 500 km on the French side,

whereas the radial distance is about 80 km.

c) *For a general-service circuit*, the same proposals can be made with respect to the cost price of a circuit in the general service (for which the reply to question 10 was the same as for leased circuits).

This proposal is finally:

$$1.8 \times 1500 + 900 \frac{L_1 + L_2}{100} \text{ gold francs}$$

per terminal Administration.

STUDY GROUP XI

Document S.G. XI/63-E
10 July 1956

Cost of an international Telex call

I. BASES OF CALCULATION

After examining replies by Administrations to the September, 1955, questionnaire for the study of the costs of an international telegraph circuit and of an international Telex call in the European system (Document T XI 0/0354), the Working Party adopted the following values for the different headings of the questionnaire which had to be considered in calculating the cost of an international Telex call (in the European system).

I. A GENERAL OBSERVATIONS
(Please see Document S.G. XI/62).

I. B VALUES ADOPTED
CA : SWITCHING EXPENSES

Capital Costs	In gold francs
11/12 Total costs (including overheads) of the equipment (in service and in reserve) in international Telex terminal exchanges *for manual switching* per international manually-operated Telex circuit	8000

N. B. :

1. The figure given is based on the present day value of the equipment as new.
2. Account has been taken in this calculation not only of the positions and their teleprinters, but also of common equipment (distribution frames, wirings, power supplies, measuring apparatus, inquiry positions, etc.).
3. In this calculation, the number of international Telex circuits operated *manually* includes outgoing, incoming, and both-way circuits.

	In gold francs
13/14 Total costs (overheads included) of the equipment (in service and in reserve) in international Telex terminal exchanges per *outgoing semi-automatic switching* per outgoing international Telex circuit operated semi-automatically	8000

N. B. : Notes 1 and 2 to reply 11/12 apply equally to reply 13/14.

15/16 Total costs (overheads included) of the equipment (in service and in reserve) in international Telex terminal exchanges per incoming *semi-automatic switching and for incoming fully-automatic switching (subscriber to subscriber)* per incoming international Telex circuit operated semi-automatically or automatically	1200

N. B. : Notes 1 and 2 to reply 11/12 apply equally to reply 15/16.

17/18 Total costs (including overheads) of the equipment (in service and in reserve) in international Telex terminal exchanges *for outgoing fully-automatic switching*, (subscriber to subscriber) per outgoing international Telex circuit operated automatically	6000

N. B. : Notes 1 and 2 to reply 11/12 also apply to reply 17/18 ; in particular, account should be taken of signalling and dialling converters, etc., required for passing from the national system to the system used in the distant country.

Switching costs annual charges :

19. *Charges on capital :* Average rate of interest paid on borrowed capital.	5 %
20. *Depreciation costs :* Average length of life assumed for the equipment used for :	
a) manual switching	10 years
b) semi-automatic switching	10 years
c) fully-automatic switching	10 years
21. Percentage ratio of the residual value of equipment to its initial value :	
a) manual switching	0
b) semi-automatic switching	0
c) fully-automatic switching	0

22. *Annual maintenance costs for switching equipment*

Average annual cost of maintenance (including overheads) per international Telex circuit in service :

a) manual	500
b) outgoing semi-automatic	500
c) incoming semi-automatic or fully-automatic	200
d) outgoing fully-automatic	400

N. B. : In answering these questions allowance has been made for labour costs, consumables stores, and electric power charges.

23. *Annual accomodation costs :*

Annual rental, for each international Telex circuit in use :

a) manual	200
b) outgoing semi-automatic	200
c) incoming semi-automatic or fully-automatic	20
d) outgoing fully-automatic	100

N. B. : Same note as that for reply 6 in Document S.G. XI/62.

CB : ANNUAL OPERATING COSTS

In gold francs

24. Average cost of providing operating staff (including foremen, supervisors, the staff of specialized accessory services, such as administration, inquiries, accounting, etc. and reserve staff) and including overheads, *for each international telex circuit in service :*

a) manually-operated	5000
b) semi-automatically operated for outgoing traffic	5000
c) semi-automatically or automatically operated for incoming traffic	200
d) automatically operated for outgoing traffic	1400*

CC : ANNUAL COSTS OF AN INTERNATIONAL TELEX CIRCUIT

Extract from Document S.G. XI/62 1500

$$+ \frac{900 \text{ Lkm}}{100}$$

+ 1500

CD : COSTS OF THE NATIONAL SECTION OF AN INTERNATIONAL TELEX CALL

25. Estimate (on average and per chargeable minute) of the costs attributable to the inland section of international Telex calls :

a) an outgoing call	0.12
b) an incoming call	0.12

Note : This figure (0.12) is only given as an indication, since the reply to question 25 depends on the characteristics of national networks.

CE : NUMBER OF CHARGEABLE MINUTES PER CIRCUIT

a) manual operation	30,000
b) semi-automatic operation	40,000
c) fully-automatic operation	40,000

II. CALCULATION OF THE COST OF A TELEX CALL PER CHARGEABLE MINUTE

This cost is the sum of :

— circuit costs ;
— charges on the capital cost of switching equipment ;
— maintenance and accomodation cost of switching equipment ;
— depreciation cost of switching equipment ;
— operating costs ;
— cost of switching the call to/from the international terminal exchange through the inland network to/from the subscriber.

Symbols :

O annual operating costs ;
E capital invested (in gold francs) ;
E_f residual value (in gold francs) (0 in this case) ;
e maintenance and accomodation costs per annum (in gold francs) ;

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[1] This figure takes into account the use by certain Administrations of automatic printing or perforating ticket machines.

r rates of interest (as %) ($\frac{5}{100}$ in this case) ;

v length of life in years ;

N number of chargeable minutes per telegraph circuit per year ;

(R the number of reserve sets of equipment per 100 sets does not enter into the calculations, since the number of circuits considered in the basic calculations refers to circuits in operation).

MANUAL SERVICE

O = 5000 (see reply 24 *a*)
E = 8000 (see reply 11/12)
N = 30 000 (see reply 26 *a*)
e = 500 (see reply 22 *a*) + 200 (see reply 23 *a*)
v = 10 (see reply 20)

		Per end (gold francs)	Per 100 km (gold francs)
Circuit costs :			
for one end = $\frac{1500}{30\,000}$	=	0.05	
per 100 km of line = $\frac{900}{30\,000}$	=		0.03
Charges on capital costs for switching :			
$\frac{Er}{N} = 8000 \times \frac{5}{100} \times \frac{1}{30\,000}$	=	0.0133	
Maintenance costs for switching :			
$\frac{e}{N} = \frac{700}{30\,000}$	=	0.233	
Depreciation costs for switching :			
$\frac{E}{v} \times \frac{1}{N} = \frac{8000}{10} \times \frac{1}{30\,000}$	=	0.0266	
Operating costs :			
$\frac{O}{N} = \frac{5000}{30\,000}$	=	0.1666	
Total	=	0.2798	0.03
Inland switching costs : (see reply 25)	=	(0.12)	

Total cost for one minute (0.12) + 0.28 + 0.03 $\frac{\text{Lkm}}{100}$ + 0.28 + (0.12) gold francs

Total cost for three minutes (0.36) + 0.84 + 0.09 $\frac{\text{Lkm}}{100}$ + 0.84 + (0.36) gold francs

SEMI-AUTOMATIC SERVICE OUTGOING

O = 5000 (see reply 24 *b*)
E = 8000 (see reply 13/14)
N = 40 000 (see reply 26 *b*)
e = 500 (see reply 22 *b*) + 200 (see reply 23 *b*)
v = 10 (see reply 20)

		Per end	Per 100 km
		gold francs	
Circuit costs :			
for one end $\frac{1500}{40\,000}$	=	0.0375	
per 100 km of line $\frac{900}{40\,000}$	=		0.0225
Charges on capital costs :			
$\frac{Er}{N} = \frac{8000}{40\,000} \times \frac{5}{100}$	=	0.0100	
Maintenance costs :			
$\frac{e}{N} = \frac{700}{40\,000}$	=	0.0175	
Depreciation costs :			
$\frac{E}{v} \times \frac{1}{N} = \frac{8000}{10} \times \frac{1}{40\,000}$	=	0.0200	
Operating costs :			
$\frac{O}{N} = \frac{5000}{40\,000}$	=	0.1250	
Total	=	0.2100	0.0225
Inland switching costs :	=	(0.12)	

Total cost for one minute $(0.12) + 0.21 + 0.0225 \frac{Lkm}{100} + 0.21 + (0.12)$

Total cost for three minutes $(0.36) + 0.63 + 0.0675 \frac{Lkm}{100} + 0.63 + (0.36)$

AUTOMATIC SERVICE INCOMING

O	= 200	(see reply 24 *c*)
E	= 1200	(see reply 15/16)
N	= 40 000	(see reply 26 *c*)
e	= 200	(see reply 22*c*)
	+ 20	(see reply 23 *c*)
v	= 10	(see reply 20)

		Per end	Per 100 km
		gold francs	
Circuits costs : (as for semi-automatic service outgoing)	=	0.0375	0.0225
Charges on Capital costs :			
$\frac{Er}{N} = \frac{1200}{40\,000} \times \frac{5}{100}$	=	0.0015	
Maintenance costs :			
$\frac{e}{N} = \frac{220}{40\,000}$	=	0.0055	
Depreciation costs :			
$\frac{E}{v} \times \frac{1}{N} = \frac{1200}{10} \times \frac{1}{40\,000}$	=	0.0030	

Operating costs :

		Per end	Per 100 km
		gold francs	
$\frac{O}{N} = \frac{200}{40\,000}$	=	0.0050	
Total	=	0.0525	0.0225
Inland switching costs :	=	(0.12)	

Total cost for one minute $(0.12) + 0.525 + 0.0225 \frac{Lkm}{100} + 0.0525 + (0.12)$

Total cost for three minutes $(0.36) + 0.1575 + 0.0675 \frac{Lkm}{100} + 0.1575 + (0.36)$

AUTOMATIC SERVICE OUTGOING
(See note 1)

O	= 1400	(see reply 24 *d*)
E	= 6000	(see reply 17/18)
N	= 40 000	(see reply 26 *d*)
e	= 400	(see reply 22 *d*)
	+ 100	(see reply 23 *d*)
v	= 10	(see reply 20)

		Per end	Per 100 km
		gold francs	
Circuits costs : (as for the semi-automatic service outgoing)	=	0.0375	0.0225
Charges on Capital costs : $\frac{Er}{N} = \frac{6\,000}{40\,000} \times \frac{5}{100}$	=	0.0075	
Maintenance costs : $\frac{e}{N} = \frac{500}{40\,000}$	=	0:0125	
Depreciation costs : $\frac{E}{v} \times \frac{1}{N} = \frac{6\,000}{10} \times \frac{1}{40\,000}$	=	0.0150	
Operating costs : $\frac{O}{N} = \frac{1\,400}{40\,000}$	=	0.0350	
Total	=	0,1075	0.0225
Inland switching costs :	=	(0.12)	

Total cost for one minute $(0.12) + 0.1075 + 0.0225 \frac{Lkm}{100} + 0.1075 + (0.12)$

Total cost for three minutes $(0.36) + 0.3225 + 0.0675 \frac{Lkm}{100} + 0.3225 + (0.36)$

Summary of fixed costs for one minute, per terminal

	Charges on Capital	Maintenance and Accommodation	Depreciation	Operation	Line Terminal Equipment	Total
Manual exchange (outgoing or incoming)	0.0133	0.0233	0.0266	0.1666	0.050	0.28 [2]
Manual exchange semi-automatic outgoing	0.0100	0.0175	0.0200	0.1250	0.0375	0.21 [2]
Automatic exchange incoming	0.0015	0.0055	0.0030	0.0050	0.0375	0.0525[2]
Automatic exchange outgoing [1]	0.0075	0.0125	0.0150	0.0350	0.0375	0.1075[2]

Summary of cost per minute, for each terminal Administration

	Outgoing			*Incoming*			
	Fixed line costs	Fixed switching costs	Inland switching costs	Fixed line costs	Fixed switching costs	Inland switching costs	Circuit costs in proportion to the distance per 100 km
Manual service	0.05	0.23	(0.12)	0.05	0.23	(0.12)	0.03
Semi-automatic service	0.0375	0.1725	(0.12)	0,0375	0.0150	(0.12)	0.0225
Automatic service	0.0375	0.0700	(0.12)	0.0375	0.0150	(0.12)	0.0225

Transit calls

Three main transit cases have to be considered for Telex calls.

First—on a circuit routed on a direct V.F. system : Telex circuits between terminal countries A and B are established over a voice frequency telegraph system of which the main line telephone circuit passes through transit country T.

In this case the share of the cost per minute of a Telex call due to the telephone circuit is 0.03 gold francs or 0.0225 gold francs per 100 km, depending on the Telex service operating arrangement applying.

Second—on a circuit routed over more than one V.F. system : Telex circuits between terminal countries A and B are established over a V.F. telegraph system between country A and transit country T, then over a V.F. telegraph system between transit country T and country B. In the transit country T the connection from one V.F. terminal to another is usually made on a single telegraph circuit without additional V.F. terminal equipment.

In this case the share of the cost for each minute of a Telex call to be borne by the transit Administration is :

0.03 (or 0.0225) $\frac{L_1}{100} + 0.05$ (or 0.0375) (fixed cost for the terminal equipment of the system from country A)

0.03 (or 0.0225) $\frac{L_2}{100} + 0.05$ (or 0.0375) (ditto, but from country B)

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[1] In the case of automatic outgoing traffic, only two Administrations were able to supply information and the calculation was only made as an indication.

[2] To these costs should be added :
— line costs in proportion to the distance ;
— inland switching costs (0.12 as an indication—see the note on page 377—reply to question 25).

L_1 being the radial distance from the frontier of country A to the V.F. terminal in country T;

L_2 being the radial distance from the frontier of country B to the V.F, terminal station in country T;

which makes a total of 0.03 (or 0.0225) $\frac{L_1 + L_2}{100} + 0.10$ (or 0.0750).

Third—indirect routing by manual or automatic switching : with the aid of the summary table of costs on page 10, it is easy to calculate the cost of a call established by means of switching in the transit country, taking into account the operational procedure for groups from country A to country T, and country T to country B.

If, for example, a call is established from calling country A to called country B, by means of switching in transit country T, circuits A.T. being operated on a semi-automatic basis and circuits T.B. on a manual basis, the cost for the transit country will be :

$$0.0225 \frac{L_1}{100} + 0{,}0375 + 0.0150 + 0.23 + 0.05 + 0.03 \frac{L_2}{100}$$

L_1 and L_2 having the same meaning as above.

The significance in the formulae given above for switching costs, and the extent to which these costs vary from one formula to another, precludes the possibility of establishing a formula which would satisfactorily cover all cases. It is, of course, possible to derive an average formula for the first and second cases which would be a reasonable compromise between the various methods of operation.

The Working Party considers that 4 gold centimes would be a suitable figure for the average total ine costs per minute of the Telex transit call. Fixed switching expenses (outgoing and incoming, but excluding inland switching costs) would then have to be added to line costs.

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