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Charging and accounting in international telecommunications services

Cost and tariff study method

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NOTES

1 Supplement 1 to the D-series Recommendations was approved in Melbourne (1988) and published in Fascicle II.1 of the *Blue Book*. This file is an extract from the *Blue Book*. While the presentation and layout of the text might be slightly different from the *Blue Book* version, the contents of the file are identical to the *Blue Book* version and copyright conditions remain unchanged (see below).

2 In this Supplement, the expression "Administration" is used for conciseness to indicate both a telecommunication administration and a recognized operating agency.

Supplement No. 1

COST AND TARIFF STUDY METHOD

(At the present time this method is applicable only to the countries in Europe and the Mediterranean Basin)

1 Introduction

1.1 In the past, before 1970, the CCITT made a number of studies of international telephone and telex service costs. Those studies usually referred, however, only to parts of the services and the Recommendations prepared on the subject of tariffs applied only to the European region. Those Recommendations were based on the principle that, in a given relation, the accounting rate consisted of terminal and transit shares which were the same for all the routes used. When a detour was used, the hypothetical terminal and transit shares had therefore to be reduced proportionally. The collection charges corresponded more or less to the amounts of the accounting rates converted into national currencies.

1.2 Between 1964 and 1968, a new philosophy based on a commercial principle was worked out. Recommendation D.150, adopted by the IVth Plenary Assembly of the CCITT (1968), made a clear distinction between the accounting rate and the collection charge. The accounting rate was regarded as a matter to be settled between Administrations, each Administration being reimbursed according to the cost of the equipment it made available. The fixing of collection charges became, within certain limits, a national matter. Each terminal Administration was expected to fix a collection charge in such a way that it covered at least the average of the accounting rates applicable to the various routes used.

1.3 In order to put this new conception into practice, it was necessary to undertake detailed cost studies for the technical facilities and the work involved in setting up telephone and telex calls, in sending telegrams, and in establishing sound-programme and television transmissions in the international service. For that purpose the IVth Plenary Assembly of the CCITT decided to set up four regional tariff groups, namely:

- the TAF Group for the African Region,
- the TAL Group for the Latin American Region,
- the TAS Group for the Asia and Oceania Region,
- the TEUREM Group for the Region of Europe and the Mediterranean Basin.

2 Methods used for establishing tariffs

In carrying out their task, the Tariff Groups used either a simple and purely pragmatic method, called the *synthetic method*, or a complex method, based on cost studies, called the *analytic method*.

2.1 *Synthetic method*

2.1.1 When the Administrations in a region do not have the necessary data for calculating the costs of the technical facilities and the work involved in the provision of their services (for example, when they do not have an analytical cost accounting system), or when they decide for other reasons not to make a detailed study, a Tariff Group can confine itself to making a synthesis of the tariffs applied by the various Administrations in its region. On the basis of this synthesis, the group establishes, by charging zone, a scale of overall rates for international accounting and, where appropriate, for establishing collection charges in national currencies. The overall charge used for international accounting is called the *accounting income*. It is normally shared between the Administrations of the terminal countries on a 50-50 basis. If, however, the facilities made available by the two terminal countries are not more or less equivalent, a proportion other than 50-50 may be adopted. In principle, the Administration of each terminal country pays a suitable share (normally half) of the remuneration, if any, due to the Administrations of the transit countries.

2.1.2 It is obvious that this synthetic method does not solve the fundamental problems of rate-fixing. It is incapable of establishing a rate for a service a priori, on a theoretical basis, but only a posteriori, on the basis of experience.

2.2 *Analytic method*

2.2.1 When the Administrations of a region are in a position to analyze the costs involved in the provision of a given service (amortization, financial charges, labour costs, cost of consumable materials for maintenance, taxes, costs of the services provided by third persons), a Tariff Group normally uses the so-called *analytic* method. This consists in laying down – on a rational basis and, in particular, on the basis of cost studies – standards for the fair remuneration of the various facilities made available by an Administration in providing a given service (telephone or telex call, telegram, etc.). For calculating costs, Administrations usually possess data derived from an analytical cost accounting system, which they supplement, as required, with more detailed studies and data provided by statistics.

2.2.2 By means of a questionnaire, the Tariff Group collects the data obtained by the Administrations in its region, synthesizes them, calculates average costs taking account of the special conditions prevailing in the various countries, and determines the standards to be recommended for remunerating the facilities made available by Administrations in international telecommunications services. These standards can then be used by the Administrations in the region in fixing their accounting shares for purposes of international accounting, their accounting rates and, hence, their collection charges. They take account not only of actual costs, but also of criteria recommended by the CCITT for rate-fixing purposes (e.g., the concept of services rendered).

2.2.3 The standards recommended for determining accounting rates are used for remunerating the Administrations of the terminal and transit countries by the so called *flat-rate price* or *traffic unit price* methods, explained in the relevant CCITT Recommendations.

It is only by the analytic method, therefore, that all the requirements of rate fixing can be met. This is the method traditionally used by the CCITT.

3 Cost studies

3.1 *General*

3.1.1 To carry out a detailed tariff study in international telecommunications services, a Tariff Group must know the cost of the services supplied by the Administrations and the factors affecting the provision of these services. The Tariff Group must therefore collect the detailed data from the Administrations in its region, synthesize them, calculate the average costs of the various factors and determine the standards to be adopted in remunerating the facilities made available by Administrations in providing a service in the international telecommunications services. Administrations must, of course, be assured that the data collected are treated absolutely confidentially.

3.1.2 The numerical data provided by Administrations should be expressed in a universally recognized currency. For this purpose, it is desirable to use the monetary units mentioned in Article 30 of the International Telecommunication Convention (Nairobi, 1982), i.e. either the monetary unit of the International Monetary Fund which is at present the special drawing right (SDR), or the gold-franc (G.Fr.).

In the event that the same monetary unit is not used by all Administrations, the Tariff Group should:

a) choose the monetary unit in which costs are calculated and present the results. The monetary unit used by the majority of Administrations having responded to the questionnaire will generally be used. Data given in the other monetary unit will be converted into the unit adopted by the Tariff Group;

b) convert the tariff standards established in the chosen monetary unit into the other monetary unit used by the minority of Administrations. For the conversion from SDR to G.Fr. or vice-versa, the Tariff Group shall use the conversion rate recommended in Recommendation D.195 and in the International Telecommunication Regulations adopted by the World Administrative Telegraph and Telephone Conference, 1988, i.e. 1 SDR = 3.061 G.Fr. or 1 G.Fr. = 1/3.061 SDR.

In view of the problems which may arise in rounding off the values obtained, Appendix I indicates the methodology used by the TEUREM Group to convert into SDR the tariff standards calculated in G.Fr. This methodology can also be used to convert from SDR to G.Fr.

3.1.3 The numerical data provided by Administrations should refer to the same reference year. The Tariff Group must bring them up to date for the period during which the tariffs will be applied. For this purpose the average annual variations of unit prices are taken into account, i.e. possible price increases due to inflation and reductions obtained through technical improvements or the more efficient use of facilities. In determining tariff standards, account will also be taken of a rate of interest sufficiently high to ensure the expected return on the invested capital and of the existing standby facilities made available by Administrations.

3.1.4 The values adopted by the Tariff Group are not "averages" in the strict mathematical sense, but represent values which are generally acceptable for all the countries concerned in the region. The determination of "acceptable" or "reasonable" values thus involves a considerable element of judgement and approximation.

3.2 *Working method*

In making cost studies and establishing tariff standards to be applied for paying for the facilities made available by Administrations in supplying services to users of the international telecommunication services, Tariff Groups generally use the method described below.

3.2.1 *Preparation of a questionnaire*

3.2.1.1 A detailed questionnaire is prepared for the service in question, namely for:

- the telephone service,
- the telex service,
- the public telegram service, or
- sound-programme and television transmissions, etc.

The questionnaire first refers to the *international* part of relations. If necessary, a special questionnaire may be drawn up to collect data referring to the *national extension*, i.e. that part of the connection linking the international centre with the national centres to which users' stations are connected.

3.2.1.2 Each questionnaire is divided, according to need, into several *parts* and *chapters*.

i) *Division into parts* according to the functions performed or other criteria such as:

- general information,
- transmission,
- switching and operation,
- national extension (for the case where a separate study is not carried out).

ii) *Division into chapters* according to accounting or statistical criteria, such as:

- investment costs,
- annual charges (capital charges, maintenance costs, building costs, operational costs),
- statistical information.

3.2.1.3 *Comments*

The telephone service and the telex service are, in many respects, extremely similar, even if the service supplied is different. There are, therefore, many resemblances between cost studies of these two services. The same applies, though to a lesser extent, to studies of sound-programme and television transmissions.

On the other hand, the public telegram service is, by its very nature, very different from the two above-mentioned services, primarily because it involves the handing in and delivery of telegrams, operations which usually call for the employment of considerable numbers of staff. Cost studies of this service therefore involve a number of specific characteristics.

For the "transmission" part, the same questionnaire (usually that for the telephone service) can be used for the various services (telephone, telex, sound-programme transmissions) for determining the costs:

- of a supermastergroup,
- of a mastergroup,
- of a supergroup,

– of a group,
– of a carrier telephone circuit, or
– of a voice-frequency telegraphy channel.

An example of the type of questions included is given in Annex A.

3.2.2 *Circulation of questionnaires and collection of data*

The questionnaires are circulated by the CCITT Secretariat to all Administrations in the region. The Administrations are invited to complete them as accurately as possible and return them to the CCITT Secretariat by a given date. It is unquestionably a delicate and difficult task for Administrations to prepare replies to these questionnaires, because the data are not always immediately available in the required form or presentation; research is, therefore, usually necessary to extract them from accounting and statistical documents and calculations are often required.

3.2.3 *Analysis of the replies and presentation of the results*

The CCITT Secretariat analyzes the replies provided by Administrations and presents the numerical data *anonymously* in the form of tables.

Tariff Group meetings make an itemized examination of the analysis results of each of the items in the questionnaires, and for each item a standard reply is formed. These standard replies constitute the basic data for the cost study.

A whole series of detailed calculations are made on the basis of the data thus arrived at. The model tables given in Annex B, used for recording the results of calculations, give an idea of the procedure followed, the order in which the data are considered and the sequence of calculations carried out.

The result of this procedure is the establishment of costs, standards of remuneration to be applied between Administrations and accounting rates for the various facilities made available and the services provided to users in the international telecommunication services, e.g.:

– per supermastergroup, mastergroup, supergroup or group of circuits;
– per telephone, telegraph, sound-programme, etc. circuit;
– per minute of telephone, telex, etc. call; or
– per word of a telegram.

The standards thus determined are included in the CCITT Recommendations applicable at the regional level.

3.3 *Analysis of certain problems relating to cost studies*

3.3.1 *Methods for calculating average costs*

According to the nature of the services provided by the Administrations, it is recommended that one of the methods described below be used to calculate the average costs for a region.

3.3.1.1 *Comparison by analytical costs*

In determining the average cost of the *international part* of a service provided (charges relating to technical equipment used exclusively for the international service and operating costs), it is customary to compare the *detailed numerical data* provided by the Administrations.

These numerical data refer to:

– investment costs,
– maintenance costs,
– building costs,
– operating costs.

The aim of the study being to calculate, for a given year, the average annual charges of the equipment made available and the average costs per traffic unit (for example per minute of telephone call), the procedure described below should be followed.

3.3.1.1.1 *Investment costs*

First, the average investment costs are calculated per given unit or element on the basis of the numerical data supplied by Administrations for the reference year (for example, per 100 km of actual length of an installed supergroup). Next, the investment cost is calculated for equipment *in service* in the form established and for the year in which the tariff rates are to be applied. To obtain these results, coefficients are applied bearing in mind:

- standbys (installed apparatus/apparatus in service),
- price increases (annual variation rates),
- composition of the standard network (relative importance of coaxial cables, radio-relay links, etc.),
- the ratio: actual length/crowflight distance of the transmission facilities.

3.3.1.1.2 *Financial charges*

The average investment costs are used to calculate the annual *financial charges* per piece of equipment in service, on the basis of the weighted average life assumed for this equipment and the interest rate assumed for remunerating invested capital. For this purpose the "Table giving amortization coefficients as a function of amortization period and interest rate", contained in Annex C, is used. These annual charges are generally called "capital charges" or "financial charges".

3.3.1.1.3 *Maintenance costs*

The average annual maintenance costs are calculated per given unit or element (installed circuit or group of circuits) on the basis of numerical data supplied by the Administrations for the reference year. If Administrations cannot specify actual amounts, agreement is reached on a percentage to be applied to the investment cost to calculate the annual maintenance costs.

The annual maintenance costs are then calculated per equipment *in service* in the form established and for the year in which the tariff rates are to be applied, following the procedure described in "Investment costs".

In evaluating maintenance costs, particular account should be taken of the following types of cost: staffing and labour, consumable materials, electricity and transport.

3.3.1.1.4 *Building costs*

Since some premises either belong to or are rented by the Administrations and equipment is generally installed in premises together with other equipment or services, building costs are usually calculated in the form of an *annual rental.* Exceptions to this rule are buildings which essentially have one purpose only, for example, radio-relay stations. In cases such as these, buildings are included in investment costs.

Annual building costs per piece of equipment *in service,* in the form established and for the year in which the tariff rates are to be applied, are calculated in the same way as annual maintenance costs.

3.3.1.1.5 *Operation costs*

For the purpose of cost studies, the only expenses considered as operation costs are the costs of the staff responsible for the setting up of calls, the international information service, the processing of telegrams, etc. Operation costs also include supervisory and senior staff. Overheads are included in these expenses.

With regard to the telephone and telex services, operation costs are calculated per circuit in service per year.

Average operation costs are determined on the basis of numerical data supplied by the Administrations for the reference year. They are brought up to date to correspond to the period in which the tariff rates are to be introduced by applying an increase coefficient to take account of the increase in salaries during the period in question, i.e. the annual variation rate in the total wage bill.

3.3.1.1.6 *Total annual charges*

The total annual charges per telecommunication circuit or circuit group are calculated by adding the amounts obtained for the "Transmission" part and the "Switching and operation" part under the headings:

- financial charges,
- maintenance costs,
- building costs,
- operation costs.

3.3.1.1.7 *Traffic unit cost*

To calculate the traffic unit cost (minute of telephone or telex call, etc.) the total annual charges for an international circuit are divided by the average number of traffic units routed by the circuit per year.

3.3.1.2 *Direct comparison of national costs*

In determining the average cost of the *national extension* of a service provided (telephone or telex communication), i.e. the part of the connection extending from the international centre to the national centres of the subscribers, it would be difficult to employ the method described under "Comparison by analytical costs". There are considerable differences between countries with regard to:

- the structure, as well as technical and operating conditions, of national networks;
- telephone and telex subscriber density;
- the distribution of international traffic within each country;
- the organization of the Administration;
- the methods and means of financing;
- the cost of living.

3.3.1.2.1 *Method employed*

In this case a simplified method is normally used i.e. the *costs calculated by Administrations for their respective countries are compared directly* per traffic unit (minute) for one of the elements or services listed below:

- a national local or trunk exchange;
- a terminal transmission equipment;
- 100 km (crowflight) of a national circuit;
- billing of subscribers, international accounting, management of international services (administrative costs).

To calculate the average total cost of the *national extension* of a region per traffic unit, the Administration should also provide statistical and financial data, namely:

- the number of national exchanges, trunk and local (weighted average) used to route an incoming and outgoing telephone or telex call;
- the number of terminal transmission equipments (weighted average) used to route an incoming and outgoing international telephone or telex call between the international centre and the national terminal centre;
- the crowflight distance (weighted average) of the national circuit used between the international centre and the national terminal centre in setting up an incoming and outgoing international telephone or telex call;
- the rate of interest on invested capital;
- the estimated average annual cost variation rate until the year in which the tariff rates are to be applied.

The procedure described below is then followed.

3.3.1.2.2 *Calculation of average costs per element*

A preliminary adjustment should be made of the numerical data supplied by each Administration for the reference year, taking into account the uniform interest rate allowed by the Tariff Group for remuneration of invested capital (this is necessary as there is usually a difference between the rate adopted by an Administration for its analytical accounting and the rate allowed by the Tariff Group). To calculate the proportion of the financial charges in the total costs, data can be extracted from the study of the costs (analytical cost comparison) of the international part of the service in question.

In the second stage of the calculation, the average costs adopted for the reference year are multiplied by a coefficient to take account of the variation in costs between the reference year and the period in which the tariff rates are to be applied, in order to obtain the average amounts to be applied during this period.

3.3.1.2.3 *Calculation of total average prices for the national extension*

From the statistical data supplied, it is possible to establish the weighted average number of elements (exchanges, terminal transmission equipments, length of national circuits) utilized in the given region for the *national extension* involved in international calls. These values are used to calculate the total average costs of the *national extension* per minute of incoming and outgoing international calls. The cost for each element is multiplied by the average number of elements utilized; the sum of these results is then calculated and the administrative costs added.

3.3.2 *Considerations relating to the calculation of investment costs and financial charges*

3.3.2.1 *General considerations*

Expenditure associated with acquiring and owning property sometimes referred to as "initial investment costs", constitutes what is usually termed investment costs. Initial investment costs generally refer to the one-time expenditure needed to acquire at a substantial cost property and plant which normally has a long life expectancy.

Investment costs are a major component in cost studies. They are entered into the accounts over the period during which the material will be used and determine one of the most important items making up the annual charges, i.e. the financial charges, or "amortization costs".

Economically, the concept of amortization lays stress on the renewal of the assets which is necessary if the initial value of the capital is to be preserved and the enterprise is not to suffer a loss of substance. Thus, the basis is generally the "replacement value of the fixed assets to the condition they were in on being put into service".

3.3.2.2 *Considerations relating to the study in question*

In a telecommunications service cost study, it is customary to:

- evaluate investments relating to equipment and installations according to the replacement value or purchasing price of this material at the time of the study;
- include the *overheads* of the Administrations (costs for administrative, research, information and training services, etc.) in the investment costs.

3.3.2.2.1 *Residual value of equipment*

Generally, at the end of its normal service period, telecommunication equipment is no longer usable and its residual value is consequently negligible.

3.3.2.2.2 *Weighting of certain basic numerical data*

International land networks frequently make use of transmission media of different kinds, i.e. symmetric pair cables, coaxial cables, radio-relay systems, for each of which separate data are required for the cost study. However, as the cost has to be determined for a combined network, weighting is necessary at some stage. To

arrive at a single cost price, weighting is carried out at the investment level as a function of the relative importance of the different types of cable used (expressed as a percentage in an item of the questionnaire).

3.3.2.2.3 *Basis for calculating the investment cost of telephone circuits on carrier systems*

Since there are differences in the maximum capacity of carrier systems (6 MHz, 12 MHz, 60 MHz), the usual basis used for calculating the investment cost of carrier system circuits is the supergroup (60 channels) actually installed rather than the maximum capacity of the route. To do this, the average cost per 100 km of the route is divided by the average number of supergroups installed. The investment cost per group (12 channels) and per telephone circuit installed is then calculated by dividing this amount by 5 and 60 respectively.

ANNEX A

Examples of questions asked in the questionnaire to collect basic data for a cost study of telecommunication services

I Investments relating to transmission systems

I.1 *Telephone circuits on carrier systems*

I.1.1 *Supergroups* (60 channels) – (Take into account only the supergroups actually installed and not the maximum capacity).

What average construction and installation costs (in gold francs) does your Administration allow for components A and B (see Note 1 below) in the case of a supergroup installed in a:

		A	B
a)	coaxial or symmetric pair land cable,	_ _ _ gold fr.	_ _ _ gold fr.
b)	radio-relay link,	_ _ _ gold fr.	_ _ _ gold fr.
c)	coaxial submarine cable (other types of submarine cable are excluded) (component A is included in component B)		_ _ _ gold fr.

I.1.2 *Groups* (12 channels)

What average construction and installation costs (in gold francs) does your Administration allow for component A in the case of a group installed in a:

		A
a)	coaxial or symmetric pair land cable,	_ _ _ gold fr.
b)	radio-relay link.	_ _ _ gold fr.

(With regard to component B, see Note 2 below.)

I.1.3 *Carrier telephone circuits*

What average construction and installation costs (in gold francs) does your Administration allow for component A of a carrier circuit: _ _ _ gold fr.

(With regard to component B, see Note 2 below.)

Note 1 – The cost of international telecommunication circuits should be expressed in the form:

$$A + B \times \frac{l}{100}$$

A represents all costs relating to terminal transmission equipment *for one end of the international circuit*;

B represents the costs per 100 km of real length, l of the circuit.

Note 2 – Component B should include the cost of intermediate repeaters, the cost of terminal repeaters to an amount not exceeding that of the intermediate repeaters and the cost of translation equipments used for the transfer from one telecommunication route to another. The cost of construction and installation per supergroup, group and circuit is a straightforward division from one step to the next.

II Investments relating to switching centres

II.1 What is the average construction and installation cost, for your Administration, of an international switching centre, including the operator's position, expressed as cost per circuit (in use or spare) for circuits operated:

	Gold francs
a) manually	.....
b) semi-automatic outgoing	.....
c) semi-automatic or automatic incoming	.....
d) automatic outgoing	.....
e) automatic transit	.....

III Annual costs relating to switching centres

III.1 *Amortization costs*

What weighted average useful life do you take to calculate one year's amortization instalment for:

	Useful life (years)
a) manual switching equipment (including the operator's position)	.....
b) semi-automatic switching equipment (including the operator's position)	.....
c) automatic switching equipment	.....

ANNEX B

TABLE B-1

Calculation of the weighted mean value of investments for the "transmission" part

Units and components considered			Investments for year	Coefficient of increase for spares	Total for year	Cost increases		Estimated investments for year	Typical network weighting coefficient	Weighted total for year	Real to crowflight length ratio	Overall results for year	
						Annual rate	Coeffi-cient					Component A	Component B
Super group	A												
	B	coax/SP RR ..... SM											
Group	A												
	B	coax/SP RR ..... SM											
Telephone circuit	A												
	B	coax/SP RR ..... SM											
Telegraph circuit	50 bauds	A											
		B											
	100 bauds	A											
		B											
	200 bauds	A											
		B											

Component A Cost of transmission system independent of length (cost of terminal equipment)

Component B Cost of transmission system in proportion to its length (cost of cable and intermediate repeaters)

coax. Coaxial cable

RR Radio-relay

SP Symmetric pair cable

SM Submarine cable

TABLE B-2

Calculation of annual costs for maintenance and buildings (transmission part)

Unit considered		Component A								Component B								
		Maintenance costs for year ..... (1)	Building costs for year ..... (2)	Total (1)+(2)	Increase coefficient for spares	Total costs for year	Cost increases		Total costs for year	Weighted maintenance cost for year	Coefficient of increase for spares	Total costs for year	Cost increase		Total costs for year	Real to crowflight length ratio	Total costs for year ..... (100 km crowflight distance)
							Annual rate	Coefficient					Annual rate	Coefficient			
Supergroup																	
Group																	
Telephone circuit																	
Telegraph circuit	50 bauds 100 bauds 200 bauds																

TABLE B-3

Total annual costs for the "transmission part"

Units and components considered			Overall investments for year	Useful life (years)	Amortization coefficient (i = ...)	Amortization		Maintenance + buildings		Total annual costs for year	
						A	B	A	B	A	B
Supergroup		A B									
Group		A B									
Telephone circuit		A B									
Telegraph circuit	50 bauds	A B									
	100 bauds	A B									
	200 bauds	A B									

i = interest on the remuneration of capital.

TABLE B-4

Telephone switching – Annual capital costs

Mode of operation	Investments						Useful life (years)	Amortization coefficient (i = ...)	Annual capital costs (year .....)
	Circuit installed (year .....)	Coefficient of increase for spares	Circuit in service (year .....)	Cost increases		Circuit in service (year .....)			
				Annual rate	Coefficient				
Manual operation Outgoing or incoming circuit Transit circuit									
Semi-automatic operation Outgoing circuit Incoming circuit									
Automatic operation Outgoing circuit Incoming circuit Transit circuit									

TABLE B-5

Telephone switching and operation – Total annual costs

Mode of operation	Switching												Operation				Total annual costs (year .....)
	Capital costs (year .....)	Maintenance				Buildings						Total switching costs (year .....)	Circuit in service (year .....)	Cost increases		Circuit in service (year .....)	
		Circuit in service (year .....)	Cost increases		Circuit in service (year .....)	Circuit installed (year .....)	Coefficient of increase for spare	Circuit in service (year .....)	Cost increases		Circuit in service (year .....)			Annual rate	Coefficient		
			Annual rate	Coefficient					Annual rate	Coefficient							
Manual operation Outgoing or incoming circuit Transit circuit																	
Semi-automatic operation Outgoing circuit Incoming circuit																	
Automatic operation Outgoing circuit Incoming circuit Transit circuit																	

ANNEX C

Table giving amortization coefficients as function of amortization period and estimated interest rate

(Annual charge to be paid at the end of each year in order to amortize a capital of 1 monetary unit during t *years)*

t	$\frac{r}{1-(1+r)^{-t}} = \frac{r(1+r)^t}{(1+r)^t-1}$											
	Interest											
	5%	6%	7%	8%	9%	10%	11%	12%	13%	14%	15%	20%
1	1.0500	1.0600	1.0700	1.0800	1.0900	1.1000	1.1100	1.1200	1.1300	1.1400	1.1500	1.2000
2	0.5378	0.5454	0.5531	0.5608	0.5685	0.5762	0.5839	0.5917	0.5995	0.6073	0.6151	0.6545
3	0.3672	0.3741	0.3811	0.3880	0.3951	0.4021	0.4092	0.4163	0.4235	0.4307	0.4380	0.4747
4	0.2820	0.2886	0.2952	0.3019	0.3087	0.3155	0.3223	0.3292	0.3362	0.3432	0.3503	0.3863
5	0.2310	0.2374	0.2439	0.2505	0.2571	0.2638	0.2706	0.2774	0.2843	0.2913	0.2983	0.3344
6	0.1970	0.2034	0.2098	0.2163	0.2229	0.2296	0.2364	0.2432	0.2502	0.2572	0.2642	0.3007
7	0.1728	0.1791	0.1856	0.1921	0.1987	0.2054	0.2122	0.2191	0.2261	0.2332	0.2404	0.2774
8	0.1547	0.1610	0.1675	0.1740	0.1807	0.1874	0.1943	0.2013	0.2084	0.2156	0.2229	0.2606
9	0.1407	0.1470	0.1535	0.1601	0.1668	0.1736	0.1806	0.1877	0.1949	0.2022	0.2096	0.2481
10	0.1295	0.1359	0.1424	0.1490	0.1558	0.1627	0.1698	0.1770	0.1843	0.1917	0.1993	0.2385
11	0.1204	0.1268	0.1334	0.1401	0.1469	0.1540	0.1611	0.1684	0.1758	0.1834	0.1911	0.2311
12	0.1128	0.1193	0.1259	0.1327	0.1397	0.1468	0.1540	0.1614	0.1690	0.1767	0.1845	0.2253
13	0.1065	0.1130	0.1197	0.1265	0.1336	0.1408	0.1482	0.1557	0.1634	0.1712	0.1791	0.2206
14	0.1010	0.1076	0.1143	0.1213	0.1284	0.1357	0.1432	0.1509	0.1587	0.1666	0.1747	0.2169
15	0.0963	0.1030	0.1098	0.1168	0.1241	0.1315	0.1391	0.1468	0.1547	0.1628	0.1710	0.2139
16	0.0923	0.0990	0.1059	0.1130	0.1203	0.1278	0.1355	0.1434	0.1514	0.1596	0.1679	0.2114
17	0.0887	0.0954	0.1024	0.1096	0.1170	0.1247	0.1325	0.1405	0.1486	0.1569	0.1654	0.2094
18	0.0855	0.0924	0.0994	0.1067	0.1142	0.1219	0.1298	0.1379	0.1462	0.1546	0.1632	0.2078
19	0.0827	0.0896	0.0968	0.1041	0.1117	0.1195	0.1276	0.1358	0.1441	0.1527	0.1613	0.2065
20	0.0802	0.0872	0.0944	0.1019	0.1095	0.1175	0.1256	0.1339	0.1424	0.1510	0.1598	0.2053
21	0.0780	0.0850	0.0923	0.0998	0.1076	0.1156	0.1238	0.1322	0.1408	0.1495	0.1584	0.2044
22	0.0760	0.0830	0.0904	0.0980	0.1060	0.1140	0.1223	0.1308	0.1395	0.1483	0.1573	0.2037
23	0.0741	0.0813	0.0887	0.0964	0.1044	0.1126	0.1210	0.1296	0.1383	0.1472	0.1563	0.2031
24	0.0725	0.0797	0.0872	0.0950	0.1030	0.1113	0.1198	0.1285	0.1373	0.1463	0.1554	0.2025
25	0.0710	0.0782	0.0858	0.0937	0.1018	0.1102	0.1187	0.1275	0.1364	0.1455	0.1547	0.2021
30	0.0651	0.0726	0.0806	0.0888	0.0973	0.1061	0.1150	0.1241	0.1334	0.1428	0.1523	0.2008
35	0.0611	0.0690	0.0772	0.0858	0.0946	0.1037	0.1129	0.1223	0.1318	0.1414	0.1511	0.2003
40	0.0583	0.0665	0.0750	0.0839	0.0930	0.1023	0.1117	0.1213	0.1310	0.1407	0.1506	0.2001
45	0.0563	0.0647	0.0735	0.0826	0.0919	0.1014	0.1110	0.1207	0.1305	0.1404	0.1503	0.2001
50	0.0548	0.0634	0.0725	0.0817	0.0912	0.1009	0.1106	0.1204	0.1303	0.1402	0.1501	0.2000

APPENDIX I

(to Supplement No. 1)

Conversion into special drawing rights (SDRs) of the tariff standards in the Recommendations of the TEUREM Group

Methodology

In Table I-1 the amounts in column 2 (gold francs) have been divided by 3.061 to produce the amounts in column 3 (SDRs). The amounts (SDRs) in column 4 have been determined in accordance with one of the three following cases.

Case a

Where the amount in 3 exceeded 100, no figures after the decimal point are shown. However if the first figure after the decimal point was equal to/greater than 5, the amount before the decimal point was rounded *up* to the nearest whole number.

e.g. 2188.8271 became 2189
3920.2874 became 3920

Case b

Where the amount in 3 was less than 100 but exceeded 1.0, the amount has been confined to 3 figures. In cases where the fourth figure was equal to/greater than 5, the preceding figures were rounded *up*.

e.g. 49.003593 became 49.0
3.7569421 became 3.76

Case c

Where the amount in 3 was less than 1.0, the amount after the decimal point has been confined to 3 figures. In cases where the fourth figure was equal to/greater than 5, the preceding figures were rounded *up*.

e.g. 0.0065338 became 0.007
0.0588043 became 0.059
0.5880431 became 0.588

TABLE I-1

Table of values, in gold francs and special drawing rights, for Recommendations D.300 R to D.310 R

Unit element considered	Values fixed in gold francs (G.Fr.)	Values fixed in (SDR)	Values fixed in SDR (amounts rounded)
1	2	3	4
Recommendation D.300 R			
Line part			
telephone circuit	1 200	392.02874	392
group	12 000	3920.2874	3 920
supergroup	50 000	16334.531	16 335
mastergroup	200 000	65338.124	65 338
supermastergroup	550 000	179679.84	179 680
Terminal equipment			
telephone circuit	1 300	424.69781	425
group	3 200	1045.4099	1 045
supergroup	6 700	2188.8271	2 189
mastergroup	16 000	5227.0499	5 227
supermastergroup	30 000	9800.7187	9 801
Earth station	30 000	9800.7187	9 801
International network			
manual operation	0.04	0.0130676	0.013
automatic operation	0.02	0.0065338	0.007
Exchanges			
manual	2.00	0.6533812	0.653
automatic	0.18	0.0588043	0.059
semi-automatic	1.80	0.5880431	0.588
of destination	0.11	0.0359359	0.036
of automatic transit	0.16	0.0522704	0.052
National extension			
outgoing	0.40	0.1306162	0.131
incoming	0.35	0.1143417	0.114
Earth station	0.46	0.1502776	0.150
Space segment	0.23	0.0751388	0.075
Recommandation D.301 R			
Exchanges			
automatic	0.09	0.0294021	0.029
semi-automatic	2.40	0.7840574	0.784
manual	2.50	0.8167265	0.817
automatic transit	0.12	0.0392028	0.039
National extension			
outgoing	0.27	0.0882064	0.088
incoming	0.25	0.0816726	0.082
Telegraph channel			
50 bauds	45	14.701078	14.7
100 bauds	90	29.402156	29.4
200 bauds	180	58.804312	58.8
300 bauds	210	68.605031	68.6

TABLE I-1 *(cont.)*

Unit element considered	Values fixed in gold francs (G.Fr.)	Values fixed in (SDR)	Values fixed in SDR (amounts rounded)
1	2	3	4
Recommendation D.301 R (cont.)			
Carrier circuit	1 200	392.02874	392.0
Terminal equipment			
50 bauds	660	215.61581	216
100 bauds	900	294.02156	294
200 bauds	1 350	441.03234	441
300 bauds	2 200	718.71937	719
Earth station			
50 bauds	1 100	359.35968	359
100 bauds	2 100	686.05031	686
200 bauds	4 000	1306.7624	1 307
300 bauds	5 000	1633.4531	1 633
Carrier circuit	30 000	9800.7187	9 801
Space segment per minute	0.038	0.0124142	0.012
Recommendation D.302 R			
Terminal tariff per word	0.80	0.2613524	0.261
Manual transit tariff	0.50	0.1633453	0.163
Gentex	0.012	0.0039202	0.004
Tariff per telegram	11.50	3.7569421	3.76
Tariff per word	0.40	0.1306762	0.131
Recommendations D.303 R and D.310 R			
Sound-programme transmission			
preparation and operation	90.0	29.402156	29.4
terminal equipment (10 kHz)	2.0	0.6533812	0.653
(stereo)	4.0	1.3067624	1.31
transit equipment (10 kHz)	3.2	1.0454099	1.05
(stereo)	6.4	2.0908199	2.09
international circuit (10 kHz)	0.4	0.1306762	0.131
(stereo)	1.0	0.3266906	0.327
surcharge	30.0	9.8007187	9.8
Television-programme transmission	150.0	49.003593	49.0
terminal equipment	10.0	3.2669062	3.27
transit	17.0	5.5537406	5.55
international circuit	15.0	4.9003593	4.90
Television circuit			
terminal equipment	125 000	40836.327	40 836
per 100 km	200 000	65338.124	65 338

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