INTERNATIONAL TELECOMMUNICATION UNION

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MAINTENANCE:

INTERNATIONAL LEASED CIRCUITS

ASSESSMENT OF THE SERVICE AVAILABILITY PERFORMANCE OF INTERNATIONAL LEASED CIRCUITS

ITU-T Recommendation M.1016

(Extract from the *Blue Book*)

NOTES

1 ITU-T Recommendation M.1016 was published in Fascicle IV.2 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 Recommendation, the expression "Administration" is used for conciseness to indicate both a telecommunication administration and a recognized operating agency.

Recommendation M.1016

ASSESSMENT OF THE SERVICE AVAILABILITY PERFORMANCE OF INTERNATIONAL LEASED CIRCUITS

1 General

The attention of Administrations is drawn to the benefits which can be derived from basing assessments of the service availability performance of international leased circuits on internationally agreed practices. Adoption of common practices assists international cooperation in identifying and clearing service difficulties, allows Administrations to compare performance results, and enables Administrations to present a common approach in discussions with customers.

To this end, this Recommendation offers guidance to Administrations on assessing the service availability of international leased circuits[1)] on the performance figures which may be used in such assessments and the method of deriving such performance figures.

Where appropriate, the terms and definitions given in Recommendation E.800 [1] and in Supplement No. 6 to Fascicle II.3[2] have been used in this Recommendation.

2 Basis of assessments of service availability performance

In establishing a common method to assess the service availability performance of international leased circuits, the CCITT has been concerned to ensure that the basic information for such an assessment is readily available to all Administrations. To this end, the assessment procedure in this Recommendation is based on a "service orientated" approach. This approach implies that fault reports made by customers and planned interruptions which unacceptably disrupt the customer's service, will play a major role.

The adoption of the service orientated approach recognizes that in order to determine the true service availability performance with accuracy it would be necessary, for example, to continuously observe the circuits in some way, and to record the number and duration of all events which affect their performance. This requirement cannot reasonably be met by most Administrations, and the best that can be achieved in practice is an approximation of the true performance.

Another basic factor in the assessment procedure is that, for international leased circuits, no differentiation should be made on the basis of, for example, circuit length, circuit quality (Recommendations M.1020, M.1025 and M.1040), type of routing, etc. Such differentiation may be carried out by an Administration for internal purposes if it so desires.

3 Purpose of the assessment procedure

3.1 *General*

The assessment procedure specified in this Recommendation may be used for two purposes:

– international purposes;

– national purposes.

3.2 *International purposes*

The assessment procedure is used for international purposes when two Administrations wish to assess together the performance of individual international leased circuits (or a group of circuits) as a whole for special investigations, for dealing with customers' complaints or similar situations.

For such assessments it is necessary, as far as practicable, to gather simultaneously all available information on the performance of the circuit(s) from the Administrations involved. Thus, the stations with control responsibilities (Recommendations M.1012 and M.1013) play an essential role.

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1) In this Recommendation only full-time, point-to-point international leased circuits (as defined in Recommendation M.1010 and specified in Recommendations M.1020, M.1025 and M.1040) are considered. The service availability performance of part-time, wide-band, multi-terminal, tec. international leased circuits requires further study.

Note – This approach should be followed when investigations of the service availability performance of international leased circuits is undertaken by CCITT, as may be required from time-to-time.

3.3 *National purposes*

The assessment procedure is used for national purposes when an individual Administration wishes to provide itself with information for its own internal purposes on the performance of the international leased circuits it operates, for example, to identify adverse trends in performance, or to check the effectiveness of its maintenance procedures. Such evaluations of international leased circuit performance may be based on information already available to the Administration (without the need to gather information from other Administrations), and may be carried out for all circuits whether or not the Administration provides the control station.

Note – Assessments of the type mentioned in §§ 3.1 and 3.2 above in no way change the intent that control stations be informed of all faults detected by a sub-control station – see Recommendation M.1013.

4 Description of the assessment procedure

4.1 *Collection of basic data*

Three fundamental conditions must be taken into account when collecting basic data for assessing the service availability performance of international leased circuits:

a) faults, as reported by the customer and confirmed by tests and investigations carried out by the Administrations;

b) impairments to normal service, as reported by the customer, where the customer chooses to continue to use the circuit in a degraded condition;

c) planned interruptions to service to enable, for example, permanent repair work to be carried out, maintenance routines to be performed, etc. (see Recommendation M.490 [3]).

In determining if and how downtime is to be included in the assessment procedure, the following principles should be applied:

– if tests or investigations reveal that a fault or impairment exists (or has existed), downtime will be taken into account;

– if no fault or impairment is ever observed by the Administration, no downtime will be taken into account;

– the time the Administration returns service to the customer (or the first attempt to do so) is taken as the end of downtime;

– only those planned interruptions which unacceptably disrupt the customers service will be taken into account.

Note – Where the bandwidth of the circuit is divided to provide for simultaneous multiple transmission of different services (for example, simultaneous speech plus data), only those faults which affect the entire circuit and partial faults which require the entire circuit to be taken out of service for fault finding and repair should be taken into account in the assessment procedure.

These principles are embodied in Tables A-1/M.1016 and A-2/M.1016, which define those conditions where downtime should be taken into account, and the start and end of downtime, for customer reported faults and planned interruptions of service respectively.

In certain circumstances the assistance of the customer or access to his premises is necessary to locate/clear a fault or an impairment to service. Where the customer denies such assistance, or denies access to his premises, the extra downtime which may result should be excluded from the assessment of performance.

4.2 *Basic data*

The basic data required in connection with the assessment procedure are:

– the number of international leased circuits involved. Guidance on how to determine this number is given in Annex B;

– the designation of each circuit involved, as agreed between Administrations in accordance with Recommendation M.140 [4];

– for each involved circuit, the number of faults and unacceptable planned interruptions of service within the observation period (refer to Annex A);

– for each fault and planned interruption of service:

  i) the start of downtime (in UTC)[2)]

  ii) the end of downtime (in UTC)

  iii) the duration of downtime;

– the address(es) of involved Administrations and, ideally, the name and telephone number of an appropriate contact person within each Administration.

The additional information specified in § 5 below is also considered as basic data for the assessment procedure.

4.3 *Observation period*

For the purpose envisaged in § 3.2 above, the observation period should be three calendar months. For practical reasons it is advisable that the observation period start at 00.00 UTC on the first day of a quarter of the year, and end at 24.00 UTC on the last day of that quarter.

For the purpose envisaged in § 3.3 above, Administrations are free to select an observation period which suits their needs.

4.4 *Exchange of information between terminal Administrations*

At the end of the observation period, the basic data is recorded on forms, examples of which are shown in Appendices I and II to this Recommendation. Examples of completed forms are given in Appendices III and IV to this Recommendation. Appendices I and III relate to information supplied by the control station, while Appendices II and IV relate to the sub-control station. Forms, completed with information from the sub-control station should be sent to the Administration which has control station responsibility.

4.5 *Elaboration of results*

It is the responsibility of the Administration providing the control station to combine the information supplied by the control and sub-control stations. In practice it is found that this information is often different, and the following rules should be used to handle such differences:

a) if a fault (or unacceptable planned interruption) is reported by both control and sub-control stations, then the start of downtime is the earliest time indicated by the control or sub-control station and the end of downtime is that recorded by the control station;

b) if a fault (or unacceptable planned interruption) is reported by only one of the stations, then such a fault is deemed to have occurred and the corresponding downtime is taken into account.

For rules used for combining the additional information specified in § 5 below, reference is made to Annex C.

2) UTC = Coordinated universal time (UTC is equal to GMT, but replaces it; see Recommendation B.11 [5]).

4.6 *Presentation of service availability performance information*

The methods of calculating and presenting service availability performance information for international leased circuits are given in detail in Annex B.

When service availability performance information is to be supplied to other Administrations, and when making international comparisons, the following parameters should be presented:

a) number of circuits involved in the assessment. (Where this is less than the total number of circuits in service, the number of circuits in service should also be supplied),

b) mean downtime per circuit,

c) mean number of faults per circuit,

d) mean time to failure (MTTF),

e) percentage of circuits for which no downtime was recorded,

f) mean time to restore service (MTRS).

In addition, and at the discretion of Administrations, the following parameters may also be presented:

g) long-term mean downtime per circuit (over at least four consecutive observation periods),

h) percentage of circuits with downtime less than the mean,

i) downtime per circuit not exceeded by 95% of the circuits.

For items a) to i) above, reference is made to Annex B.

4.7 *Treatment of events which distort service availability performance figures*

Service availability performance figures for international leased circuits can be significantly influenced (or their meaningfulness destroyed) by catastrophic events, for example, destruction of facilities by hurricane or earthquake. In view of this, the following procedure should be adopted:

Events which, based on previous experience, have noticeably influenced the performance figures should not be excluded. However, in this case, a second calculation should be made to present the performance figures with the catastrophic event(s) excluded.

This procedure attempts to maximize the possibility of all events being included in the performance figures in some manner.

5 Considerations for comparing service availability performance information internationally

5.1 Administrations are encouraged to exchange service availability performance information on international leased circuits on a regular basis.

5.2 In order to assist the interpretation of service availability performance information, particularly when exchanged between Administrations, relevant additional information should also be supplied. Such additional information should cover the following aspects:

a) priority maintenance attention to international leased circuits;

b) duplicated circuit sections;

c) fault clearance service;

d) transmission limits which define whether or not a fault exists;

e) information to customers about planned interruptions to service.

Annex C specifies the above information in greater detail, while Appendices III and IV show how the information is to be exchanged between Administrations.

5.3 Detailed maintenance procedures and the methods by which Administrations confirm the existence of faults on international leased circuits are different. Such differences may lead to differences in the service availability performance results obtained by Administrations.

ANNEX A

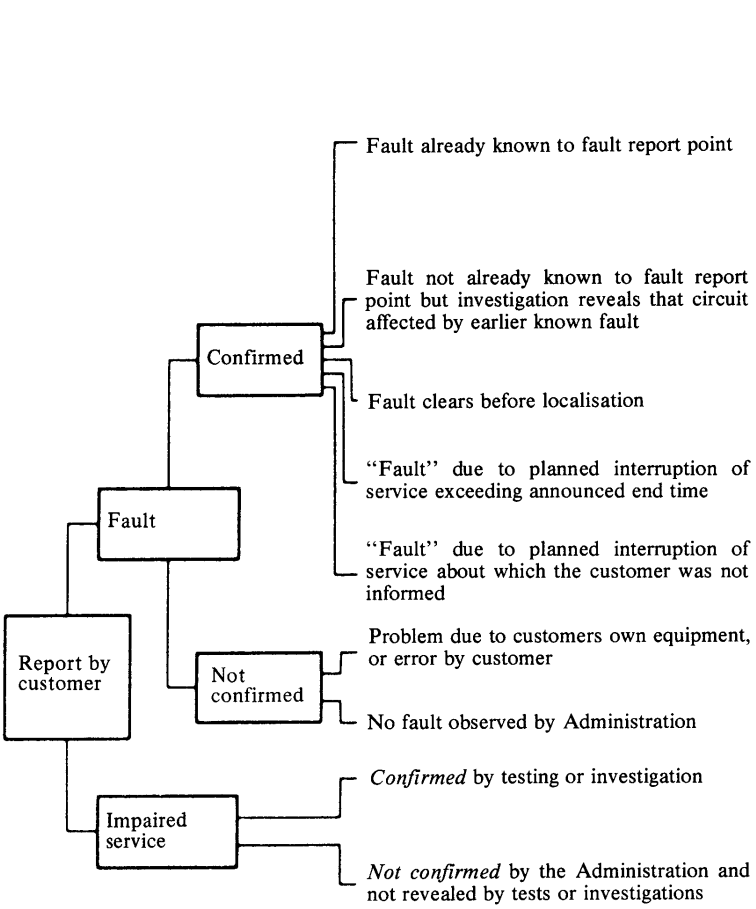
(to Recommendation M.1016)

Rules for determining the number of faults and the downtime to be taken into account in assessments of the service availability performance of international leased circuits

A.1 Detailed principles for the determination of the number of faults and impairments affecting service availability performance, and their resulting downtime, are given in Table A-1/M.1016.

TABLE A-1/M.1016

Determination of downtime due to customer reported faults and service impairments



	Downtime	
Included	Starts	Ends
Yes	Customer report time	When service returned to customer (or first attempt to do so)
Yes	Customer report time	
Yes	Announced end time of planned interruption	
Yes	Announced start time of planned interruption (Note 1)	Announced end time of planned interruption (Note 2)
No	–	–
No	–	–
Yes	Downtime = total time the circuit was taken from the customer for testing and fault clearance	
No	–	–

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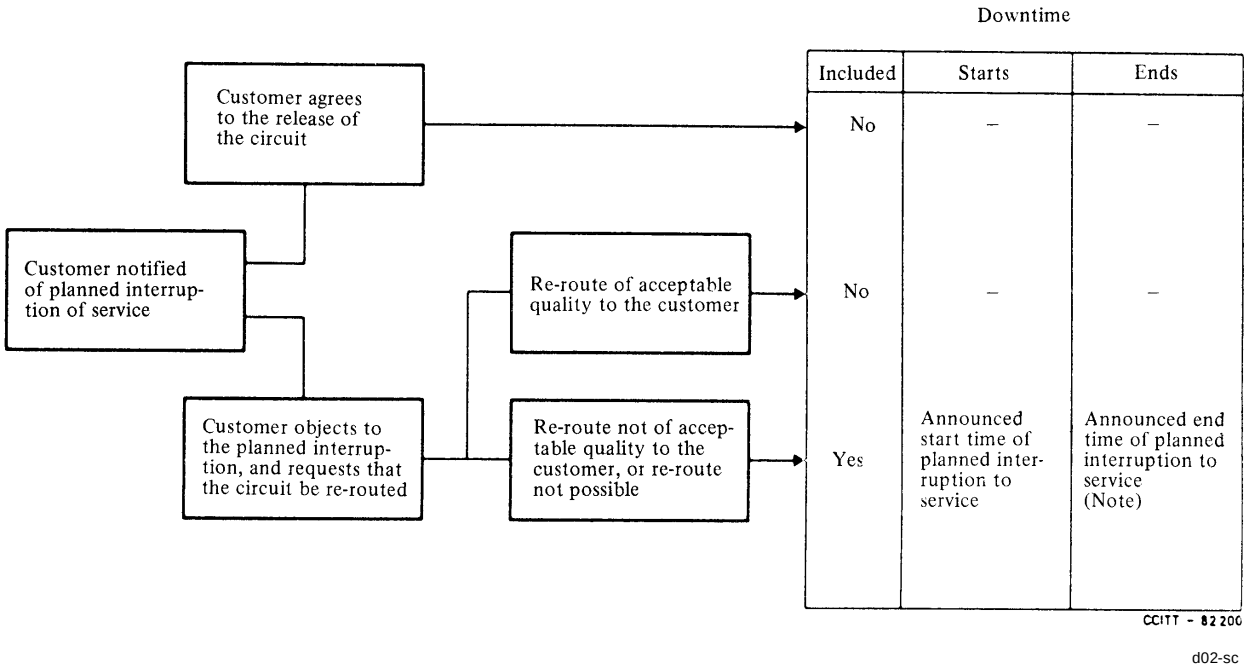
Note 1 — If the announced start time is not known to the fault report point, the customer report time should be used.

Note 2 — If the announced end time is not known to the fault report point, the time the service is returned to the customer (or first attempt to do so) should be used.

A.2 Principles to determine the downtime due to planned interruptions of service are given in Table A-2/M.1016.

TABLE A-2/M.1016

Determination of downtime due to planned interruptions of service



Note — For fault reports which are received because the announced end time is exceeded, see Table A-1/M.1016.

A.3 If a circuit is in a downstate at the beginning of the observation period, the fault or planned interruption of service causing the downstate is *not* taken into consideration. However, downtime is deemed to start at the beginning of the observation period.

A.4 If a circuit is in a downstate at the end of the observation period, the fault or planned interruption of service causing the downstate is taken into consideration. The downstate is deemed to end at the end of the observation period.

ANNEX B

(to Recommendation M.1016)

Presentation of service availability performance information for international leased circuits

Note – This annex contains additional explanations and rules of calculation for the performance parameters specified in § 4.6. §§ B.1 to B.9 below relate to items a) to i) in § 4.6 respectively.

B.1 *Determination of the number of circuits involved in the assessment*

The calculation of service availability performance figures for international leased circuits requires that the exact number of circuits, *n* involved in the assessment be determined.

For the assessment purposes envisaged in § 3.1, only those circuits existing throughout the observation period should be considered. Thus, circuits provided or ceased within an observation period should be ignored.

For the purpose envisaged in § 3.2, the number of circuits existing at the end of the observation period can be used in the calculation of service availability performance figures.

For both the purposes mentioned above, all full-time, point-to-point international leased circuits should be included in the assessment. However, should the effort and cost of this approach be too great, Administrations may use a randomly selected sample of circuits of suitable size.

B.2 *Mean downtime per circuit*

Mean downtime per circuit should be calculated using the following formula:

$$\text{Mean downtime per circuit } (\mu_{DT}) = \frac{1}{n} \sum \text{Downtime in observation period}$$

where

n is the number of circuits involved (cf. § B.1)

downtime is in hours

μ_{DT} is in hours.

B.3 *Mean number of faults per circuit*

The mean number of faults per circuit should be calculated using the following formula:

$$\text{Mean number of faults per circuit} = \frac{1}{n} \sum \text{Faults}$$

where

n is the number of circuits involved (cf. § B.1).

B.4 *Mean time to failure*

Mean time to failure (MTTF) should be calculated using the following formula:

$$\text{MTTF} = \frac{(n \times \text{observation period}) - (\sum \text{Downtime})}{\text{Events that contribute to downtime}}$$

where

n is the number of circuits involved (cf. § B.1)

MTTF is in days

Observation period is in days

Downtime is in days

Note – The right hand side of the equation above is sometimes called mean time between failures (MTBF).

B.5 *Percentage of circuits for which no downtime was recorded*

$$\text{Percentage of circuits for which no downtime was recorded} = \frac{\text{Number of circuits with no downtime}}{n} \times 100$$

where

n is the number of circuits involved (cf. § B.1)

This percentage corresponds to the point marked "y_1" in Figure B-1/M.1016.

B.6 *Mean time to restore service*

Mean time to restore service (MTRS) should be calculated using the following formula:

$$\text{MTRS} = \frac{\sum \text{Downtime}}{\sum \text{Events that contribute to downtime}}$$

where

Downtime is in hours

MTRS is in hours

B.7 *Long-term mean downtime per circuit*

Long-term mean downtime per circuit should be calculated on the basis of the results of at least four consecutive observation periods, weighted for the number of circuits involved, from the following formula:

(In the case of 4 observation periods)

$$\text{Long-term mean downtime per circuit } (\mu_{DT\Sigma}) = \frac{\sum_{i=1}^{4} (n_i \times \mu_{DT_i})}{\sum_{i=1}^{4} n_i}$$

where

n_i and μ_{DT_i} are the values corresponding to each observation period

μ_{DT_i} is in hours

$\mu_{DT\Sigma}$ is in hours

B.8 *Percentage of circuits with downtime less than the mean value* (μ_{DT})

The percentage of circuits with a total downtime less than the mean downtime per circuit (μ_{DT}) should be determined, for example, by preparing a cumulative frequency distribution graph as shown in Figure B-1/M.1016. (The required percentage of circuits is shown by point "y_2" of Figure B-1/M.1016).

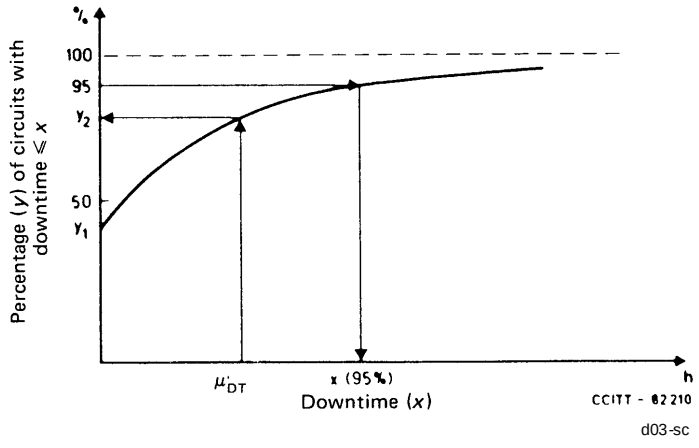


FIGURE B-1/M.1016

Percentage of circuits with downtime not exceeding a given value

B.9 *Downtime per circuit not exceeded by 95% of circuits*

The downtime not exceeded by 95% of circuits is shown by the point marked "*x*(95%)" in Figure B-1/M.1016.

ANNEX C

(to Recommendation M.1016)

Additional information to be exchanged between Administrations concerning service availability performance

C.1 *Types of information*

Where service availability performance information is exchanged between Administrations, it should be supported by the following additional information:

a) International leased circuits are given priority maintenance attention over public circuits:

   i) YES

   ii) NO

b) Duplicated circuit sections (circuit level only):

   i) SUBSCRIBER LINE (TERMINAL NATIONAL SECTION) AND/OR NATIONAL LINE (WHOLLY OR PARTLY) AND/OR INTERNATIONAL LINE

   ii) NO DUPLICATION

c) Fault clearance service:

   i) OFFICE HOURS ONLY

   ii) 24 HOURS / 7 DAYS PER WEEK

d) Limits applied to determine if a fault exists:

   i) Recommendation M.1040

   ii) Recommendation M.1040 type, but with more stringent limits/additional parameters

   iii) Recommendation M.1040 type, but with less stringent limits/fewer parameters

   iv) Recommendation M.1020

   v) Recommendation M.1020 type, but with more stringent limits/additional parameters

   vi) Recommendation M.1020 type, but with less stringent limits/fewer parameters

   vii) Recommendation M.1025

   viii) Recommendation M.1025 type, but with more stringent limits/additional parameters

   ix) Recommendation M.1025 type, but with less stringent limits/fewer parameters

e) Customer informed about planned interruptions of service:

   i) IN PRINCIPLE ALWAYS

   ii) IN PRINCIPLE NEVER

   iii) SOMETIMES

This additional information should be recorded on the forms shown in Appendices I and II of this Recommendation. Appendices III and IV of this Recommendation show examples of these forms filled out by the control and sub-control stations respectively.

C.2 *Rules for the combination of additional information coming from the control and sub-control stations*

C.2.1 *Rule for priority maintenance [§ C.1a) above]*

Where a circuit gets priority maintenance attention by one terminal Administration and not the other, “priority maintenance attention” shall be deemed to exist on the circuit as a whole.

C.2.2 *Rule for duplicated circuit sections [§ C.1b) above]*

Where at least one Administration states that the circuit is (partly) duplicated, the circuit is considered to be (partly) duplicated. Otherwise, the circuit is “not duplicated”.

C.2.3 *Rule for fault clearance service [§ C.1c) above]*

Where one terminal Administration provides “office hours only” fault clearance services while the other provides “24 hours/day” service, the circuit shall be deemed to have “office hours only” service.

C.2.4 *Rule for limits/parameters [§ C.1d) above]*

Where different limits/parameters are applied by the terminal Administrations, the information from the control station Administration will prevail.

C.2.5 *Rule for planned interruptions [§ C.1e) above]*

The rules for combining information on whether or not customers are advised about planned interruptions of service are shown in Table C-1/M.1016.

TABLE C-1/M.1016

Rules for combining information on planned interruptions of service

Control station Administration indicates:	Sub-control station Administration indicates:	Situation for the circuit is deemed to be:
Customer always informed	Never Sometimes Always	Customer is always informed
Customer is sometimes informed	Never Sometimes	Customer is sometimes informed
	Always	Customer is always informed
Customer is never informed	Never	Never
	Sometimes	Sometimes
	Always	Always

APPENDIX I
(to Recommendation M.1016)

INVESTIGATION OF INTERNATIONAL LEASED CIRCUIT PERFORMANCE
DATA FROM THE ADMINISTRATION WITH *CONTROL STATION* RESPONSIBILITY

(Observation period: _____)

Circuits between . . . . . (Control ADMIN) and . . . . . (Sub-control ADMIN)

Circuit designation	Start of downtime		End of downtime		Duration (min)	Additional information (7)				
	Date	Time (UTC)	Date	Time (UTC)						
(1)	(2)	(3)	(4)	(5)	(6)	a	b	c	d	e

Contact person for this data . . . . . .

APPENDIX II
(to Recommendation M.1016)

INVESTIGATION OF INTERNATIONAL LEASED CIRCUIT PERFORMANCE
DATA FROM THE ADMINISTRATION WITH *SUB-CONTROL STATION* RESPONSIBILITY

(Observation period: _____)

Circuits between . . . . . (Sub-control ADMIN) and . . . . . (Control ADMIN)

Circuit designation	Start of downtime		End of downtime		Duration (min)	Additional information (7)				
	Date	Time (UTC)	Date	Time (UTC)						
(1)	(2)	(3)	(4)	(5)	(6)	a	b	c	d	e

Contact person for this data . . . . . .

APPENDIX III
(to Recommendation M.1016)

INVESTIGATION OF INTERNATIONAL LEASED CIRCUIT PERFORMANCE
DATA FROM THE ADMINISTRATION WITH *CONTROL STATION* RESPONSIBILITY

(Observation period: 1 Jan 1982 – 31 March 1982) Example only

Circuits between United Kingdom (Control ADMIN) and Federal Republic of Germany (Sub-Control ADMIN)

Circuit designation	Start of downtime		End of downtime		Duration (min)	Additional information (7)				
	Date	Time (UTC)	Date	Time (UTC)						
(1)	(2)	(3)	(4)	(5)	(6)	a	b	c	d	e
London-Frankfurt DP7	3 Jan	0810	3 Jan	1100	170	i	i	ii	iv	i
	7 Feb	1600	7 Feb	1610	10					
	16 Feb	0930	16 Feb	1030	60					
	3 March	1700	4 March	0810	1050					
London-Dusseldorf DP3	17 Jan	1200	17 Jan	1410	130	i	ii	ii	iv	i
London-Dusseldorf DP6	1 March	0825	1 March	0910	45	i	ii	ii	iv	i
	3 March	0830	3 March	1000	90					
London-Hamburg XP7	21 Feb	1600	21 Feb	1815	135	i	ii	ii	iv	i
	23 Feb	1105	23 Feb	1120	15					
London-Frankfurt DP2	No Faults					i	ii	ii	iv	i
London-Frankfurt DP9	No Faults					i	ii	ii	iv	i
London-Frankfurt XP2	No Faults					i	ii	ii	iv	i
London-Hamburg DP1	No Faults					i	ii	ii	iv	i

Contact person for this data . . . . . .

APPENDIX IV
(to Recommendation M.1016)

INVESTIGATION OF INTERNATIONAL LEASED CIRCUIT PERFORMANCE
DATA FROM THE ADMINISTRATION WITH *SUB-CONTROL STATION* RESPONSIBILITY

(Observation period: 1 Jan 1982 – 31 March 1982) Example only

Circuits between Federal Republic of Germany (Sub-control ADMIN) and United Kingdom (Control ADMIN)

Circuit designation	Start of downtime		End of downtime		Duration (min)	Additional information (7)				
	Date	Time (UTC)	Date	Time (UTC)						
(1)	(2)	(3)	(4)	(5)	(6)	a	b	c	d	e
Frankfurt-London DP7	3 Jan	0900	3 Jan	1030	90	ii	ii	i	iv	iii
	21 March	1100	21 March	1110	10					
Dusseldorf-London DP3	7 Feb	0900	7 Feb	0915	15	ii	ii	i	iv	iii
Hamburg-London XP7	21 Feb	1625	21 Feb	1800	95	ii	ii	i	iv	iii
Dusseldorf-London DP6	No Faults					ii	ii	i	iv	iii
Frankfurt-London DP2	No Faults					ii	ii	i	iv	iii
Frankfurt-London DP9	No Faults					ii	ii	ii	iv	iii
Frankfurt-London XP2	No Faults					ii	i	i	iv	iii
Hamburg-London DP1	No Faults					ii	i	i	iv	iii

Contact person for this data . . . . . .

References

[1] CCITT Recommendation *Quality of service and dependability vocabulary*, Vol. II, Rec. E.800.

[2] CCITT Supplement *Terms and definitions for quality of service, network performance, dependability and trafficability studies*, Vol. II, Fascicle II.3, Supplement No. 6.

[3] CCITT Recommendation *Exchange of information for planned outages of transmission systems*, Vol. IV. Rec. M.490.

[4] CCITT Recommendation *Designation of international circuits, groups, group and line links, digital blocks, digital paths, data transmission systems and related information*, Vol. IV, Rec. M.140.

[5] CCITT Recommendation *Legal time; use of the term UTC*, Vol. I, Rec. B.11.